Textbook of Urogynaecology

Editors:
Stephen Jeffery
Peter de Jong

Developed by the

Department of Obstetrics and Gynaecology

University of Cape Town

Edited by Stephen Jeffery and Peter de Jong

Creative Commons Attributive Licence 2010

This publication is part of the CREATIVE COMMONS

You are free:
to Share – to copy, distribute and transmit the work

to Remix – to adapt the work

Under the following conditions:

Attribution. You must attribute the work in the manner specified by the author or licensor (but not in any way that suggests that they endorse you or your use of the work)

Non-commercial. You may not use this work for commercial purposes.

Share Alike. If you alter, transform, or build upon this work, you may distribute the resulting work **but only under the same or similar license to this one**.

- For any reuse or distribution, you must make clear to others the license terms of this work. One way to do this is with a link to the license web page: http://creativecommons.org/licenses/by-nc-sa/2.5/za/
- Any of the above conditions can be waived if you get permission from the copyright holder.
- Nothing in this license impairs or restricts the authors' moral rights.
- Nothing in this license impairs or restricts the rights of authors whose work is referenced in this document
- Cited works used in this document must be cited following usual academic conventions
- Citation of this work must follow normal academic conventions

http://za.creativecommons.org

Contents

List of contributors 1

Foreword 2

The Urogynaecological History 3

Lower Urinary Tract Symptoms and Urinary incontinence: Definitions and overview. 8

Examination and the POP-Q 17

Essential Urodynamics 23

Medical Management of the Overactive Bladder 26

Intractable OAB: Advanced Management Strategies 40

The Treatment of Stress Incontinence 45

Management of Voiding Disorders 55

Sexual Function in women with Incontinence 64

Urinary Tract Infections (UTIs) in Women 71

Neurogenic Bladder 76

Interstitial Cystitis 95

Introduction to Pelvic Organ Prolapse 97

Pathoaetiolgy of Prolapse 108

Conservative Management of Pelvic Organ Prolapse 119

Surgical Management of Urogenital Prolapse 126

Sacrocolpopexy 133

Pelvic Floor Muscle Rehabilitaion 137

Management of Faecal Incontinence 149

Use of Mesh, Grafts and Kits in POP surgery 154

Management of Third and Fourth degree tears 181

Management of Urogenital Fistulae 186

Role of the laparoscope in Urogynaecology 198

Suture Options in Pelvic Surgery 201

Thromboprophylaxis in Urogynaecological Surgery 213

Contributors

Corina Avni
Women's Health Physiotherapist
Lavender House
Kingsbury Hospital
Claremont
Cape Town

Dick Barnes
Department of Urology
University of Cape Town

Hennie Cronje
Department of Obstetrics and Gynaecology
University of the Free State

Peter de Jong
Department of Urogynaecology
University of Cape Town

Etienne Henn
Department of Obstetrics and Gynaecology
University of the Free State

Barry Jacobson
Department of Haematology
University of Witwatersrand

Stephen Jeffery
Department of Urogynaecology
University of Cape Town

Suren Ramphal
Department of Obstetrics and Gynaecology
University of Natal

Peter Roos
Department of Urogynaecology
University of Cape Town

Trudie Smith
Department of Obstetrics and Gynaecology
University of the Witwatersrand

Douglas Stupart
Department of Colorectal Surgery
University of Cape Town

Paul Swart
Department of Obstetrics and Gynaecology
University of Pretoria

Kobus van Rensburg
Department of Obstetrics and Gynaecology
University of Stellenbosch

Frans van Wijk
Pretoria Urology Hospital
Pretoria

Foreword

First Edition of Textbook of Urogynaecology

Urogynaecology is an exciting and dynamic subspecialty. The last decade has seen a rapid advance in the management options available to the gynaecologist in treating women with pelvic floor dysfunction. Stress incontinence surgery was revolutionised by the development of the TVT and exciting long term data has confirmed this device as a gold standard in the management of SUI. Overactive bladder has seen the launch of a number of new anticholinergic drugs with better side-effect profiles and dosing schedules. We also now have some alternatives to the drugs including Botulinum Toxin A and neuromodulation. We are developing a greater understanding of the role of childbirth and pregnancy in pelvic floor dysfunction. The last three years has seen the launch of intriguing pelvic floor replacement systems and although we are some way off from achieving long term data on these devices, this is no doubt an important step in the evolution of pelvic floor surgery.

This book has been written by a number of authors from different parts of South Africa. The field of urogynaecology is still in its infancy and we therefore have many unanswered questions. In this volume, the reader will therefore encounter varying opinions. There is a significant amount of overlap and difference of opinion and we hope this will stimulate the reader to read widely and formulate his or her own opinion.

The electronic format of this text has made it possible to offer it to the reader at an affordable price. We trust that this book will contribute to a better understanding and management of South African women with pelvic floor dysfunction. We dedicate it to the women of South Africa.

A special thanks to Robertha and Anthea Abrahams for secretarial work, and Dr Julie van den Berg for assistance with proof reading.

The Editors

Chapter 1

The Urogynaecological History

Stephen Jeffery

Pelvic floor dysfunction is associated with multiple symptoms including bladder, bowel and sexual complaints. In addition, women may present with neurological symptoms, psychological issues and relationship dysfunction. It is therefore imperative that the history and examination are performed in a comprehensive fashion.

Urogynaecological symptoms are never life-threatening but they can have a profound impact on the women’s quality of life. Clinical assessment therefore aims to determine the extent of the impairment on quality of life and thereby institute the most appropriate route of investigation and management.

Clinicians use the traditional approach of history and examination. Symptoms as elicited by the traditional interview by the doctor have been shown to be fraught with subjective influences. A number of questionnaires are now available which are able to elicit symptoms in a standardised form and quantify them. This is particularly useful in a research setting but these instruments are now increasingly being used in day-to-day practice. Similarly, the examination of the urogynaecological patient has become more scientific with the advent of more detailed and scientific prolapse scoring systems.

History

Urinary Symptoms

Frequency
This is defined as the number of voids during waking hours. Normal frequency is considered to be between four and seven voids a day.

Nocturia

This is the number of times a woman has to awake from sleep to pass urine. This varies with the age of the woman, with an increase reported in woman above the age of 70 years where normal would be considered to be twice at night, three times for women over 80 and four times for women over 90 years of age.

Incontinence

Symptoms of Urinary Incontinence are notoriously difficult to evaluate. The International Continence Society defines this as the "involuntary loss of urine which is a social or hygienic problem and objectively demonstrable".

Stress Incontinence

This is the involuntary loss of urine with a rise in intra-abdominal pressure. Factors that commonly elicit stress incontinence include running, laughing, coughing, sneezing and standing up from a seated position.

Urinary urgency

This is the compelling desire to void which is difficult to defer. It must be differentiated from urinary urge which is a normal desire to void which can be comfortably deferred by the woman.

Urgency Incontinence

Here, the women describes the symptoms of urgency and she is unable to get to the toilet in time and develops incontinence as a result.

Determining the severity of Incontinence

It is important to make a clinical attempt to determine the severity of the incontinence symptoms. The woman could be asked to quantify the symptoms on a scale of 0 to I0. When this is done using a chart it is called a visual analogue scale (VAS). Many women present with mixed symptoms of both stress and urge incontinence and by asking them to quantify each symptom using the visual analogue score, we are able to determine which is more severe.

The patient should also be asked about the use of continence aids such as pads and how often she changes her underwear. The number of incontinence episodes per day can also be indicative of the severity of the condition.

Symptoms of voiding dysfunction

These symptoms are not as common in women as in men but if present, should prompt the appropriate investigation of urinary residual and flow rate. These symptoms include:

- Hesitancy
- Straining to void
- Incomplete Emptying
- Post- Micturition dribbling
- Poor Stream
- Double Voiding

Bladder pain

Women with bladder pain should be questioned in detail regarding the nature and occurrence of the symptoms. Pain that is relieved with passing urine may be associated with Interstitial Cystitis/ Painful Bladder Syndrome. Women with pain as a significant symptom should be evaluated with cystoscopy and biopsy since pain may also be associated with tumours and stones.

Urethral Pain

This may be associated with infections or urethritis.

Haematuria

Women with urinary symptoms should always be questioned regarding the presence or absence of blood in the urine and investigated appropriately.

Prolapse symptoms

Women with prolapse have a broad range of symptoms. Studies have shown that the symptoms increase significantly with stage 2 prolapse or greater. Most women will complain of a bulge or a lump, whilst others will describe either discomfort or a burning sensation. Still others will describe associated voiding or defaecatory difficulty, needing to reduce the prolapse to void or completely evacuate their bowels.

Bowel symptoms

Evaluation and questioning regarding bowel symptoms is an essential part of the evaluation of the pelvic floor.

Anal Incontinence

This is the involuntary passage of flatus.

Faecal Incontinence

This is defined as the involuntary passage of liquid or solid stool. This should be quantified by asking the women about the frequency, severity, use of continence aids and impact on quality of life.

Faecal urgency and urge incontinence

This is an important symptom

which is often underreported and seldom elicited by the clinician.

Defaecatory dysfunction

Women should be asked about any difficulty in completing defaecation including digitation, splinting or manual evacuation.

Constipation

A record should be made of frequency of stools and any symptom of constipation.

Sexual History

A detailed history of sexual function is vital to a thorough assessment of pelvic floor disorders. Women should be asked if they are sexually active. Any problems should be noted including dyspareunia, vaginal slackness, vaginal tightness, anorgasmia, coital faecal or urinary incontinence during intercourse.

Other relevant parts of the history

Neurological history

Women should be questioned regarding symptoms of limb weakness and sensory fallout. Any history of multiple sclerosis, parkinsonism, spinal cord injury, stroke or spina bifida should also be recorded.

Medications

A note should be made of medications that may be worsening the symptoms, including diuretics and alpha –blockers.

Medical History

Diabetes Mellitis and Insipidus are usually associated with polyuria. Cardiac failure can present with nocturia as a result of the redistribution of fluid when the patient is lying down.

Fluid Intake

The amount and type of fluid consumed on a daily basis should be recorded. Caffeine and alcohol can exacerbate symptoms of overactive bladder significantly and these products in particular should be enquired about.

Obstetric History

The number and type of deliveries are important as well as any history of perineal or anal sphincter injury.

Surgical History

Previous pelvic surgery, including prolapse and incontinence surgery, should be noted.

Causes of Incontinence

I.	**Stress Incontinence**
	Sphincter Dysfunction
	Abnormal Bladder neck support
2.	**Detrusor Overactivity**
	Idiopathic
	Neurogenic
3.	**Mixed incontinence**
4.	**Overflow Incontinence**
5.	**Functional Incontinence**
	Confusion
	Dementia
6.	**Pharmacologic**
7.	**True incontinence**
	Fistulae
8.	**Transient Incontinence**
	UTI
	Restricted Mobility
	Constipation
	Atrophic Urethritis
9.	**Congenital Abnormalities**
I0.	**Excessive urine production**
	Diabetes Mellitis and Insipidus
	Diuretics
	Cardiac failure

Adapted from Textbook of Female Urology and Urogynaecology Eds Cardozo and Staskin.

Chapter 2

Lower urinary tract symptoms and urinary incontinence: an overview

Peter de Jong

Definitions of Symptoms

Lower urinary tract symptoms, (LUTS) are equally bothersome to men and women, and greatly affect the quality of life (QOL).

The term "Lower urinary tract symptoms" is used to describe a patient's urinary complaints without implying a cause. Lower urinary tract symptoms were defined by the standardization sub – committee of the International Continence Society.

LUTS are the subjective indicators of a disease or change in conditions as perceived by the patients, carer or partners and may lead her to seek help from health care professionals. Symptoms may either be volunteered or described during the patient interview. They are usually qualitative.

In general, lower urinary tract symptoms cannot be used to make a definitive diagnosis. However LUTS can also indicate pathologies other than lower urinary tract dysfunction, such as urinary infection. The clinician will make his/her best efforts to exclude other causes of LUTS.

Lower urinary tract symptoms are categorized as storage, voiding and post micturition symptoms. (Table 1)

Storage Symptoms are experienced during the storage phase of the bladder, and include daytime frequency and nocturia.

Increased daytime frequency is the complaint by the patient who considers that he/she voids too often by day. The average person voids 6 times a day.

Nocturia is the complaint that the

individual has to wake at night one or more times to void.

Urgency is the complaint of a sudden compelling desire to pass urine, which is difficult to defer.

Urinary incontinence is the complaint of any involuntary leakage of urine.
In each specific circumstance, urinary incontinence should be further described by specifying relevant factors such as type, frequency, severity, precipitating factors, social impact, effect on hygiene and quality of life, measures used to contain the leakage, and whether or not the individual seeks or desires help because of urinary incontinence.

Stress urinary incontinence is the complaint of involuntary leakage on effort or exertion, or on sneezing or coughing.

Urgency urinary incontinence is the complaint of involuntary leakage accompanied by or immediately preceded by urgency.

Mixed urinary incontinence is the complaint of involuntary leakage associated with urgency and also with exertion, effort, sneezing or coughing.

Enuresis means any involuntary loss of urine. If it is used to denote incontinence during sleep, it should always be qualified with the adjective “nocturnal”.

Table 1 LUTS

FILLING / STORAGE	EMPTYING / VOIDING	POST VOIDING SYMPTOMS
Frequency	Hesitancy	Post – micturition dribbling
Urgency	Straining to void	Feeling of incomplete emptying
Nocturia	Poor stream	
Urgency Incontinence	Intermittency	
Stress Incontinence	Dysuria	
Nocturnal Incontinence	Terminal dribbling	
Bladder / Urethral Pain		
Absent or Impaired Sensation		

Nocturnal enuresis is the complaint of loss of urine occurring during sleep.

Continuous urinary incontinence is the complaint of continuous leakage and may denote urinary fistula.

Bladder sensation can be defined, during history taking, into four categories.

Normal: the individual is aware of bladder filling and increasing sensation up to a strong desire to void.

Increased: the individual feels an early first sensation of filling and then a persistent desire to void.

Reduced: the individual is aware of bladder filling but does not feel a definite desire to void.

Absent: the individual reports no sensation of bladder filling or desire to void.

Voiding symptoms are experienced during the voiding phase.

Slow stream is reported by the individual as the perception of reduced urine flow, usually compared to previous performance or in comparison to others.

Intermittent stream or Double voiding (Intermittency) is the term used when the individual describes urine flow which stops and starts, on one or more occasions, during micturition.

Hesitancy is the term used when an individual describes difficulty in initiating micturition resulting in delay in the onset of voiding after the individual is ready to pass urine.

Straining to void describes the muscular effort used to initiate, maintain or improve the urinary stream.

Terminal dribble is the term used when an individual describes a prolonged final part of micturition, when flow has slowed to a trickle or dribble.

Post micturition symptoms are experienced immediately after micturition.

Feeling of incomplete emptying is a self – explanatory term for a feeling experienced by the individual after passing urine.

Post micturition dribble is the term

used when an individual describes the involuntary loss of urine immediately after passing urine, usually after leaving the toilet.

Frequency – Volume Chart (Bladder Diary)

Frequency – volume charts (FVC) have become an important part of the evaluation of LUTS. Most experts would agree that these charts provide invaluable information about a number of symptoms including urinary frequency, urgency, incontinence episodes, and voided volume. In fact some symptoms, like nocturia, cannot be properly evaluated without a chart. Frequency – volume charts are critical for the distinction between nocturnal overactive bladder and nocturnal polyuria, two common causes of nocturia. Despite this the structure, content and duration of chart keeping for evaluation has not been standardised. There are a number of parameters that can be assessed by the FVC, including: total number of voids per 24 hours, total number of daytime (awake) voids, total number of night time voids, total fluid intake, total voided volume, maximum, minimum and mean voided volume, number of urgency episodes, and number of incontinence episodes.

FVC's have been shown to be reproducible and more accurate when compared with the patient's recall. The optimal length of a diary varies according to the parameter assessed and precision and sensitivity required. In addition, if one is trying to assess change, the baseline parameter (e.g number of voids, incontinence episodes) will affect the length of the diary needed to detect a certain change. A 7 day diary is a reasonable option for most patients with incontinence. If record keeping for 7 days increases a patient's burden the number of days required to evaluate voiding symptoms should be reduced.

The majority of information collected on FVC's or bladder diaries has been used to establish baselines or to study patients with OAB or incontinence.

Physical examination

A general physical examination of the patient is mandatory, since many co–morbid conditions are likely to impact on the symptoms of LUTS (Table 2)

Table 2 Comorbid conditions causing LUTS

- Medical disorders
  - Hypertension / heart failure
  - Mulitple sclerosis
  - Diabetes Mellitus
- Reduced mobility
- Alzheimers
- Medical therapy, i.e diuretics
- Neurological disorders

A detailed gynaecological assessment is important, with particular attention to pelvic floor disorders, and prolapse. A full neurological examination is also required. Digital rectal examination is useful to evaluate the possibility of co – existent anal / faecal incontinence.

Special investigations

Urinalysis

Urinalysis is not a single test - complete urinalysis includes physical, chemical, and microscopic examinations. Dipstick urinalysis is certainly convenient but false positive and false negative results may occur. It is considered an inexpensive diagnostic test able to identify patients with urinary tract infection (UTI) as indicated by the presence of leucocyte esterases and nitrites, although infection may exist in the absence of pyuria and, in the elderly population, pyuria may develop in the absence of UTI. Microscopic haematuria can be easily identified by dipsticking because of the presence of haemoglobin. The detection of haematuria is important because the condition is associated with a 4 – 5% risk of diagnosing a urological disorder or malignancy within 3 years. Because of the high prevalence of urinary tract infection (UTI) and the increase of LUTS in the presence of UTI, all guidelines on the management of patients with LUTS and urinary incontinence, endorse the use of urinalysis in primary care management.

Urodynamic Investigations

What is meant by the term Urodynamic investigations?

In 1970 Bates coined the expression that ‘the bladder often proves to be an unreliable witness’, meaning that the presenting symptoms of the patient and the eventual diagnosis of the problem are often at variance. In 1972 Moolgaoker stated that ‘urinary symptoms in the female do not form a scientific basis for treatment'.

Urodynamic tests have been developed to confirm the underlying diagnosis in a patient complaining of symptoms of urinary incontinence. These tests identify the etiology of the problem and elucidate its pathophysiological mechanism. Their use is sometimes debatable, since grade A evidence supporting the general use of urodynamics in the investigation of incontinence, is not available.
The most basic form of urodynamic testing which is used in present day practice consists of:

1. Uroflowmetry (otherwise known as a 'free flow measurement'
2. Multichannel urodynamics which involve filling and voiding cystometry (the latter being a so – called 'pressure – flow' study).

Depending on the sophistication of the apparatus used, either a leak – point pressure measurement, or urethral pressure profilometry may be performed additionally as a test of urethral function. Urodynamic testing can either be static or ambulatory.

Videocystourethrography is used in advanced centres and is the gold standard of the investigation of female urinary incontinence. It involves contrast media and screening radiology superimposed upon conventional cystometry to provide an accurate diagnosis. This modality is not widely available.

Increasingly, ultrasound imaging is also being used to measure both bladder neck descent and bladder wall thickness. Electromyography and cystoscopy are adjuncts to urodynamics in complex patients with atypical pathology.

The measurement of urethral resistance pressure has recently been pioneered. This does have potential as a diagnostic tool of the future. However, at present its widespread use as a routine urodynamic tool is questionable and it should only be used in research studies aimed at clarifying its value.

Basic tests which should be performed on patients prior to urodynamic testing include a urine microscopy and culture, and a measurement of residual urine volume, either by catheter or ultrasound. A bladder diary (frequency / volume chart) is also a necessary aid to diagnosis. The latter has been shown to provide valuable information on the patient's voiding pattern and functional bladder capacity, as well as giving an indication of leakage episodes.

It can be said that most urodynamic tests are expensive, time consuming and invasive (involving catheterization of the patient). They also require considerable expertise and access to sophisticated equipment. There should therefore be sound motivation for their use as a diagnostic tool.

Clinical Indications for Urodynamics Investigations

There are many etiological factors leading to urinary incontinence in women. Certainly the most common problems are urodynamic stress incontinence due to urethral sphincter weakness or bladder neck hypermobility, and detrusor overactivity leading to incontinence (in most cases 'urge incontinence'). Other causes of incontinence include fistulae, urethral diverticulae, urethral instability, the urethral syndrome and also the contributory effect of urinary tract infection. It must be emphasized that many of these conditions may mimic the symptoms associated with stress incontinence and destrusor overactivity.

A cough – induced bladder contraction causing leakage may be confused with stress incontinence (so called 'stress – induced instability').

There may be serious sequelae if a patient suffering from urinary incontinence is not adequately evaluated and an incorrect diagnosis is made. The most serious of these is inappropriate surgery. Failure to recognize concomitant detrusor overactivity and / or voiding dysfunction may also affect the outcome of appropriate surgery.

Table 1 lists the most important indications for urodynamic studies.

Table 1: Indications for urodynamic studies

1.	Prior to surgery
2.	Failed medical or surgical treatment
3.	Complex symptomatology
4.	Neurological dysfunction
5.	Voiding dysfunstion
6.	Medico – legal cases

Clinical Diagnosis versus urodynamic diagnosis

Over the past 35 years there have been ongoing discussions in the literature on how best to evaluate patients with incontinence. The accurate identification of patients with SUI has received considerable attention

The accuracy of history alone

Most of the early papers looked at the discriminatory value of a pure history of either stress incontinence or detrusor instability. Symptoms alone were used to make a diagnosis before patients were subjected to confirmatory cystometry. Most of the earlier studies had relatively low numbers of patients. In summary, it is clear from the majority of studies that a history of incontinence alone is not enough to enable a clinician to make an accurate diagnosis for a decision on whether or not to embark on stress incontinence surgery. The symptom of stress incontinence may be very sensitive, but is so nonspecific as to render it of little diagnostic value.

History is best used as a guide to the subsequent evaluation process and to serve as a measure of disease severity.

History, clinical examination and basic tests

In the ongoing search for an uncomplicated and cost – effective approach to the pre – operative evaluation of a patient for stress incontinence surgery, several authors looked at other parameters which could prove useful.

In summary the addition of other clinical parameters and simple office tests do enhance the sensitivity of a history. However, the various authors still found the combination inadequate for a reliable diagnosis and most felt that additional research was warranted.

In South Africa, Urogynaecology as a subspeciality is still in its infancy. Treatment decisions in female urinary incontinence management are mostly made on clinical judgment. There are very few management protocols in place and this is an area which urgently requires development, particularly at specialist level.

Medical practice is increasingly becoming dogged by litigation and practitioners have to be able to show that they have their patient’s best interest at heart by backing up clinical diagnosis with special investigations.

In the larger centres in SA there are facilities available for performing urodynamic studies but these are mostly underutilised. They are often also run by staff who are not properly trained to provide good quality results and interpretation.

There is an increasing number of practitioners in SA who have a special interest in Urogynaecology and who manage female patients with urinary incontinence. It is these practitioners who should be at the forefront of attempts to develop mechanisms which are aimed a providing the best possible service for their patients. “Best practice’ therefore also means a move away from ‘preference – based’ to ‘evidence – based’ medicine.

Chapter 3

Physical Examination and the POP-Q

Peter de Jong, Stephen Jeffery

All women presenting with pelvic floor dysfunction should be thoroughly examined in the supine, left lateral and standing positions. Where a surgical intervention is planned, the responsible surgeon should determine exactly what may be required at operation – so that the appropriate consent can be obtained and the correct intervention planned.

General

The women's mobility and general condition should be noted.

Neurological examination

The spinal segments S2,3.4 should be assessed by testing the tone, strength and sensation in the lower limbs. The anal sphincter tone should be tested.

Gynaecological Examination

It is impossible to perform an adequate urogynaecological examination without using a Sims speculum and in some circumstances two Sim's speculae are required. The examination begins with the woman in the dorsal position. The vulva and vagina are inspected for any lesions, atrophy or excoriation. The woman is then asked to cough or valsalva while the clinician observes for any stress incontinence. She is then asked to turn onto her left side and the Sims speculum is used to inspect the anterior and posterior vaginal walls for prolapse. It is imperative that the middle compartment is also adequately assessed for any uterine or vaginal vault descent. This can be difficult, but if one uses two Sims speculae placed anteriorly and posteriorly, while the women strains down, it is relatively easy to assess this compartment. The prolapse should be graded using either the Baden-Walker or POP-Q systems (see below). If the women's symptoms are not adequately explained by the findings at examination, it may be useful to perform an additional assessment with her standing. This is accomplished by asking her to stand with her legs apart while the examiner bends in front of the patient and gently palpates the anterior, middle and posterior compartments. She is then asked to cough again in the standing position.

Classification and grading of prolapse

Grading and classification of pelvic organ prolapse enables clinicians to communicate with each other and is also useful in a research setting. The most commonly used grading system is the Baden-Walker halfway system which grades prolapse as follows:

Grade I: Descent halfway to the introitis
Grade 2: Descent down to the vaginal introitis
Grade 3: Descent beyond the introitis but not maximal
Grade 4: Maximal descent

This grading system is useful in day to day clinical practice but it has a number of shortcomings. It does not give a quantitative impression of the severity of the prolapse. It does not address the vaginal length, perineal body size or the length of the urogenital hiatus. The POP-Q (Pelvic Organ Prolapse Quantification System) was developed by the International Continence Society to address these issues and it supercedes the previous systems used to describe POP. The new objective assessment allows a clear and unambiguous description of prolapse, facilitating better objective assessment, management and surgical comparison. Precise staging made gynaecological oncology an objective progressive disciple, and it is hoped that introduction of POP – Q will allow similar advances in the management of prolapse. Terms used in the past such as for example small, medium or large, cystocoele or rectcoele, are no longer applicable. At first glance, the system appears complicated and difficult to master but once it is understood, it can be performed in less than 30 seconds while performing a routine gynaecological examination. It is based on measurements that are taken using the introitis as reference. Any measurement above this is negative and anything below this is positive. The measurements are taken using a marked Pap smear spatula. Six specific vaginal sites (points Aa, Ba, C, D, Bp and Ap) and the vaginal length (tvl) are assessed using centimeters of measurement from the introitus. The length of the genital hiatus (gh) and perineal body (pb) are measured.

The points are defined as follows, with the ranges as suggested in the following table.

All measurements are made to the nearest 0.5cm

Consensus and validation of the new system has been extensive. The clinical examination is performed and the measurements recorded on the “POPQ grid”. (Table 2)

TABLE 1: POP - Q DEFINITION AND RANGES

Point	Measurement	Range
Aa	Anterior vaginal wall 3cm proximal to the hymen	-3 to +3
Ba	Leading – most point of anterior vaginal wall prolapse	-3 to +tvl
C	Most distal edge of cervix or vaginal cuff (if cervix is absent)	-/+ tvl
D	Most distal portion of the posterior fornix	-/+ tvl
Ap	Posterior vaginal wall 3cm proximal to the hymen	-3 to +3
Bp	Leading – most point of posterior vaginal wall prolapse	-3 to +tvl
gh	Perpendicular distance from mid – urethral meatus to posterior hymen	No limit
pb	Perpendicular distance from mid – anal opening to posterior hymen	No limit
tvl	Posterior fornix or vaginal cuff (if cervix is absent) to the hymen	No limit

TABLE 2: The POPQ Grid – Used to Record Examination Results.

anterior wall **Aa**	anterior wall **Ba**	anterior wall **C**
genital hiatus **gh**	perineal body **pb**	total vaginal length **tvl**
posterior wall **Ap**	posterior wall **Bp**	posterior fornix **D***

*Measurement D is not taken in the absence of a cervix

The measurement of prolapse is performed in accordance with certain measurement fundamentals. (Table 3)

Table 3: POPQ Measurement Fundamentals

All measurements are made to the nearest 0.5cm
All measurements are made relative to the hymen
Points proximal to the hymen are negative (inside the body)
Points distal to the hymen are positive (outside the body)
The hymen is assigned a value zero
gh, pb, and tvl measurements will always have a positive value
All measurements, except for tvl, are made while patient is bearing down

Both the patient's position during the examination (lithotomy, birthing chair, or standing) and the state of her bladder and rectum (full or empty) should be noted

Staging of the grade of pelvic support is objectively done on a five – stage system. (Table 4)

Table 4: The five stages of Pelvic Organ Support

Stage 0:	No descent of any compartments
Stage 1:	Descent of the most prolapsed compartment between perfect support and – 1cm, or 1cm proximal to the hymen
Stage 2:	Descent of the most prolapsed compartment between -1cm and +1cm.
Stage 3:	Descent of the most prolapsed compartment between +1cm and (tvl -2cm)
Stage 4:	Descent of the most prolapsed compartment from (tvl -2cm) to complete prolapse

Explanation of individual points

Points Aa, Ab, Pa and Pb are the most difficult to understand. They represent the extent of prolapse, be it above the introitis (ie negative) or below the introitis (ie positive)

Point Aa

If an imaginary small man walked from the introitis up the anterior vaginal wall and made a mark once he had covered 3 cm this would be point Aa. The distance this point descends on the vertical plane can therefore be either -3, -2, -1 if it is above the introitis, 0 at the introitis and +1,+ 2 or +3 below the introitis. This point is therefore never more than 3 and represents the bottom 3cm of the vagina.

Point Ba

This point describes additional prolapse of the anterior vaginal wall that goes beyond the first 3 cm. It is the most distal part of the prolapse. It can therefore be greater than the +3 described for point Aa. For the milder prolapse, it often equates to that of Aa. Because it essentially defines more extensive prolapse, when there is no prolapse, by convention we make it the same as Aa.

Point Ap

Again our imaginary man makes the 3cm trip up the posterior wall where he marks off point Ap. The distance this point descends can again be therefore either -3, -2, -1 if it is above the introitis, 0 at the introitis and +1,+ 2 or +3 below the introitis.

Point Bp

Again, this point describes more extensive prolapse beyond the 3 cm mark of Ap similar to Ba. Again if there is no prolapse, by convention it is -3.

Point C

This describes the prolapse of the cervix or vaginal vault. If the cervix, for example, is 7cm above the introitis, this point is then -7, if it is 4 cm below C is +4.

Point D

This describes the descent of the posterior fornix again similar to the cervix.

Total vaginal Length

This is the measurement of the length of the vaginal tube from top to bottom. It is usually measured with the marked spatula inserted to its maximum into the vagina.

Urogenital hiatus

The measuring spatula is placed anteroposteriorly along the introitis and measures from the urethral meatus to the midline of the posterior hymen.

Perineal body

Again the perineum is measured from the posterior hymen to the anus in the midline.

Chapter 4

Essential Urodynamics

Stephen Jeffery

Urodynamics

Whole books have been written on Urodynamic practice and technique. The diagnosis in women with urinary incontinence based on clinical findings is correct in only 65% of cases. There is a large overlap between symptoms and examination and urodynamic findings. 55% of women with stress incontinence will have a mixed picture. The cystometrogram becomes essential, in a number of women, to enhance diagnostic accuracy and therefore enable us to institute treatment.

The equipment

The Urodynamics system comprises two catheters, one placed in the bladder and another in the rectum, a computer and the urodynamics software and pressure transducers, a pump system, and a flowmeter. The catheter that is placed in the bladder is has a double lumen, one to measure the bladder pressure (Pves) and the other lumen is used to fill the bladder with water via the pump system. Sometimes, two separate catheters are used for filling and pressure recording. The rectal probe measures the intra-abdominal pressure (Pabd) and this pressure could therefore also be obtained by inserting the line into the vagina or even into a colostomy. A Urodynamic report usually gives 3 pressure tracings: Pves (bladder pressure), Pabd (abdominal) and Pdet (detrusor pressure). The detrusor pressure is obtained by the following formula Pdet = Pves-Pabd. Urodynamics is therefore often called Subtracted Cystometry.

The Procedure

The test comprises three phases.

1. Free flow phase

The woman is asked to arrive at the investigation with a full bladder. She is then asked to void on the flowmeter, which is usually mounted on a commode, in privacy. It should be noted that this part of the test differs from the voiding cystometry, which is done after the filling phase once the bladder is full and the lines are in situ to measure the pressures.

Flow Meter Commode

2. Filling phase

The bladder and rectal lines are inserted with the patient supine and any urinary residual is noted. The lines are flushed and the system is zeroed. The women is asked to cough to check that the Pdet measurement is correct. For example, if the Pabd is not measuring correctly, the Pdet will not be accurately calculated. If both the vesical and rectal lines are measuring appropriately, when the women coughs, there should be no deviation of the Pdet – only on the vesical line and the abdominal line since these are both under the influence of abdominal pressure. In other words, when there is a rise in abdominal pressure with coughing, the same pressure is transferred to the bladder. The Pdet will therefore be zero since Pves minus Pabd is zero and the detrusor line will be flat with deviations only in the Pabd and Pves.

Bladder filling is commenced once the operator is satisfied that the tracing is technically correct. The patient is asked to report on her first desire as well as the moment she has a strong desire to void. Any urgency and associated incontinence is noted. Provocative measures through the filling phase include asking the woman to heel bounce, wash hands and cough. This will also hopefully elicit any stress incontinence which is usually also occasionally recorded on the trace by a flowmeter but if this modality is not available on the filling phase, is usually observed by visual inspection of the vulva. When the patient is unable to tolerate any more filling, the pump is stopped, this is the maximum cystometric capacity.

3. Voiding Cystometry

This is done by asking the patient to void while the pressures are recorded.

Possible Diagnoses

During Free Flow

Flow rate is abbreviated as Q. A normal flow curve is bell-shaped. An obstructive pattern is flat or with intermittent sections of flow. The maximum flow is denoted as Qmax. A normal flow rate is defined as less than I5ml/s.

During Filling phase

Any contractions of the detrusor tracing suggest a diagnosis of detrusor overactivity (DO). One should always look at the abdominal tracing and this should be flat during a detrusor contraction to diagnose DO. If the abdominal curve is also elevated, this would suggest possible poor subtraction and a diagnosis of DO should not be made. If the Detrusor pressure curve rises slowly during the filling phase, this would suggest poor compliance. If one notes both stress incontinence and DO during filling, a diagnosis of mixed incontinence is made.

During voiding Cystometery

Pressures are measured during the voiding cystometry phase and therefore parameters such as PdetQmax, the detrusor pressure during maximum flow, is measured. A pressure greater than 20cmH2O would suggest an obstruction.

Chapter 5

The Medical Management of the Overactive Bladder Syndrome

Peter de Jong

Introduction

The term "overactive bladder" was proposed as a way of approaching the clinical problem from a symptomatic rather than a urodynamic perspective. The overactive bladder syndrome (OAB) has been defined by the International Continence Society as urinary urgency with or without urge incontinence usually with frequency and nocturia. It is a diagnosis based on lower urinary tract symptoms alone. While not life threatening, it can have a considerable adverse impact on the quality of lives of those who suffer from it, and it is highly prevalent within society. Recent epidemiological studies have reported the overall prevalence of OAB in women to be 16%, suggesting that there could be 17.5 million women in the USA who suffer from the condition. The prevalence increases with increasing age being 4 percent in women younger than 25 years and 30 percent in those older than 65 years. The overall prevalence of OAB in individuals aged 40 years and older is 16%. Frequency, the most common symptom, occurs in 85% of respondents, while 54% complain of urgency and 36% of urge incontinence.

Initial management of OAB should take into account the individual's lifestyle and any appropriate interventions that can be employed to minimize symptoms. For example, reducing excessive fluid intake (25ml / kg / day is sufficient) and minimising caffeine and alcohol consumption may be helpful, as well as reviewing any medication that may have an impact on lower urinary tract function, such as diuretics.

Behavioral therapies and, particular, bladder retraining may help a person regain central control of micturition and can be highly effective in well – motivated individuals, although there is a recognized high relapse rate.

Drug therapy is the mainstay of treatment for OAB, and from the number of preparations that have been studied, it is clear that there is no ideal drug for all people. In the past, clinical results of treatment have often been disappointing due to both to poor efficacy and unacceptable adverse effects. Earlier preparations were not subjected to the current rigorous randomised controlled trials and, therefore, lack evidence – based data. Comparison of drug therapies for this condition is difficult due to the placebo effect of 30 – 40%, and since the response to any of the available drugs is only in the region of 60%, any differences that are detected are likely to be small, and thus require large – scale studies to show efficacy.

The drugs that are currently prescribed for OAB have an antimuscarinic component, and this limits compliance with the treatment because of a lack of acceptability to some people. Recent advances have included sustained release preparations of existing compounds, innovative routes of administration and newer antimuscarinic preparations.

While many people will be considerably improved and even cured of their symptoms by drug therapy, there are always those who do not respond and for them, it is most important that further investigations are undertaken to ensure that the correct problem is being addressed. Urodynamic studies will confirm (or otherwise) a diagnosis of detrusor overactivity in which case, further trials of different antimuscarinic preparations would be desirable, whereas in the absence of proven detrusor overactivity, an alternative diagnosis should be sought to avoid further ineffectual treatment and, hence disillusionment and a waste of resources.

Definition of OAB syndrome

OAB is a clinical diagnosis and

comprises the symptoms of frequency (>8 micturitions / 24 hours), urgency and urge incontinence, occurring either singly or in combination, which cannot be explained by metabolic (e.g diabetes) or local pathological factors (e.g urinary tract infections, stones, interstitial cystitis).

In clinical practice, the empirical diagnosis is often used as the basis for initial management after assessing the individual's lower urinary tract symptoms, physical findings and the results of urinalysis, and other indicated investigations. Thus, the International Continence Society in its Standardisation of Terminology report from 2002 defined the OAB syndrome as urgency with or without urge incontinence, usually with frequency and noctuira. These symptom combinations are suggestive of urodynamically demonstrable detrusor overactivity, but can be due to other forms of urethro – vesical dysfunction. The term “overactive bladder” can be used if there is no proven infection or other obvious pathology.

In the current International Continence Society (ICS) definition of the OAB syndrome, urgency is an obligatory component. This is in line with current opinion regarding the importance of urgency as the driving force behind the other components, frequency, nocturia and incontinence, which are also mentioned in the definition. Urgency is, however, difficult to measure and in many of the clinical trials assessing the pharmacological treatment of OAB syndrome, micturition frequency has often been used as the primary endpoint as it is easier to quantify.

The OAB – how common is it?

There are at present only a few population – based studies that have assessed the prevalence of OAB. The prevalence of OAB symptoms was estimated in a large European study involving more than 16 000 individuals. Data were collected using a population – based survey of men and women aged ≥ 40 years, selected from the general population in France, Germany, Italy, Spain, Sweden and the UK using a random, stratified approach. The main outcome measures were prevalence of urinary frequency (>8 micturitions /24 hours), urgency and urge incontinence; proportion of participants who had sought medical advice for OAB symptoms; and current previous therapy received for these symptoms. The overall prevalence of OAB symptoms in this population of men and women aged ≥ 40 years was 16%. About 79% of the respondents with OAB symptoms had experienced symptoms for at least 1 year and 49% for 3 years. Sixty – seven percent of the women and 65% of the men with OAB symptoms reported that their symptoms had an impact on daily living. The prevalence of OAB symptoms increased with age in both men and women. OAB symptoms were relatively more common in younger women compared with men, while the opposite was found for the older age groups where symptoms were more common in men. However, when comparing the total population of men and women, there was little difference in the overall prevalence reported in women and men.

The prevalence of OAB symptoms has also been assessed in a large population based survey from the USA. The National Overactive Bladder Evaluation (NOBLE) was designed to assess the prevalence and burden of OAB. A sample of 5204 adults ≥ 18 years and representative of the US population by sex, age, and geographical region was assessed. The overall prevalence of OAB was similar between men (16.0%) and women (16.9%) and was similar to the results reported earlier from Europe. The impact of OAB symptoms on quality of life was assessed in a subset of the participants from the NOBLE study. In individuals who reported OAB symptoms, these symptoms had a clinically significant negative effect on quality of life, quality of sleep, and mental health.

Impact of OAB symptoms on employment, social interactions, and emotional wellbeing

Symptoms suggestive of an OAB often have a profound negative influence on quality of life. It is not only episodes of leakage that effect wellbeing but also urgency and frequency have considerable detrimental effects on daily activities. Constant worry about when urgency is going to strike results in the development of elaborate coping mechanisms to enable people to manage their condition (e.g voiding frequently in an effort to avoid leakage episodes, mapping out the location of toilets, drinking less, or the use of incontinence pads). It is not difficult to see how these troublesome symptoms may disrupt people's daily lives and occupations. Despite the negative impact of these symptoms on quality of life, many affected individuals fail to report this condition to their physicians of symptoms for many years. This may be due to embarrassment or possibly because of the mistaken opinion that effective treatment is not available.

The management of overactive bladder

Incontinence occurs in approximately a third of people presenting clinically with OAB, and approximately a third of them have a mixed picture of combined sphincteric weakness and detrusor overactivity. The prevalence of OAB is higher among the elderly population (age 64 and above); it is estimated to be approximately 30 – 40% among persons older that 75 years, and this may have additional ramifications as both urinary urgency, associated incontinence and noctuira have been shown to be associated with an increased incidence of falls and fractures among elderly.

The intensity of urinary urgency has a significant association with other symptoms of OAB. Urgency is the 'driving' symptom in OAB, those experiencing OAB frequently experience urgency at inconvenient and unpredictable times and consequently, often lose control before reaching the toilet. This adversely affects their physical and psychological state by limiting daily activities, intimacy, compromising sexual function and worsening self – esteem. It is no surprise therefore that improvements in urgency are often stated by people to be the most noticeable response to therapy.

Urgency is a sensory symptom and as such is difficult to define, to communicate to both patients and colleagues alike and the measure and quantify. Despite the difficulties, urgency and the other symptoms of OAB result in a significant deterioration in HRQL. To date, patient diaries have been shown to be a reliable way to collect various OAB symptoms, including urgency episodes, and diary entry remains the most accurate and sensitive method for evaluating changes in urgency with pharmacotherapy. Data obtained on the basis of 3 – or 4 – day diaries suggest that short – duration diaries are just as reliable as those recorded for 7 days, and because they impart less patient burden, may be an acceptable method of assessing the symptoms of OAB. Apart from increases in cystometric capacity, invasive pressure flow studies have failed to show positive results with existing antimuscarinic therapy.

Initial assessment must include a thorough history and physical examination. A complete pelvic and neurological exam is mandatory, to exclude other conditions that may mimic OAB symptoms. Urine analysis, and microscopy and culture will exclude urinary infections. Further special investigations are not required.

Treatment for all forms of incontinence should commence with conservative methods before progressing to more complex surgical procedures if these do not work. A multidisciplinary approach is important in its management. In addition to urologists and gynaecologists, continence nurse specialists, physiotherapists and healthcare professionals in community based primary care services play a pivotal role in the management of incontinent patients.

Behavioural therapy and pharmacotherapy are the mainstay of treatment, and there is continuing search for more effective and selective drugs with minimal adverse effects (AEs). About 50% of people gain satisfactory benefit from pharmacotherapy. The role of physiotherapy in the treatment of urge incontinence remains unclear as evidenced by systematic review of clinical trials.

Treatment of OAB is multifaceted. Effective treatment modalities include lifestyle modifications, medications, bladder retraining, and exercises to strengthen the pelvic floor (Kegel Exercises)

1. Lifestyle modifications
    - The patient should limit intake of foods and drinks that may irritate the bladder or stimulate the production of urine e.g alcohol, caffeine, coffee, tea and fizzy drinks, and aspartate sweeteners.
    - Drink 25ml / kg / day of fluids

- Maintain healthy bowel actions. Eat high fibre foods such as wholewheat bread and pastas.
- Stop smoking
- Lose weight (if obese)

2. Bladder retaining

The patient should -

- Gradually increase the time between voids
- Increase the time intervals by 15 minutes until she reaches an optimal time which is comfortable for her.

3. Pelvic floor muscle exercises (Kegel Exercises) (See elsewhere)

Surgical options (some still experimental) have been added in recent years and these include, neuromodulation and botulinum toxin injection therapy, but these interventions are reserved for cases where medical therapy fails.

Drug therapy

There are a number of antimusarinic agents in contemporary use. Oxybutynin chloride is the most commonly prescribed anticholinergic for OAB worldwide. It has antimuscarinic activity acting primarily on the M1 and M3 receptor over the M2 receptor. Two oral formulations of this drug are now available on our market and include immediate – release (IR) and extended – release (ER) forms. More recently, a transdermal formulation has been introduced. Several randomised placebo controlled trials have shown oybutynin IR to be effective in producing subjective improvement in patients (at least 50% improvement in incontinence episodes) as well as objective parameters. Dose begins at 2.5mg bd, going up to a maximum of 5mg tds. Adverse effects include dry mouth, blurred vision, constipation, urinary retention, gastro – oesophageal reflux, dizziness and central nervous system (CNS) effects. The AEs, particularly dry mouth, can lead to a high (up to 80%) dropout rate within 6 months of commencing treatment.

In an attempt to reduce the incidence of these AEs, a new formulation, allowing a more controlled release of the drug over a 24 – hour period (oxybutynin ER) was introduced. The sustained release produces a more sustained plasma concentration when compared with the IR preparations and, hence, a much more stable steady – state concentration for 24 hours. Tablet doses between 5 and 10 mg are available, and several randomized controlled studies have shown that oxybutynin ER is as effective as IR preparations with the additional benefit of a reduction in dry mouth. Other modes of oxybutynin delivery include intravesical and transdermal administration. Intravesical therapy was developed to increase the balance in favour of efficacy over AEs in those patients routinely using intermittent self – catheterisation. Oxybutynin (typically 5mg) is mixed with normal saline and administered twice a day via a urethral catheter. Several small open – label studies have shown that intravesical administration of oxybutynin can reduce subjective and objective detrusor overactivity. Clearly, the main limitation of this route of administration, associated with the use of intermittent self – catheterisation, is the increased risk of developing cystitis due to an irritant effect of the solution, and a higher risk of developing urinary tract infections with subsequent high dropout rates.

Following the hypothesis that oxybutynin metabolites are the principal cause of AEs, alternative delivery routes have been sought that would avoid oral administration and first pass metabolism. Consequently, a transdermal preparation of oxybutynin has been developed. At the present time, this agent has not yet been licensed for use in SA. An initial short – term study of transdermal verus oral oxybutynin IR in adults with urinary urge incontinence reported that both treatment options had similar efficacy, but the transdermal route produced significantly less dry mouth. A double – blinded randomised controlled trial (RCT) of transdermal oxybutynin at 3.9 mg administered twice weekly versus placebo, reduced the number of weekly incontinence episodes, reduced average daily urinary frequency increased average voided volume and significantly improved quality of life (QOL) compared with placebo. The incidence of dry mouth was similar in both the groups, and the main AEs associated with transdermal delivery were erythema and pruritis at the site of application.

Different anticholinergics available in RSA

Drug Name	Brand Name	Licensed dose
Tolterodine tartrate ER	Detrusitol XL	4mg o.d
Darifenacin hydrobromide	Enablex	7.5 – 15mg tds
Oxybutynin hydrochloride	Ditropan	2.5mg b.i.d – 5mg tds
Oxybutynin hydrochloride ER	Lyrinel XL	5 – 20mg o.d
Oxybutynin hydrochloride tds	Kentera	1 patch twice weekly
Trospium chloride	Uricon	20mg b.i.d
Solifenacin succinate	Vesicare	5 – 10mg o.d
Propiverine hydrochloride	Detrunorm	15mg o.d. – tds
Propiverine hydrochloride ER	Dertrunorm XL	30mg o.d.

Key:
o.d. = once daily
b.d. = twice daily
tds = three times daily

Propiverine hydrochloride is a tertiary amine with a half – life of approximately 20 hours, showing peak levels in serum after approximately 2.3 hours after ingestion. Like oxybutynin it exhibits a mixed action, exhibiting both anticholinergic and musculotropic effects (calcium channel blocking activity). Doses vary between 15 and 30 mg daily. The clinical trials and data with this agent are limited to a month's duration or less. In a double – blinded randomized placebo – controlled trial of people with OAB, propiverine 15 mg three times daily was compared with oxybutynin 5 mg twice daily and placebo. Both drugs produced objective and subjective improvements compared with placebo at 4 weeks compared with baseline. Propiverine was as effective as oxybutynin in reducing urgency and urge incontinence, but was associated with a lower incidence of dry mouth.

Tolterodine was launched in 1998 and was the first modern anticholinergic on the market.

The ER formulation was released as a once – daily preparation aimed at producing a stable serum concentration over 24 hours. ER has peak serum concentration at 2 – 6 hours post administration. Therapy with tolterodine ER 4mg appears to be efficacious in both older and younger people with OAB; it is useful for at least up to 12 months with improvement in voiding diary parameters including urgency, and patient perception of their condition with a benefit of HRQL based on the King's health questionnaire. The ER formulation is more effective than placebo in different degrees of incontinence severity. It has been shown to be effective in treating women with mixed urinary incontinence with a predominance of urge symptoms over stress.

Trospium chloride, a quaternary amine, is purported to lack CNS effects as it does not cross the blood – brain barrier. Its half – life is between 12 – 18 hours and reached peak plasma concentrations between 4 and 6 hours. The usual dose is 20mg twice daily. Trospium 20 mg twice daily has shown similar results when compared with oxybutynin 5 mg twice daily, with significant reduction in urodynamic and voiding diary parameters (frequency, urgency and urge incontinence) for up to 52 weeks after trospium 20 mg twice – daily treatment.

Two new anticholinergic agents have been released in recent years, namely **solifenacin** and **darifenacin**. Solifenacin has a mean time to maximum plasma concentration of 3 – 8 hours and long elimination half – life of >45 – 68 hours. Solifenacin produces a significant reduction in voiding frequency and a significant increase in volume voided/void in people with OAB and urodynamic evidence of detrusor overactivity. The recommendation is for an initial 5 mg dose with the possibility of dose flexibility by increasing the dose to 10 mg as required. The long term efficacy of solifenacin has been reported in an open – label extension of randomised placebo – controlled trials. The efficacy seen in the initial trials was maintained for up to 52 weeks. About 85% of the study population was satisfied after 24 weeks of flexible dosing, and with regard to efficacy, 74% of the population were satisfied after 24 weeks of flexible dosing.

Darifenacin is a tertiary amine

derivative and is the most selective M3 receptor antagonist. It has been shown to have a higher degree of selectivity for the M3 over the M2 receptor compared with other anticholinergics, with marginal selectivity for the M1 receptor. In healthy volunteers after oral administration of darifenacin, peak plasma concentrations are reached after approximately 7 hours with multiple dosing, and steady – state plasma concentrations are achieved by the sixth day of dosing. In a double – blind, radomised, crossover study comparing darifenacin with oxybutynin in people with proven detrusor overactivity and associated symptoms of OAB, darifenacin was as effective as oxybutynin in terms of the ambulatory urodynamic variables tested but darifenacin 15 and 30 mg controlled release was significantly better in salivary flow compared with oxybutynin 5 mg three times daily.

The introduction of darifenacin has fuelled debate over the potential importance of pharmacological selectivity as related to the AE profile. M1 and M3 receptor have been attributed to dry mouth, M1 to cognitive impairment, M2 to cardiac effects and M3 and M5 to visual effects. Certainly, in this population, this would be of greater significance due to the existence of comorbidity and the susceptibility to impaired cognitive function and nervous system effects. Definitive comment on this subject will inevitably await adequately powered head – to – head comparative studies. Dose flexibility has been explored with darifenacin and clearly showed that some people who do not respond to a lower dose of drug (7.5mg) will do so at higher doses (15mg), but will develop more pronounced AEs inevitably, however, they may accept this as part of the ‘trade – off’ for the greater efficacy experienced

It is clear that among the many drugs tried for the treatment of OAB, acceptable efficacy, documented in RCT’s of good quality, has only been shown for a limited number. The anitmuscarinics tolterodine, trospium, solifenacin and darifenacin, the drugs mixed actions, oxybutynin and propiverine, and the vasopressin analogue, demopressin, were found to fulfill the criteria for level1 evidence according to the Oxford assessment system and were given grade A recommendations by the International Consultation on Incontinence. All antimuscarinics apart from oxybutynin IR were found to be well tolerated. Dry mouth was the most commonly reported adverse event and no drug was associated with an increase in any serious adverse event.

Generally there is little or no good evidence to choose between the anticholinergics

Oestrogen

Whilst the use of oestrogen in the treatment of women with stress incontinence is controversial, its use in women with the irritative symptoms of OAB is more established. Postmenopausal women with genital atrophy or OAB symptoms may receive oral or topical therapy provided no contra – indications exist, but at present, oestrogen therapy for stress incontinence is unwise. As we wallow in post "Women's Health Initiative" hype, we must remember the negative impact of withholding the beneficial effects of oestrogen on the pelvic floor, and not precipitate a host of symptoms caused by significant genital atrophy. Oestrogen is not useful for treating urinary incontinence, but may reduce the incidence of UTI's.

MIXED INCONTINENCE

Ethipramine

Tricyclic anti – depressants have been used widely for symptoms of frequency, urgency, urge incontinence and especially nocturia for many years. Although grade 1 evidence justifying their use is lacking, many patients are satisfied with the results. Ethipramine is inexpensive and widely available, with a multitude of effects – and side effects.

Its actions are anticholinergic in nature, with an adrenergic effect on the bladder neck. Theoretically at least, this makes it ideal for mixed incontinence, but its side – effects are often troublesome. It causes cardiac conduction defects and this has caused the WHO to warn against its use. Dry mouth and drowsiness are the most bothersome side effects, limiting its use. The drug is available in 10mg and 25mg tablets, and the usual starting dose is 10mg in the mornings, with 25mg or 50mg at night. The soporific effect of ethipramine may be used to advantage, allowing increased evening dosage. Contra – indications are as for other anti – cholinergics. If clinicians prescribe ethipramine, they must be aware of its cardiac effects especially in elderly women.

Imipramine

The use of imipramine is parallel to that of ethipramine – with the proviso that it remains untested as a pure anticholinergic for use in incontinence. Imipramine is primarily, with amytriptyline, an antidepressant, and its useful anticholinergic effects are purely fortuitous. Clinicians must be aware that these agents are of limited use as niche agents, and that ethipramine is perhaps more clinically useful.

Pharmcotherapy remains the mainstay of therapy for the treatment of OAB, and the contemporary literature shows that antimuscarinic agents are used as a first line therapy for OAB. To gain a better understanding of the overall benefits of OAB treatment, it is critical that RCTs use validated instruments to assess HRQL and to relate these changes to changes in OAB symptoms. The International Continence Society advocates the use of HRQL measures in clinical research has provided increasing evidence for the HRQL benefits conferred by effective OAB treatments.

The future emphasis of work in this field must also incorporate patient – perceived outcomes using existing tools to assess bother and QOL.

The future

There is an overall trend towards development of once daily extended release preparations for existing anticholinergics, such as extended release oxybutynin and propiverine. Multiple strengths are now available in certain once daily agents such as solifenacin, allowing more flexible therapeutic options. Urinary urgency does not always arise within the bladder, and that when investigating OAB we should consider a variety of pathological causes. With the exception of botulinum toxin and neuromodulation for failed medical therapy for OAB, there have been no new important surgical innovations. These last two options have superceded bladder augmentation by bowel interposition, since they are far less invasive, are reversible, and have fewer side effects.

Chapter 6

Intractable Overactive Bladder: Advanced Management Strategies

Stephen Jeffery

Introduction

The mainstay of treatment for Overactive Bladder is fluid management, bladder retraining and anticholinergic drug therapy. There are, however, a subset of women who do not respond to these standard treatment regimens and remain incontinent, their symptoms having a profound impact on their quality of life. Studies have shown that only 18% of women stay on their drug treatment for longer than 6 months. This appears to be as a result of inadequate efficacy and not side effects. Morris et al performed one of the only trials on long –term outcomes of women treated for OAB with a standard care package of anticholnergics and bladder retraining. Looking at the same subjects a mean of eight years following discharge from the incontinence clinic, only 7% of the cohort reported being cured, with 65% still suffering significant symptoms. Previously, the only therapeutic option for these patients was surgery in the form of bladder augmentation. These operations, however, carry a high morbidity with most having voiding dysfunction requiring clean intermittent self catheterization, and troublesome mucus production.

A number of newer promising treatment options have been developed, including Botulinum Toxin and nerve stimulation techniques.

1. Botulinum Toxin

Botulinum Toxin, which is produced by the bacterium, Clostridium Perfringens, is the most potent toxin known to man. It is a Gram positive, anaerobic bacteria which is commonly found in the soil and 1g of the toxin can kill 1 million people. It blocks the release of acetylcholine at the neuromuscular junction in the detrusor muscle. Amongst those who have contributed to the science of Botulinum Toxin, credit must be given to Schantz who purified the toxin and enabled its mass production. Its first clinical use was in 1980 when it was used to treat strabismus. There are 7 subtypes, A, B, C, D, E, F , G, however only Toxins A and B are available commercially. The Botulnum A Toxin preparation, Botox® (Allergan Inc.) is probably the most well known, but there is an alternative called Dysport® (Ipsen Pharma).   Botulinum Toxin B is marketed by Solstice.

Botox® has been more extensively evaluated in the literature than Dysport®, but there are now a number of studies that now confirm its efficacy. Botox® is three times more potent than Dysport and most reports use 300u for Neurogenic DO and 200u for Idiopathic DO. Exact dosages for Dysport are less clear and ranges from 500u to 1000u are administered.

The toxin is usually administered using either a flexible or rigid cystoscope using a flexible 26 gauge needle that is threaded through the working channel of the scope. The toxin is diluted into 20 ml of normal saline and injected in 1ml aliquots under local or general anaesthesia. Most practitioners avoid injecting the bladder trigone because of the theoretical risk of reflux. Recent work has, however, shown that trigonal injections are not associated with reflux and have equivalent efficacy to the extra-trigonal administration. When a flexible cystoscope is used, the Botox can be given using local anaesthetic gel but sedation or general anaesthesia is usually necessary when using a rigid scope.

Schurch et al were the first to use intradetrusor Botox injections for the treatment of severe detrusor overactivity in spinal cord injured patients. Profound improvements were demonstrated, with 17 of 19 patients achieving continence. A large amount of data has emerged since then suggesting excellent efficacy in Neurogenic DO. Schurch et al reported again in 2005 on 59 NDO patients. This was double blind placebo controlled parallel group study. They gave patients either placebo, Botox 200u or

Botox 300u. Up to six months follow-up, they reported a 50 % reduction in incontinence episodes with 49% of the cohort reporting being dry. The urodynamic findings compared to placebo were remarkable with highly significant increases in maximum cystometric capacity at two, six and 24 weeks compared to placebo.

Following the success in NDO a number of studies began looking at the treatment of Idiopathic DO. The problem with IDO is the risk of voiding dysfunction – since unlike in NDO, most of these patients have normal voiding function. Popat et al published the first data on IDO using Botox, achieving continence rates of 57%. The incidence of de novo voiding dysfunction was 19%. In a further randomized controlled trial, Sahai et al report profound improvements in multiple outcomes following the injection of Botox when compared to placebo.

The main adverse event following Botulinum injections is temporary urinary retention, with a reported incidence of between 19% to 35%. Women who develop this complication are required to perform clean intermittent self catheterization or have a suprapubic catheter inserted.

The Botulinum Toxin effect on the detrusor lasts for approximately six to nine months and it usually requires repeat administration following this. As the urgency and urge incontinence return, normal voiding is also regained in those women who developed urinary retention.

An important factor to take into consideration is the cost of the Botulinum Toxin product. Botox is sold in vials of 100u and a single course of 300u would have a cost in excess of R6000. Dysport has only recently been launched in South Africa and would have a comparable price tag. One would need to add to this the costs of administration, including surgeons fees, theatre time and disposables.

2. Sacral Nerve Stimulation (SNS)

This device works by implanting a pacemaker-like neurostimulator in the lower back that sends mild electrical impulses to electrodes that are usually placed adjacent to the third sacral nerve root. The device received European Union approval in 1994 and USA FDA approval in 1999 and more than 35000 devices having been implanted worldwide to date. In patients with OAB, SNS restores the balance between inhibitory and excitatory control systems at various sites in the peripheral CNS. This involves stimulation of somatosensory ascending tracts projecting from the bladder into the pontine micturition centre in the brain stem. The electrical impulses also activate the pelvic efferent hypogastric sympathetic nerves, which promotes continence.

The device is inserted in two phases. The test phase includes the temporary insertion of a needle into the sacral foramen under local anaesthetic and the electrical stimulation is derived from an externally placed battery and generator. If the subject reports a satisfactory response after three to four weeks, defined as more than 50% improvement in symptoms, a permanent device is sited. This involves the implantation of a long-term battery and neurostimulator in the buttock and lower back.

A RCT reported continence outcomes of 47% at six month follow up, with a further 29% reporting more than 50% reduction in leakage episodes. A further systematic review confirmed these findings with 67% of patients reporting being dry or having a more than 50% improvement in symptoms. Another trial that followed patients up for a mean of more than 5 years reported continued success in 76% of the cohort.

Despite these success rates, this therapeutic option is not accessible to the majority of women largely due to the cost of the device and the expertise required to place and maintain the neurostimulator. It is available in South Africa, supplied by Medtronic, but retails for approximately R55000.

There are also significant adverse events associated with this equipment including pain and discomfort, seroma formation, disturbed bowel function and wound dehiscence.

3. Posterior Tibial Nerve Stimulation

Because of the technical and cost implications of SNS, indirect neuromodulation of S2,3 and 4 via stimulation of the posterior tibial nerve, was developed. The technique is performed by passing an electric current between a small acupuncture needle 4cm above the medial malleoulus and an electrode on the sole of the patient's foot. The device has only recently become available and marketed by Manta Surgical under the name of "Urgent PC" in South Africa. There is a significant disposable component to the equipment, including a single use electrode and needle and this unfortunately drives up the cost of using this device. The treatment regime consists of up to 12 weekly sessions of 30 minutes although it may be efficacious after shorter treatment periods, it does not last indefinitely and it needs to be repeated after a few months.

It has been shown to be efficacious in two trials with one reporting more than 50% reduction in leakage episodes in 70% of their cohort, 46% of the subjects reporting being dry. 71% of the cohort of 53 patients in another trial reported treatment success.

4. Surgical Therapy

Clam ileocystoplasty and augmentation procedures are usually reserved for patients with neurogenic detrusor overactivity and high pressure bladders with the potential of upper tract damage. The advent of neuromodulation and Botox has provided us with additional options prior to resorting to surgery. Augmentation procedures also have a high incidence of urinary retention requiring catheterization.

5. Alternative therapy

A number of studies have shown acupuncture to be a useful adjunct to therapy. A study performed in the late 1980's reported a 77% reduction in urgency and frequency in 77% of their patients versus only 20% in placebo. These findings have been confirmed by Bergstrom et al who also demonstrated reduced incontinence episodes. The most interesting data have emerged from a trial where women were randomised to acupuncture in bladder specific points versus relaxation point acupuncture. They demonstrated significant improvements in quality of life and frequency episodes in the group receiving bladder specific acupuncture. Acupuncture is readily available, is inexpensive and can be performed by many physiotherapists- and hence should be kept in mind for those women who do not want medication.

The Treatment of Stress Incontinence

Peter de Jong

Stress Urinary Incontinence is defined as the complaint of involuntary leakage on effort or exertion, or on sneezing or coughing.

Stress incontinence occurs when one coughs, sneezes or jumps, resulting in a few drops or urine leaking out. It is caused by vaginal childbirth, aging and genetic factors.

Where do we begin? – Physiotherapy

The first step in therapy is to have the sufferer visit a physiotherapist with a special interest in pelvic floor rehabilitation. The physio will assess the strength of the patient's pelvic floor, and suggest exercise to enhance the muscle power of the Levator muscles. She will need to have a programme of daily exercises extending over a number of weeks.

Pelvic Muscle Exercises
Do 45 pelvic muscle exercises every day, 15 at a time, 3 times a day:
15 lying down in the morning
15 standing up in the afternoon
15 sitting down in the evening

For each exercise:
Squeeze the pelvic muscles for 10 seconds (start at 1 second and build up)
Relax for 10 seconds

Remember to relax at the muscles in your abdomen when you do these exercises, and continue to breathe normally.

Test the power and effectiveness of your exercises by placing 2 fingers in the vagina, and squeezing. The physio will assist in assessing pelvic muscle tone.

The physiotherapist may also choose to employ the following:
Weighted vaginal cones, which are placed in the vagina while the patient actively squeezes the pelvic muscles to prevent the vaginal cones from falling out. The weights begin at 20g, and increase until the woman can manage to retain a cone of 100g, for 30min twice daily.

Faradism, where tiny electric impulses are sent through an electrode placed in the vagina. The current stimulates the correct muscles to contract, and so build Levator power.

Bio feedback, where the patient squeezes a balloon placed in the vagina, reflecting on an indicator the power of the pelvic muscle contractions.

If a woman persists in physiotherapy, there is no doubt that the technique will result in better muscle strength and control, with a corresponding improvement in bladder control.

Bear in mind that physiotherapy is without side effects, may be done at home, and empowers the sufferer to take charge of her recovery.

Physiotherapy is also useful in the management of the overactive bladder, when exercises are known as the “urge strategy”, and help in the management of urge incontinence

When Is Surgery Indicated?

When the relief obtained by physiotherapy is unsatisfactory, then other options may be explored.

For women with significant symptoms (for example, they need to wear a pad daily), some form of surgical option may be indicated.

The Surgical Management Of Stress Incontinence

Vaginal birth and aging are important causes of urinary stress incontinence. Ingenious operations to cure this common and distressing symptom in women have been devised. As a better understanding of the mechanisms of continence have evolved, operations to cure the condition have improved.

Over the years there have been many operations for the treatment of urinary incontinence, suggesting no single procedure is effective in the management of this common and distressing condition. Recently new procedures have become available, being safer, and more effective, than previous interventions.

Historical Perspective

Traditionally the anterior repair of a cystocoele using Kelly plication sutures have been useful in the management of stress incontinence. However the effect is transient, and while it cures anterior compartment prolapse, the anterior repair is not an authentic continence operation. Meta analyses of heterogenous studies suggest a continence rate of 67% - 72%, but generally the success is around 66%. Long term results are poor, and at 5 years success falls to 37%. The major indication for a bladder buttress in contemporary practice is for the woman who prefers to sacrifice continence for a reduced chance of complication – the incidence of long – term voiding complication following this procedure approaches zero.

One of the first effective procedures to gain acceptance was the Burch colposuspension. John Burch described his operation in the 1950’s and it became the accepted benchmark. Several sutures plicate the peri – urethral fascia to elevate the anterior vaginal wall and bladder. Colposuspension is still applicable today, if the patient requires a continence procedure and is fortuitously undergoing laparotomy.

While the Burch procedure is as effective as modern sub – urethral slings, a prospective randomized trial showed higher morbidity than the sling so it is nowadays probably best reserved for women subject to serindipidous pelvic surgery. Several drawbacks attend the operation, chief of which is subsequent enterocoele formation. Voiding dysfunction, detrusor overactivity and uterovaginal prolapse are consistently reported sequelae to colposuspension.
The widespread adoption of the modern TVT has been primarily driven by the reduced surgical morbidity of such procedures. In

a recent randomized controlled trial between the TVT and colposuspension, analysis after 2 years reported an objective success rate for the Burch of 51% versus 63% for the TVT group.

In the 1960's needle suspension procedures were popularized by Stamey, Pereyra, Raz and others, but time has shown that while short – term cure was reasonable, they were insufficiently robust to maintain continence. Needle suspensions are now perhaps only indicated in the less – mobile elderly where a quick gentle procedure will suffice. Efficacy in the long term is poor, with only 50% - 60% cure at 4 years. Needle suspensions do not produce a lower complication rate than the colposuspension, and there is little evidence to support their continued use.

Having been described and used more than a century previously, the rectus sheath sling was all the rage in the 1970's. While this effectively cures stress incontinence, the procedure suffers considerable morbidity, and comes with the high price of voiding difficulty and irritative storage bladder symptoms. The mean cure rate is a pleasing 86% but long term voiding dysfunction (refractory urge incontinence, the need for clean intermittent catheterisation, and sling revision) occur in 10% of cases. Rectus fascia procedures are safe, with good longterm results and have became the benchmark for this form of sling surgery. Autologous slings can be used to provide effective long term cure of stress incontinence, but allograft and xenograft slings should only be used in the context of well constructed research trials.

In the 1980's the laparoscopic Burch was introduced, riding the crest of the endoscopic revolution. This sporting procedure was the province of the laparoscopic affecionado, but showed no advantage over the other procedures of the time. There is a higher cure rate with the "open" Burch procedure, and the evidence on laparoscopic Burch is limited by short – term follow – up, small numbers, poor methodology and its technical difficulty.

Peri - urethral injectable agents have been used for the treatment of SI for the past century, but newer agents have caused a re – focus on these methods. A variety of substances have been reported to be safe including GAX collagen, Teflon, zirconium beads, hyaluronic acid, and autologous fat and cartilage. But the ideal agent remains elusive. Agents are applied without general or regional anaesthesia, but there is no agreed method, technique, location, volume or equipment for the procedure. Although short term efficacy in some agents is satisfactory, evidence shows that long term durability of more than 4 years is poor, and no agent is superior to another in terms of efficacy, durability or safety. A recent report suggests that stem cells may be injected adjacent to the urethral sphincter. No data is available suggesting how stem cells obtain innervation, or functional potential. This form of therapy is for now at least, still very experimental. Para – urethral injections can be offered to women with SI on the basis of low operative morbidity – if they are prepared to accept a poor long term success rate.

In the 1990's the concept of urinary continence being maintained by sub – urethral fascial support was mooted by Petros and Ulmsten in their "Integral Theory" of female continence. From this came the Tension- Free Revolution, with the realization that an open – weave 10mm sub – urethral sling placed without tension mid – urethrally, afforded remarkable results with little morbidity. The original retropubic approach (TVT-R) has now in the new millennium been superceded by the transobturator slings – safer, easier vaginal procedures with the same tension – free sub – urethral principle, but avoiding the pelvic cavity and its viscera completely.

Long term data suggested that (at least until recently) the retropubic TVT-R had become the benchmark, with excellent cure rates in a well described, standardized procedure, easily reproduced by most urogynaecologists with predictable outcomes. The Burch colposuspension, conversely, had many modifications and variations of sutures, approaches and methods, yielding variable outcomes as a result.

With progress in minimally invasive surgery, and the idea instead of using trochars attached to synthetic slings instead of open incision, the retropubic midurethral sling (MUS) was developed.

For descriptive purposes, the term MUS will be used to describe the group of synthetic slings placed under the midurehtra with a small incision using various trochar devices. This is in contrast to the traditional slings which typically were placed under the proximal urethral through larger incisions without trochars. The 2 general categories of MUS are the retropubic and transobturator Cede

The Retropubic TVT (TVT-R)

The classic retropubic tension – free vaginal tape (TVT-R) is a safe and well – tolerated procedure with an 81% cure at 7 years follow – up, and an improvement rate of 94%. Some fatalities have occurred due to bowel damage and uncontrolled retropubic haemorrhage. A few small, retrospective, non – randomized studies comparing retropubic to the newer transobturator procedures show similar cure rates, but these studies are too underpowered to show meaningful differences in complications rates. Review papers suggest the obvious, that obturator approaches are safer because of avoidance of pelvic cavity viscera – but no hard evidence exists to support this notion. Given that transobturator approaches are probably safer and equally as effective as retropubic TVT, the thoughtful continence practitioner must consider if the "inside – out" route is safer, or otherwise, than the "outside – in" transobturator approach.

The New Transobturator Approach

Transobturator "outside – in" procedures

This concept was first described in 2001, and represented a completely different approach for placement of the tension – free mid – urethral tape. Initially a welded semi – rigid tape of non – woven monofilament polypropylene was used, with 5% elasticity and 70% porosity (Obtape TOT device). This tape is now obsolete. Women are placed in the Lithotomy position, and the 10mm tape passes sub – urethrally through the obturator fossa to exit the skin through a small incision on the medial aspect of the inner thigh. The introducer passes from the obturator fossa medially inwards towards the vagina, hence the “outside – in” appellation.

The manufacturers (Mentor – Porges) have since introduced the ArisR type 1 light weight superior mesh, being woven in such a manner as to have low elasticity. Since 2002 more than 25, 000 TOT procedures have been performed, giving a reported success rate of 80% - 90%, improvement in continence of 7% – 9%, and a failure rate of up to 7%. Complications include bladder injuries in 0.7% of cases, and a 3% – 5% incidence of voiding dysfunction.

Post – operative retention occurs in around 0.5% of cases, with other complications including thigh pain, haematomas, vaginal and urethral erosions. The overall Obtape complication rate is around 3.6%. These results have been carefully collated by a French Multicenter Registry with ObtapeR surveillance, comprising 9 centres and including data from some 730 women.

In a recent study of 117 women, the ObtapeR afforded a 92% cure (defined as complete or partial satisfaction), with a 5% complication rate. Tape erosions over the 22 month follow – up period, occurred in 3 cases.

Another popular “outside – in” device is the MonarcR tape, and one – year data shows similar results. The objective cure rate is 82%, with adverse events including mesh erosions, urinary retention and urinary tract infections.

Data are very difficult to interpret and care must be taken when comparing studies. Since no “head to head” prospective randomized comparative trials of methods have been presented, it is impossible at this point to claim superiority or safety of one product over another.

Transobturator “inside – out” procedures

The Transobturator “inside – out” approach was first mooted by de Leval in 2003. The device is introduced through a 10mm suburethral vaginal skin incision, and passed laterally through the obturator fossa to the medial thigh area, and hence the “inside - out” moniker. This novel approach was developed after extensive cadaveric dissection and one year data suggest a 91% cure rate, with 5% of cases showing improvement. Post operative complications include voiding dysfunction in 5% of women, with a 12% incidence of transient inner thigh pain and a few cases of vaginal healing defects. In a 2004 prospective series, Waltregny found a cure rate of 94% with no reported complications. Procedures typically take around 20 minutes to perform, and may be done as day case procedures if the patient prefers. Although general or regional anaesthesia is the norm, they may be done under local anaesthetic. Intra – operative cystoscopy is not generally required.

It is difficult to draw conclusions from these data, and clinical trials will show comparative success rates and the incidence of perioperative complications. It has become common to measure the "passing distance" of the different devices to vital anatomical structures in preserved or fresh cadaver specimens, but once again this does not necessarily translate to clinical safety or otherwise.

Transobturator "Outside In" Vs "Inside Out" – Which Is Best?

The "Outside in" approach of Delorme

The original technique of Delorme is intuitive and uncomplicated, even in obese subjects. Theoretically the passage of the vaginal finger may cause some tissue destruction because of the more extensive dissection, particularly in the atrophic vagina with thinner vaginal skin, leading to infection, erosion or tape displacement. With the introduction of the new improved type 1 mesh (ARISTM), a lower erosion rate is expected. Complications involving the urethra, bladder and vagina have been described.

The "Inside out" approach of de Leval

This dissection is less extensive without the need for digital control, and the mesh used is extra - ordinarily well tolerated with long – term clinical data available. Whilst the urethra and bladder may be at less risk than in the original outside - in technique, clinical trials will need to confirm, or refute the notion of increased safety using the newer operation.

Hysterectomy during a continence procedure

Hysterectomy is a commonly performed operation in gynaecology, and SI is a common condition. Should hysterectomy be combined with a prophylactic continence procedure? Is the efficacy of either procedure affected by concomitant surgery? Assuming that SI is a symptomatic and demonstrable problem, evidence suggests that abdominal hysterectomy performed at the time of a Burch colposuspension has no adverse effect on the cure rate of stress incontinence, but complications are increased significantly. However vaginal hysterectomy at the time of a TVT has no adverse effect on surgical outcome. Bear in mind that when performing an anterior repair procedure, a significant percentage of cases will develop de – novo SI because urethral obstruction is relieved. It is very difficult to predict which cases will develop de novo SI, and no predictive tests are currently available to determine which cases should be offered "prophylactic" incontinence procedures.

The Future

Recently the "mini – sling" products have become available, consisting of shorter lengths of mesh introduced vaginally below the subpubic arch, with no exit points. The mini – sling type operations work on a different principle to the conventional obturator approach, and are placed with the mesh adjacent to the urethra. At this stage no long term comparative data regarding efficacy are available. Stem cells injected para – urethrally remain an interesting possibility, but are still, at this stage, experimental.

Conclusion

The obturator approach to the treatment of stress incontinence offers many advantages over previous operations, especially ease of surgery, safety and good predictable cure rates. Apologists for each method have preferences that should be respected – but at the present time there is no sound clinical evidence comparing the "outside – in" to the "inside – out" transobturator approach, and this data is awaited with interest. Theory and opinion do not translate to clinical evidence. While the retropubic approach is still popular, the obturator approach has many probable advantages to recommend this technique, and make it the treatment of choice. A multitude of sling products are now available on the South African market, many being fake copy – cat counterfeits of the originators. While the ersatz knock – offs may be slightly cheaper (since no development costs were involved), the originators have the advantage of published clinical trials proving good outcomes. Fake products are seldom an improvement on the originals and must be used with caution.

References

Extensive use has been made of detailed reviews by Cardozo and Chapple published in the BJOG. The interested reader is urged to obtain the BJOG supplements, and obtain references from the reviews.

Chapter 8

The Management of Voiding Disorders

Peter Roos

Introduction

Incomplete bladder emptying and urinary retention can lead to severe urinary tract infection and upper urinary tract disease as a consequence of retrograde infection and hydronephrosis. Obviously these problems all carry quite a significant morbidity and even mortality if unrecognised and untreated. Undiagnosed problems related to voiding will often be diagnosed only when one encounters the troublesome complication of urinary retention following pelvic floor surgery. It is therefore essential that anybody practicing gynaecology, urology or uro-gynaecology should have an understanding of the causes, diagnosis and management of voiding disorders.

Aetiology

There are essentially only 3 reasons that an individual will experience difficulty with voiding:

- Inefficient or absent detrusor contractility. Impaired detrusor contractility (IDC) and detrusor areflexia (DA).
- Obstruction to urinary flow often called bladder outlet obstruction in males. (BOO)
- Lack of co-ordination between detrusor contraction and relaxation of the urethral sphincter, known as detrusor-sphincter dyssynergia (DSD).

It would seem quite simple to now present a trainee in gynaecology, urology or uro-gynaecology with a set of tables giving the causes of the three different types of dysfunction. The problem however is that neurological pathology can often be a cause of these dysfunctions and various neurological conditions can cause overactive bladder symptoms, impaired detrusor contractility and incontinence. A good starting point therefore is to list the various neurological factors which can affect the lower urinary tract (Table I)

Table I: Neurological Disorders Affecting Voiding

- Cerebrovascular accidents
  Brain tumours
- Cerebral Palsy
- Parkinsons disease
- Shy-Drager Syndrome
- Multiple sclerosis
- Spinal cord injuries – suprasacral and sacral
- Infectious conditions (tabes dorsalis, poliomyelitis, transverse myelitis, herpes zoster)
- Skeletal abnormalities of the spine (disc problems, ankylosing spondylitis)
- Peripheral nerve damage (radical surgery, diabetes mellitus)

Neurological disorders often overwhelm the average clinician, who probably slept through neurology lectures at university. These are just a few important things to remember.

Most conditions of the central nervous system can produce the full range of bladder symptoms, varying sometimes from one stage of the disease to another.

Sacral spinal injuries, lumbar-sacral nerve route compression and peripheral nerve damage usually cause DA.

Important causes of DSD are spinal cord injuries and multiple sclerosis. These conditions can cause high pressures within the bladder of above 40cmH20 without the urethral sphincter opening. This causes severe back pressure and upper urinary tract damage. Fortunately most neurological conditions causing bladder pathology will be perfectly obvious. It is however important in the patient with atypical or mixed urinary symptoms to be on the lookout for more subtle neurological changes before instituting treatment, especially surgical treatment.

Table 11: Other Causes Of Voiding Dysfunction

Obstructive

- Urethral stenosis
- Urethral sphincter hypertrophy
- Pelvic masses

- Uterine prolapse
- Anterior vaginal wall prolapse
- Foreign bodies
- Post surgical, especially surgery for urinary stress incontinence

Inflammatory

- Severe vulvo vaginitis (genital herpes, severe vulvo-vaginal candidiasis)
- Urethritis and cystitis

Pharmacological

- General anaesthesia
- Regional anaesthesia
- Analgesics (Morphine)
- Anti depressants
- Anti cholinergics

Detrusor Muscle Abnormalities

- Detrusor myopathy
- Over distention

Psychogenic

Post Partum Voiding Difficulty

Idiopathic

Surgical

- Will be discussed later in this chapter

Diagnosis

History

A good history is usually the most important aspect of making a diagnosis for any condition. Until recently, however, the correlation between history, clinical findings and special investigations has shown poor correlation in women and been more extensively and better defined in men.

The following urinary symptoms are however important in making the diagnosis of suspected voiding abnormalities. Be aware however that different studies have linked these symptoms differently to confirmed voiding disorders

- Hesitancy
- Straining to void
- Feeling of incomplete emptying
- Terminal dribble
- Post micturition dribble
- Splitting and spraying of urine
- Changing position to void

The above urinary symptoms may also be associated with overactive bladder symptoms and incontinence.

Further important questions in the history would be careful questioning about the usage of medications, recent pelvic or abdominal surgery, neurological symptoms and symptoms of utero-vaginal prolapse.

Examination

A good general examination looking for systemic causes of urinary symptoms is vital.

Abdominal and pelvic examinations should concentrate on detecting local lesions and anomalies, which might cause urinary obstruction, such as pelvi-abdominal tumours, utero-vaginal prolapse, vulvo-vaginitis, urethritis and evidence of pelvic floor spasm or relaxation.

In difficult cases, with mixed urinary symptoms, or where symptoms have had sudden onset, careful neurological examination including inspecting the lumbar spine, assessing sensory and motor function in the pelvic area and checking peripheral reflexes are all important features of the examination.

Special Investigations

- Mid stream urine examination for infection and haematuria
- Post micturition residual volume. For a long time, a residual volume of 100ml was considered to be cut off point for normality, however more recently it has been suggested that any residual volume over 30ml might be associated with urinary tract infection. Residual volumes can be measured either by catheterisation or ultrasound scanning. Ultrasound scanning is less invasive and causes less discomfort than urinary catheterisation. It is important to remember however that the accuracy of this measurement depends on the time since the last passage of urine until the time of the measurement of the residual volume.
- Uroflowmetry is an excellent non invasive screening test for voiding dysfunction. A flow rate of less than 15ml per second would be considered to be abnormal. This flow rate however also needs to be compared to the voided volume and the Liverpool Nomogram, plotting flow rate against voided volume, is used for this purpose.
- Uro-dynamic studies. If the diagnosis of voiding dysfunction has been made, uro-dynamic

studies are important for confirmation of this diagnosis and to assess whether the voiding dysfunction is associated with poor detrusor contractions or obstruction, associated with high bladder pressures of more than 20cm H2O with maximum flow of less than 15ml/sec.
- Imaging of the bladder and lower urinary tract by means of ultrasound or videocystourethrography can also be used.
- Other simple non invasive investigations could include voiding diaries and frequency and volume charts kept by the patient.

Treatment Of Voiding Disorders

(Excluding Voiding Difficulty After Incontinence Surgery)

The treatment of voiding disorders obviously is dependant on the underlying cause. If the underlying cause is obstructive, such as in pelvic swellings, utero-vaginal prolapse, constipation or foreign bodies, these problems should obviously be attended to. Treatment of vulvo-vaginitis and urethritis goes without saying.
In consultation with the medical practitioners taking care of this particular patient, changes in medication, which might be causing the problem should be considered as well as attention to the psychological and psychiatric health of the individual.
If the condition is untreatable or chronic, such as in neurological disorders, the following options are recommended:

- Timed voiding with assistance in increasing abdominal pressure, such as the Valsalva manoeuvre or Crede's manoeuvre, where the patient or an assistant increases the abdominal pressure by pushing supra-pubically.
- Intermittent clean catheterisation. This has proven to be a very useful and safe method of emptying the bladder without continuous catheterisation. This can be done at 2-4 hourly intervals and can be performed by the patient themselves if they have the necessary motor co-ordination to do it. In spinal injuries below C7, most patients can manage this themselves. Clean catheterisation as opposed to sterile catheterisation is quite acceptable in the home environment, however in hospital, it might be more

appropriate to use sterile techniques to prevent cross infection.
- Continuous catheterisation. This can either be done by trans-urethral catheter or supra-pubic catheterisation. These patients need careful surveillance for urinary tract infection, stone formation and regular cystoscopy to exclude the development of bladder carcinomas.
- Medical therapy. Medical therapy should be aimed at treating urinary tract infections and reducing the risks of high pressure bladders with a closed urethra by using anti cholinergic agents. Medical therapy to increase detrusor contractions has been disappointing.
- Neuromodulation with stimulators might be used in some of these conditions.

Voiding Difficulty After Incontinence Surgery

Voiding difficulty and retention of urine following surgery for urinary stress incontinence is becoming less common, but is nevertheless a stressful and uncomfortable complication for both patient and surgeon. Having said that, the incidence is probably becoming less with the use of mid urethral tapes, this condition probably also remains under diagnosed and under reported.

The two major issues concerning post operative urinary retention are:

1. Can it be predicted and therefore prevented
2. What to do about the problem once it arises.

Causes Of Post Operative Voiding Dysfunctions

- Undiagnosed pre-existing condition.
- Factors related to anaesthesia e.g general anaesthesia, regional anaesthesia, atropine, anaesthetic reversal agents and analgesics
- Post operative pain.
- Oedema and swelling around the urethra and bladder neck.
- Constipation.
- Operative technique e.g over-elevation of the bladder neck with colpo-suspension and urethral compression with mid-urethral tapes.
- Other possible causes of post operative voiding dysfunction are previous incontinence

surgery, age and post menopausal status

Incidence

The reported incidence of post operative voiding difficulty and retention of urine varies greatly in the literature and is frequently thought to be under reported.

Comparative studies between colpo-suspension and tension free vaginal tapes suggest that the incidence is approximately 7% in both of these procedures. The reported incidence of voiding dysfunction following mid urethral tapes, either by the retro-pubic or trans-obturator route seems to settle between 4 and 6 % but has been reported as high as 10%. Reported incidence of voiding dysfunction in previously used procedures such as Burch colpo-suspension, Marshall Marchetti Krantz procedures, slings and needle suspensions have varied between 5 and 22%.

Voiding dysfunction following the injection of bulking agents, does not seem to have been a major problem.

Prediction Of Post Operative Urinary Retention

- Although there is no universal agreement, it is important to pay attention to the symptoms of voiding dysfunctions listed above.
- History of age, menopausal status and previous surgical history should be taken into account.
- The presence of a raised residual urine.
- Uroflowmetry of less than 15ml/second.
- Abnormalities of uro-dynamic studies, particularly those suggestive of outflow obstruction and poor detrusor activity for whatever cause.
- Inexperienced surgeon not following recommended techniques

Management

- Prevention. Attention should be given to the above predisposing factors. In the care of a trained uro-gynaecologist after careful assessment, these factors do not necessarily preclude the use of surgery for the treatment of urinary stress incontinence.
- Counselling. Patients having surgery for urinary stress incontinence should all be counselled that urinary retention and voiding difficulty might be a complication in up to 10% of cases. Furthermore,

in cases where voiding difficulty might be anticipated, it might be worthwhile teaching clean, intermittent self catheterisation pre-operatively.
- Temporary causes of voiding dysfunction and retention should be treated expectantly. Within a few days, swelling, bruising and oedema should disappear and various drugs contributing to the problem should be excreted. The treatment of pain and constipation are important.

Post operative voiding difficulty with high residual volumes and urinary retention might occur either in the immediate post operative period or much later, even after years. The management of the problem related to the surgical procedure itself, particularly with the use of mid urethral tape, is according to whether the diagnosis is made in the immediate post operative period or much later

- Early post operative voiding difficulty, particularly with the presence of a mid urethral tape, which persists beyond the time when the reversible causes have disappeared, is usually treated early in the first 7-10 days before tissue ingrowth has taken place. This can be done as a simple surgical procedure with local anaesthesia. The vaginal epithelium over the tape is opened and the tape itself is pulled down 1-2 cm.
- Later diagnosis of voiding difficulty in the presence of mid urethral tapes, when tissue ingrowth has already taken place, needs to be done as a more formal surgical procedure either cutting or removing a portion of the tape underneath the urethra.
- Other forms of surgical release include transvaginal and retropubic urethrolysis.

A very nice description of the methods of releasing post surgical obstruction can be found in the Textbook of Female Urology and Uro-gynaecology, Volume 2 Chapter 68 by Huckabay and Nitti, Editors Cardozo and Staskin, Publishers Informa Healthcare, 2006

The early and late release of mid urethral tapes is very successful in the management of voiding difficulties and interestingly, up to more than 60% of patients will remain continent despite cutting or removing the tape, however in some of these patients, overactive bladder symptoms might persist.

There is some difference of opinion as to whether when removing a tape for obstruction, one should replace it immediately with a new tape. There are some who recommend removing the tape and then doing a cough test to assess whether there is stress incontinence, before putting a new tape in. It would seem however appropriate to adopt a wait and see policy in view of the fact that so many people, particularly with late release of tapes will remain continent after the tape cutting or removal.

In the event of planning conservative management for the above problems, it is frequently necessary to perform intermittent catheterisation and pay special attention to the treatment of overactive bladder symptoms with anti cholinergics. With the easy access to changing tension and removing and cutting mid urethral tapes, conservative management with prolonged catheterisation and the use of anti cholinergics is becoming less popular.

Recommended Reading

1. Vasavada S, Appell R A, Sand P K, Raz R eds. Female Urology, Uro-Gynaecology and Voiding Dysfunction. London: Taylor and Francis 2005.
2. Abrams P. Urodynamics third edition. Springer-Verlag London 2006.
3. Cardozo L, Staskin D Textbook of Female Urology and Uro-Gynaecology Second Edition Informa Healthcare 2006.
4. Lansang R S. Bladder Management March 2006. eMedicine Specialities, Rehabilitation Protocols. Massagli T L, Talavera F, Salcido R, Allen K L, Lorenzo C T editors.
5. Both the International Uro-Gynaecology Journal (including pelvic floor dysfunction) and BJU International are journals worth consulting on a regular basis, where you will find updates, reviews and original articles on the topics discussed in this chapter.

Chapter 9

Sexual function in women with urinary incontinence

Kobus van Rensburg

Introduction

Urinary incontinence and pelvic organ prolapse can adversely affect almost every aspect of a woman's life, including her sexuality. Sexual function is complex and impacts the woman to affect the perception of her own image and the formation of relationships with others.

Sexuality and urinary incontinence are often considered to be taboos in the minds of many people, but recently the fields of urogynaecology and female urology have focused attention on female sexual function to align it with the extensive research performed in male sexuality.

At present, there is no consensus regarding the definition of normal sexual function. In 1992 the World Health Organization International Classification of Diseases-10 defined female sexual dysfunction (FSD) as "the various ways in which an individual is unable to participate in a sexual relationship as she would wish". In1998, Basson et al received consensus on the classification of sexual dysfunction and divided it into four major categories including dysfunction of desire, arousal and orgasm with a fourth category for sexual pain disorders. The final category included other sexual pain disorders not associated with coitus (Table1). The American Foundation for Urologic Diseases classification system includes personal distress in each category and therefore the general opinion is that in order to make a diagnosis of FSD, it must be associated with personal distress.

The focus of this chapter will be directed towards the impact of urinary incontinence on female sexuality.

Prevalence

i) FSD

According to the National Health and Social Life Survey FSD is common, with a prevalence of 43% in women between the ages of 18 and 54 years. Lack of desire is the most common category with 32% of patients describing this as reason for their dysfunctional sex lives. (Table 2)

ii) FSD and urinary incontinence

Coital urinary incontinence (CUI) occurs in 24- 34% of women. Thirty-two percent of women reported urinary incontinence at intercourse in a recent South African study, with 31% avoiding intercourse altogether due to their urinary leakage. In the same study, stress urinary incontinence (SUI) was more commonly associated with leakage during penetration (32%) when compared to urge urinary incontinence (UUI) (7.8%). However, women with urge urinary incontinence leaked more often during orgasm (15.4%) compared to women with SUI (6.6%). This confirms then the commonly held notion that SUI occurs more commonly during penetration and UUI during orgasm.

Etiology of sexual dysfunction

i) FSD

The etiology of FSD is multi dimensional including physiological and psychological factors, and interpersonal and sociocultural influences. (Table 3)

Physiological factors, such as medical condition involving the urogenital tract, contribute to the complex etiology of FSD. Psychological factors such as mood disturbances, stress and substance abuse are also etiological factors. Interpersonal relationship such as partner illness or lack of privacy might also contribute to FSD. Finally, sociocultural influences, such as cultural and religious

Table I. Categories of sexual dysfunction

Low sexual desire	Difficulty with Arousal	Difficulty with orgasm	Sexual pain disorder
Hypoactive sexual desire disorder Sexual aversion	Female arousal disorder		Dyspareunia Vaginismus Other non-sex causes

beliefs have an important impact on sexual function.

Table II Prevalence of female sexual dysfunction

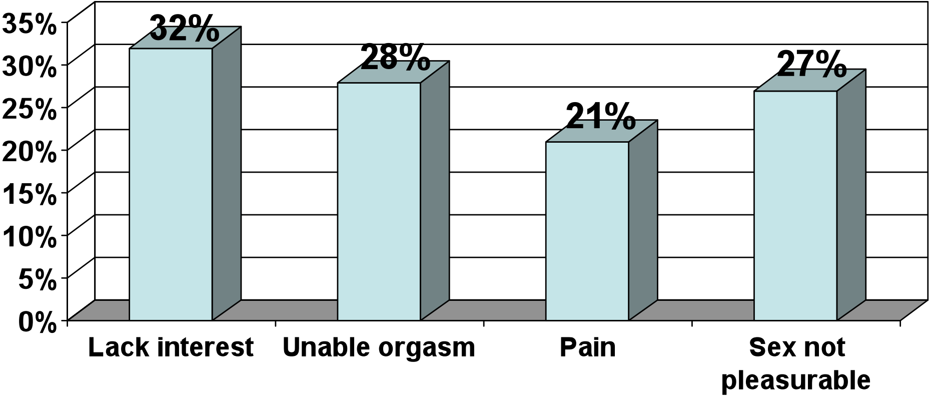


Table III: Etiology of female sexual dysfunction (FSD) (Bachman et al. In CD: Insights in FSD (2004)

- Physiol
- Psycol
- Urogenital
- Depression / Anxiety
- Neural
- Prior abuse
- CVS
- Stress
- Medication
- Alcohol / Substances
- Hormonal loss
- FSD
- Interpersonal Sociocultural influences
- Inadequate education
- Conflict family, religious
- Societal taboos

ii) FSD and urinary incontinence

Urinary incontinence can be associated with FSD for a number of reasons, including physical and psychological factors, performance anxiety, pain and an unsympathetic reaction from the partner. Other issues contributing to a sense of reduced sexuality include a poor self-esteem, mood changes associated with decreased libido, the use of protective underwear and reduced spontaneity. The fear of leaking urine and a concern about odour also induce a sense of anxiety. Women who leak and have developed a vulval dermatitis as a result may occasionally present with Dyspareunia.

Looking at the overall impact of

stress, urge and mixed urinary incontinence, it would appear that a mixed picture has the most significant impact on sexual function in women.

Coital incontinence should always be evaluated in the context of the women's age since this has also been identified as an independent risk factor for a decline in sexual activity. Specifically, the menopause is known to be significantly associated with a decrease in libido, sexual activity and responsiveness. Caution should therefore always be exercised when evaluating a woman with FSD, where coital incontinence is occasionally blamed for sexual problems which pre-existed.

Evaluation of FSD

Currently there are no completely reliable instruments available to measure or diagnose sexual dysfunction. It is essential that a women's sexual function causes personal distress before the clinician makes a diagnosis of FSD. Sexuality is only one aspect of quality of life (QOL). The World Health Organization defines QOL as not only the absence of disease, but also complete physical, social and mental wellbeing.

Different methods of evaluating of QOL are available. Validated questionnaires represent a more objective assessment and have become an essential tool used to standardize and collect data. Two types of questionnaires are available, including a general questionnaire and a condition specific questionnaire. The general questionnaire is insensitive to a condition such as urinary incontinence, whereas a condition specific questionnaire is more surgery sensitive to the effect of lower urinary tract symptoms on QOL, but in turn does not evaluate other health related issues.

Questionnaires are often intrusive and ask very intimate questions. However, in a study that was used to develop and validate a questionnaire looking at urinary incontinence and sexual function (SF-IUIQ), 82.2% of the women did not report feeling too embarrassed to complete the questionnaire. The short form of the pelvic organ prolapse/urinary incontinence sexual questionnaire (PISQ-12) is a useful condition specific questionnaire. In the clinical setting this short form of the PISQ provides a template for clinicians to discuss sexuality and helps to evaluate outcome before and after treatment intervention which could be conservative or surgical.

Treatment of Urinary incontinence and Female sexual dysfunction

In most studies looking at the outcomes of treatment for urinary incontinence, objective measures of continence outcomes are usually the primary aims and sexual function is usually assessed as a secondary outcome.

Conservative treatment

These measures usually reduce urinary incontinence and improve QOL and sexuality. The International Continence Society (ICS) includes pelvic floor muscle training (PFMT) as first line therapy for stress urinary incontinence, urge urinary incontinence and mixed urinary incontinence. A number of small studies have been done to evaluate the impact of PFMT on coital incontinence. In a RCT of 59 women with SUI , Bo et al reported a 50% decrease in coital incontinence in the group receiving PFMT compared to a reduction of only 10% in the placebo group. Admittedly, this was a small study but it certainly supports the role of PFMT as a first line in reducing coital incontinence.

For some patients, simple advice such as emptying the bladder prior to intercourse or a change in position are effective in reducing coital urinary incontinence.

Women with overactive bladder find the symptoms particularly more bothersome compared to those patients complaining of stress urinary incontinence since urinary leakage is not the only symptom. Bladder training and anticholinergic drugs are the treatments of choice, but the cure rates and the impact on sexuality remain unclear.

Surgical treatment and sexual function

When surgery is planned the risk of post-operative dyspareunia related to each type of operation, should always be considered. An increasing number of papers have raised the issue of FSD in women who undergo urogynaecological surgery but conflicting data have been reported.

In the past the Burch colposuspension was most commonly performed operation for the surgical treatment of stress urinary incontinence. During the last decade, however, the mid-urethral tapes, employing polypropylene monofilament mesh, have become the gold standard. Baessler et al were the first to report, in a retrospective study on Burch colposuspension, on a 70% decrease in coital incontinence following surgery. It decreases incontinence at penetration by 80% and during orgasm by 75%.

A review of vaginal surgery for SUI and female sexual function reports that the retropubic TVT does not appear to adversely affect overall sexual function. Other retrospective and prospective studies have reported varying results ranging from deterioration to equivocal with some reporting improvement in outcomes. (Table IV) Mesh erosion is an important cause of dyspareunia for both sexual partners. In a prospective study looking at urodynamic stress incontinence treated with either retropubic TVT or transobturator TVT, overall scores as measured by the PISQ sexual questionnaire improved significantly with specific improvements in the physical and partner related domains. The behavior/emotive domain showed no significant improvement.

Other treatment

Estrogen treatment requires further research, but currently it does not appear to be of value in the treatment of urinary

TableI V: Sexual function after tension-free vaginal tape procedure

Sexual function % Reference:	Study type	Number of Patients	Unchanged	Improved	Worsened
Maaita et al (2002)	Retrospective	43	72	5	14
Yeni et al (2003)	Prospective	32	No pre- and postoperative difference		
Elzevier et al (2004)	Retrospective	65	72	26	1.6
Glavind and Tetche (2004)	Retrospective	48	60	25	6
Mazouni et al (2004)	Prospective	55	74	2	24
Ghezzi et al (2006)	Prospective	53	62	34	4

incontinence.

Conclusions

Sexuality is complex and the etiology of female sexual dysfunction is multidimensional. FSD is common and the taboo nature of sexuality and urinary incontinence is a challenge for the clinician. Coital incontinence and urinary incontinence can cause FSD. Validated questionnaires, evaluating sexuality will render more reliable and objective data in the future. These instruments also have a role in assessing FSD pre- and post treatment. The use of pelvic floor muscle training should be considered as the first line of treatment for coital incontinence. Simple advice to empty the bladder prior to intercourse should also be offered. Surgical treatment for stress urinary incontinence does not adversely affect female sexual function but further research, specific to mixed urinary incontinence, is required. Sexuality should be an essential outcome measure with intervention studies on the surgery for SUI.

Chapter 10

Urinary Tract Infections (UTIs) in Women

Dick Barnes

Incidence

Urinary Tract Infections are extremely common in women of all ages. 25-30% of women aged 20-40 years have had a UTI and 40% of patients with UTIs will have a recurrence within one year. The prevalence of UTIs in young women is thirtyfold that of young men but with increasing age this ratio decreases due to high incidence of BPH in men. The elderly (20% of women) have a significant incidence of bacteriuria (predisposing factor to development of UTI).

Pathogenesis

The urinary tract is normally sterile above the level of distal urethra. In the majority of UTIs, the organism ascends to the urinary tract via the ascending route. The female urethra is short and close to the faecal reservoir (source of most organisms causing UTIs) hence the higher incidence of UTIs in females compared to males. The main defence mechanism against infection is the hydrokinetic effect of regular effective voiding. For a significant infection to develop, an organism needs to gain access to the urinary tract, adhere to the urothelium and multiply in numbers. Virulent bacteria can overcome normal host defence mechanisms whereas less virulent bacteria result in significant infections in patients with abnormal urinary tracts or those with compromised immunity. During sexual intercourse the faecal organisms causing UTIs colonise the vagina and thus sexual activity encourages ascending infection.

The microbiology of UTI is as follows:

- Escherichia coli (E coli) responsible for:
  - 85% of community acquired } UTIs
  - 50% of hospital acquired }
- other common Gram-negative organisms:
  - Klebsiella
  - Proteus
  - Pseudomonas
- Gram-positive organisms can also cause UTIs:
  - Strep. faecalis
  - Staph. aureus
  - Staph. epidermidis
  - Staph. saprophyticus
- In diabetics and immunocompromised patients fungi (Candida) and viruses (adenovirus, cytomegalovirus) cause a significant proportion of UTIs

Predisposing Factors

General Factors

- Females
- Elderly
- Diabetes mellitus: The glucose in urine is a good culture medium for organisms. Diabetes also impairs the function of white blood cells and diabetic autonomic neuropathy may cause a lower motor neuron neuropathic bladder with poor bladder emptying.
- Immunocompromised patients:
  - malnutrition
  - HIV/AIDS
  - cancer
  - chemotherapy
  - immunosuppression
- Analgesic abuse
  - can cause papillary necrosis

Local Factors

Any condition that impairs the normal flow of urine, or interferes with normal emptying can predispose to infection.

- Obstruction of upper tracts (kidneys and ureters)
  - stones
  - PUJ obstruction
  - sloughed papillae (diabetics)
- Bladder outflow obstruction
  - urethral stricture
  - post mid-urethral tape surgery
- Neuropathic bladder
- Vesico-ureteric reflux
- Foreign bodes in urinary tract
  - bladder catheter
  - double J ureteric stent
- Urological “procedures”
  - cystoscopy
  - urodynamics
- Vesico colic fistula
- Pregnancy
- Vaginal infections

Acute Pyelonephritis

Acute pyelonephritis is an acute bacterial infection of the renal parenchyma and is the commonest disease of kidney.

Complications of Acute Pyelonephritis

- Septicaemia and septic shock
- Abscess
  - intra-renal
  - perinephric
- Chronic pyelonephritis
  - healing with scarring
- Renal failure
  - if bilateral chronic pyelonephritis

Clinical Presentation

- History
  - fever and rigors
  - loin or back pain
  - nausea and vomiting in some patients
  - LUT symptoms (frequency, dysuria) often absent
- Examination
  - ill and pyrexial
  - loin tenderness
- Urine
  - Dipstick: WBCs ++ Nitrite test positive
  - Microscopy: pus cells ++ organism +
  - Culture: send specimen before starting antibiotics
- Blood Culture
  - NO imaging (i.e. U/S) is needed in the acute phase UNLESS:
    - diabetic
    - immunocompromised
    - history of stone disease
    - no response to antibiotics within 72 hours

Treatment

- General Measures
  - admission to hospital if toxic, vomiting
  - intravenous fluids if inadequate hydration
  - blood culture if high temperature
- Antibiotics
  - Goals of treatment
    - eradicate infection
    - prevent complications
  - Ideal antibiotic
    - bactericidal
    - broad spectrum
    - high penetration and concentration in urine and renal tissue
  - Antibiotics most frequently used:
    - Aminoglycosides
    - Fluoroquinolones
    - Cephalosporins
    - Co-amoxiclav (Augmentin)
    - Amoxycillin and Co-Trimoxazole are not useful agents for empirical

    - therapy because of high incidence of resistance to E coli
    - antibiotics should be given for 7-14 days and whichever agent is used, cure rate = 90%
- Urological Investigation (once acute infection has resolved)
  - All women with recurrent UTIs
  - Associated haematuria
    - patients with recurrent acute pyelonephritis in the absence of urinary tract abnormality should have long-term continuous low dose antimicrobial prophylaxis (see below)

Cystitis

Clinical Presentation

- frequency and urgency
- suprapubic and back pain
- dysuria
- no pyrexia
- elderly patients may present with sudden onset of incontinence and/or smelly urine

Treatment

Three day course of treatment is sufficient to eliminate uncomplicated cystitis completely Single dose therapy only 70% effective.

Agents used:

- Fluoroquinolones
- Co-amoxiclav
- Cephalosporins
- Nitrofurantoin

Recurrent Cystitis

- recurrent cystitis in females is very common and is usually re-infection

General Measures

- good fluid intake
- local hygiene
- sexual intercourse
- void before and after intercourse
- avoid spermicidal creams and diaphragm contraceptives
  - topical oestrogens for atrophic vaginitis
  - treat constipation

Specific Measures

Three options:

1. Continuous low dose chemoprophylaxis Nitrofurantoin, Cephalosporin nocte dose for 6-9 months
2. Post intercourse single dose therapy if UTIs related to intercourse. Antimicrobials as above
3. “Self-start” Therapy. Patient has supply of treatment (usually Fluoroquinolone), when symptoms of cystitis begin send

urine specimen for culture and initiate therapy, attend doctor few days later when culture result available

Neurogenic Bladder

Frans van Wijk

Introduction

In a normal urogynecology practice, physicians might from time to time see patients with underlying neurologic diseases. These women may present to the clinic with symptoms of lower urinary tract dysfunction including incontinence, incomplete bladder emptying or recurrent bladder infections. It is important to have a basic knowledge of possible underlying neurological conditions that might cause these symptoms. It is not the aim of this chapter to include all neurologic conditions and give a complete overview of all the possible treatment modalities. It is, however, important to understand the basic concepts and therefore a proper knowledge of the physiology and anatomy of bladder function is essential. The physician will then be able to localize the site of the lesion and adjust the treatment. It is also important to know of treatment modalities so that the patient can have access to different options if necessary.

NLUTD (neurogenic lower urinary tract dysfunction) is a condition where diagnosis and treatment needs to be tailored to the individual patient and underlying disease. It is often the most challenging as well as the most gratifying condition to treat and care for.

Physiology

Normal voiding is a complex interaction of supraspinal and spinal control. This will cause relaxation of the urethra and sustained contraction of the detrusor to facilitate complete empting of the bladder.

Neural control of normal

micturition is a complicated system. A simplified summary is as follows:

The supra-pontine control centres in the frontal cortex of the limbic area and the cerebellum have an inhibitory effect on the function of the bladder. The pons has two regions, the M- region for stimulation and the L- region for inhibition. The spinal cord will relay the sympathetic, parasympathetic and somatic fibers to the lumbar and sacral areas and the parasympathetic system will stimulate the detrusor muscle whereas the sympathetic system will increase outflow resistance. The somatic system has control of the rhabdo muscle of the urethra as well as control of the pelvic floor muscles. All 3 systems must work in balance to create normal storage and voluntary voiding of the bladder.

A neurogenic bladder can be described as the effect of neurological disease on lower urinary tract function.

To understand the function better the different systems will be discussed separately.

Central nervous system (CNS)

The cortical pathways originate in the pre central gyrus, lateral prefrontal cortex and anterior cingulate gyrus. These centers mainly inhibit the midbrain area, the so-called pontine micturition center (PMC). CNS control of micturition centers around the middle pons. Barrington showed in cats that the motor tone of the bladder arises in this region. The Pontine Micturition Centre (PMC) is called the M-region and causes stimulation of detrusor muscle and relaxation of the sphincter. Stimulation of this center will lower urethral pressure, inhibit pelvic floor contraction and stimulate detrusor contraction.

Stimulation on the same level as the M-Region but more lateral, the so called L-region, will stimulate Onuf’s nucleus to contract the urethra. Thus the midbrain will control either storage or emptying function of the bladder through the M and L pontine micturition regions.

CNS control centers around the middle pons, where Barrington showed in cats that the motor tone of the bladder arises, is the most important.

The midbrain gets inhibitory and stimulatory control from many different regions in the brain namely frontal cortex, cerebellum, and hypothalamus.

The main neurotransmitters in the CNS are glutamate for stimulation and GABA and glycine for inbibition.

A central concept in the development and organization of the brain is plasticity. This means that the brain can adjust its hard-wiring through conditioning or external stimuli.

This is mainly achieved by the organization of the interconnections through the white matter. It is now understood that the white matter is an extremely dynamic part of brain development.

The changes of aging on the brain have a variable effect and may cause abnormal sensory perceptions or reduced inhibition of bladder function.

Parasympathetic System

Parasympathetic stimulation will start in the M-regions of the pontine micturition center to the intermedial grey matter of the spinal cord at level S2-4.These fibres will then emerge from the piriformis muscle overlying the sacral foramina and form the pelvic plexus which in turn supplies the pelvic organs. The fibres terminate in ganglia in the wall of the bladder making it vulnerable to injuries of the bladder e.g. over-stretching, infection or fibrosis.

In the ganglia, the nerves are stimulated by nicotinic acetylcholine receptors. Other neurotransmitters are also active at ganglia level but not as important.

Postganglionic parasympathetic fibres diverge and store neurotransmitters in synaptic vesicles. On electrical impulse the vesicle binds to the synaptic membrane and deposits the acetylcholine in the synapse to stimulate muscarinic receptors on the muscle fibres stimulating muscle contraction through intracytoplasmic calcium release.

Sympathetic system

Sympathetic stimulation reaches the bladder through preganglionic fibres from thoracolumbar spinal segments that synapse in paravertebral and paravertebral sympathetic pathways. Postganglionic neurons reach the upper vagina, bladder, proximal urethra and lower ureter through the hypogastric and pelvic plexuses. The sympathetic preganglionic neurotransmitter is mainly acethylcholine, acting on nicotinic receptors and post ganglionic transmitters, primarily norepinephrine. Stimulation of B-adrenergic receptors in the bladder causes relaxation of the smooth muscle and stimulation of alpha-one receptors in the bladder base and smooth muscle of the urethra causing muscle contraction.

Norepinephrine also suppress secretion of the presynaptic parasympathetic cholinergic neurotransmitter. Urine storage is thus attained by detrusor relaxation, urethral muscle contraction and inhibition of parasympathetic stimulation all through sympathetic stimulation.

Somatic innervation

Skeletal muscle is present in the distal portion of the urethra and pelvic-floor muscles. The innervations come from Onuf's somatic nucleus in the anterior horn of S2-4 segments. This nucleus gives rise to the pudendal nerve, which supplies the rhabdo urethral sphincter. Important neurotransmitters include serotonin and norepinephrine. These increase the effect of the excitatory neurotransmitter, glutamate, on pudendal motor neurons. The effects on the rhabdo sphincter are achieved by acetylcholine stimulation of nicotinic cholinergic receptors.

Sensory pathways

The two important sensory feedbacks are transported to the central nervous system through the parasympathetic and sympathetic system. They have a contra and ipsilateral supply.

Proprioceptive endings are present in collagen bundles in the bladder and these are responsible for stretch and contraction sensations.

Free nerve endings (C fibres) are in the mucosa and submucosa and stimulated through pain and temperature. The sensory endings contain acetylcholine and substance P.
Urethral sensation is transmitted mainly through pudendal nerve.

Central areas that receive bladder and urethral sensation are the periaqueductal grey matter (PAG), insula and anterior cingulate gyrus. An area in the frontal cortex is also activated at times of filling. A study of both normal patients and those with overactivity of the bladder showed different areas of predominant activity. Using functional magnetic resonance imaging (fMRI)4), the insula is stimulated to a greater extent anteriorly with unpleasant bladder sensations. These sensations are received by the PAG and mapped in the insula. It would therefore seem that not only normal sensory impulses but also abnormal impulses or abnormal mapping are responsible for overactivity of the bladder. It is easy to understand that diffuse neurologic disorders might have an effect on the perception of sensory impulses of a normal LUT.

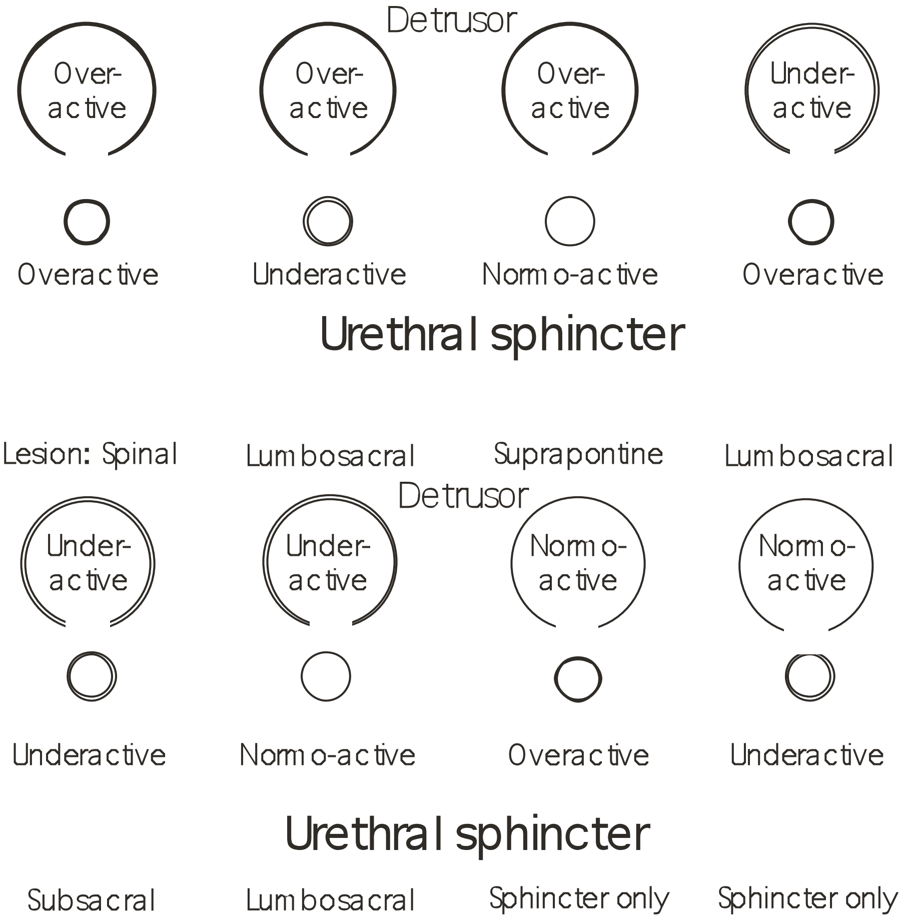
Epidemiology

There are no exact figures on the prevalence of neurologic disease of the lower urinary tract. It is important, however, to recognize that patients with neurological disease should be evaluated for lower urinary tract function. Any patient with unexplained lower urinary tract symptoms should be evaluated for possible neurologic abnormality. It is even more important that, before invasive surgery, including prolapse and incontinence operations, that neurological conditions are considered, especially if the symptoms do not fit together.

Classification

It is clear from the previous physiologic description that a simple classification is not possible. Therefore, the physician should evaluate detrusor and sphincteric function as separate entities. Both of these can be either normal, hyperactive or hypoactive in function. It is also important to make sure that there is co-ordination between the detrusor and sphincteric function. Sphincteric function has an autonomic (sympathetic) and a somatic control. Incoordination is described as detrusor-sphincter dyssynergia. The diagnosis of detrusor-sphincter-dyssynergia will not state which system causes the outflow obstruction (sympathetic or somatic). These can, however, be differentiated by proper examination. A distinction should be made between detrusor-smooth muscle sphincter dyssynergia or detrusor-striated muscle dyssynergia.

The higher the lesions, the more hyperactivity we find and the lower the lesion, the more


Detrusor
Over-active
Over-active
Over-active
Under-active
Overactive
Underactive
Normo-active
Overactive
Urethral sphincter
Lesion: Spinal
Lumbosacral
Suprapontine
Lumbosacral
Detrusor
Under-active
Under-active
Normo-active
Normo-active
Underactive
Normo-active
Overactive
Underactive
Urethral sphincter
Subsacral
Lumbosacral
Sphincter only
Sphincter only

Madersbacher classification system with typical neurogenic lesion

This classification will give a good description of the pathophysiology as well as guide further treatment

hypofunction.

The evaluation of the patient should include:

- Detrusor function
- Urethral function
- Co-ordination between the two

Neurologic Conditions

Supra-pontine lesions

Supra pontine lesions e.g.

Alzheimer or stroke patients. These conditions will lead to less inhibition of bladder control. It is important to understand that aging will cause atrophy of the cortex and can therefore also cause less control of the bladder function. This might not directly be associated with pathology but occur as part of the normal aging process. High lesions will mostly cause over activity of the bladder but coordinated voiding with normal urethra.

Diverse neurologic conditions:

Parkinson's disease

Parkinson's disease gives a diffuse dysfunction of the neurologic system because of degeneration of primarily the dopaminergic neurons. Dopamine deficiency in the substantia nigra accounts for the classical motor features of the disease. This leads to resting tremors and slow onset of movements. This condition will only cause lower urinary tract dysfunction after many years and there is a slow progression in the disease. Treatment must always take into consideration that the condition might deteriorate and that the patient might lose proper motor activity of the hands and later not be able to self-catheterize. Treatment decisions must take into account the progression of the disease.

If lower urinary tract symptoms develop early then Multiple System Atrophy (MSA) must be considered.

Voiding dysfunction occurs in 35-75% of patients. It normally consists of frequency, urgency, nocturia and urge incontinence. Urodynamically they normally have detrusor overactivity. Generally they have coordinated sphincters although sporadic involuntary activity of the striated muscle might occur as shown by EMG measurements without any true obstruction.

Multiple Sclerosis (MS)

Multiple Sclerosis is a progressive disease affecting young and middle aged people with twofold predilection for females. The primary lesion is neural demyelination with axon sparing and it is possibly immune mediated. Demyelination often affects the corticospinal and reticulospinal columns of the spinal cords. Therefore voiding and sphincteric dysfunction is common. Voiding symptoms will be present in 50-90% of patients. Detrusor overactivity with striated sphincter dyssynergia is the most common finding. Detrusor areflexia might also be present. Up to 15% of patients might present with the urinary symptoms before the primary neurologic diagnosis of Multiple Sclerosis is made.

Multiple System Atrophy (MSA)

This is a progressive degenerative neurologic disease that is characterized by combination of Parkinsonism, cerebellar ataxia and autonomic failure. In this condition the lower urinary tract function will be affected fairly soon after the start of the disease. Therefore, aggressive rehabilitation for the urinary tract dysfunction is often not indicated and not very satisfactory. The cause of the disease is unknown and it is a progressive neurodegenerative condition with a life expectancy of a mere 9 years. The so called Shy-Drager syndrome is possibly the end stage of the disease.

Spinal cord damage

Spinal cord damage, as in spinal cord injuries, spina bifida patients and compression of the spinal cord due to disc compression, tumors or cysts as well as cauda equina lesions can all lead to different types of fallout of the bladder and sphincter control.

These patients will normally end up having treatment in a center for neurologic rehabilitation. It is important to have a high index of suspicion for cauda equina lesions or spinal cord compression in patients that develop new symptoms of lower urinary tract dysfunction, especially if it is associated with fallout in the lower extremities. It is normally caused by central disc compression at the level of L5 or S1 where the cauda equina is central in the spinal space before it exits through the foramina. Cauda Equina syndrome is characterized by perineal sensory loss, loss of both anal and bladder voluntary sphincters and sexual responsiveness. They have acontractile detrusor muscle and no bladder sensation.   These patients will have to be evaluated urgently to prevent permanent damage. Even with emergency decompression, permanent detrusor areflexia is common. Complete spinal cord lesions below T6 will normally give detrusor over activity with smooth sphincter synergia and striated sphincter dyssynergia. Sensory loss will also be present below the lesion.

Lesions above T6 might have

smooth muscle sphincter dyssynergia as well, because of sympathetic damage.

Treatment of spinal cord injuries should aim to create a low-pressure system and emptying with clean intermittent catheterization.

A complication of the above T6 lesions is Autonomic Hyperreflexia. This is characterized by an acute autonomic response (primarily sympathetic) causing headache, hypertension and flushing of the body above the lesion. Avoidance of stimuli in susceptible patients is important and sublingual nifedipine either as prophylactic or therapeutic treatment seems very effective. Dosage of 10- 20 mg might be used as it prevents smooth muscle contraction through calcium channel blockade.

Transverse myelitis is a rapidly developing condition affecting motor, sensory and sphincter function. It will mostly stabilize in 2-4 weeks and recovery is usually complete.

Peripheral Nerve Damage

Peripheral nerve damage is normally associated with diseases like diabetes, herpes virus infection, Guillain-Barre Syndrome and surgical trauma to pelvic plexus during radical surgery to the pelvic organs. In obstructed labor, minor damage can happen to the innervation of the lower urinary tract. This will normally lead to atonic or hypoactive function of the detrusor or sphincter muscle. Fortunately, damage to the pelvic plexus is often transient and temporary measures are strongly advised in the initial period. The condition will stabilize and function will return spontaneously to the pelvic plexus. Correction of the under lying neurologic damage is almost never possible.

Diverse

HIV

The true incidence of lower urinary tract symptoms in the acquired immunodeficiency syndrome is not known. The whole spectrum of dysfunctions can be present in these patients but seems to be in the more advanced stages of the disease. Treatment principles are the same as other neurological conditions.

Fowler Syndrome

This syndrome presenting in young women below 30 presenting with acute retention and often have polycystic ovarian disease. A classical EMG finding of the sphincter was described by Fowler characterized by the inability to relax the sphincter. It is in the absence of demonstrable neurologic disease and very susceptible to neuromodulation therapy.

Clinical Evaluation

The evaluation of the neurologic patient includes the normal physical, biochemical and dynamic testing that is important in all patients with lower urinary tract symptoms. The only difference is that special attention must be taken to include the state of the upper tract and neuromuscular evaluation. EMG measurements will give a better understanding of the exact lesion.

History and physical examination

Thorough history and physical examination is necessary with care to evaluate perineal sensation, sphincter tone and lower extremity reflexes and sensation. Abdominal examination will sometimes detect a full bladder.

Remember that the neurogenic patient might have the normal anatomic abnormalities of the urogynae patient and good pelvic floor examination must be carried out.

Knowledge of the dermatomes and reflexes will help to localize the lesion.

Special investigations

Ultrasound of the bladder, urine dipstick and serum creatinine is indicated. If any abnormality is picked up with these screening tests, the necessary workup must be done.

Urodynamic evaluation

Standard Urodynamic testing gives information on bladder and urethral function. To evaluate co-ordination between bladder contraction and urethral relaxation cystometogram and EMG or video urodynamics will give more information.

In the neurogenic patients, urodynamic studies are very important to evaluate the precise function of the lower urinary tract. Urodynamic studies should be performed in a specialized unit where good studies will be done as well as EMG measurements of the pelvic floor if needed.

Video urodynamics or ultrasound visualization of the bladder and the bladder outlet might enhance the information available on normal urodynamic studies. In a high-pressure bladder system with detrusor pressures reaching more than 40 cm of water, especially in the presence of detrusor sphincter dyssynergia, it might lead to upper tract deterioration. The physician must make sure that proper knowledge of bladder function as well as urethral and pelvic floor activity is known after a full urodynamic evaluation. Specific attention should be given to sensation of the bladder at the time of   urodynamic study to plan further treatment. Urodynamic evaluation must always try to mimic the real life symptoms during the study.

Specialized tests

1. Ice water test might give information on the difference between reflex and areflexic neurologic bladders, but is controversial.
2. Betanecol super sensitivity test might also give more information on the difference between neurologic or miogenic a contractile bladders. The current recommendation is that it has to be used with care and only as part of a full evaluation.
3. EMG of the sphincter. It is recommended that EMG of the urethral sphincter can be used in the diagnosis of neurologic bladder dysfunction. There is not a good correlation between anal sphincter activity and urethral function.
4. The following tests are currently still experimental and there is no clear clinical proof that it will add to the information on the specific patient.

EMG of the detrusor muscle
Dynamic bulbocaverneus reflex
Nerve conduction studies
Somatosensory evoke potentials
Electro sensitivity of the low urinary tract
Sympathetic skin response

More research is necessary before these specific tests can prove to be useful as a clinical tool.

Treatment

AIMS:

- Protect renal function, prevent infection
- Restore continence
- Restore emptying
- Controlled collection of urine if restoration of function not possible

Planning of treatment is important as the underlying disease and the effect on the lower urinary tract symptoms is almost never stable and neither is the physical condition of the patient. These patients are therefore better cared for in a team situation or with close interaction with the neurologist.

Underlying condition should be stable.

E.g. - The spinal cord injury patient needs to be over the shock phase.
The Parkinson patient, on effective treatment.
The stroke patient rehabilitated and stable, etc.

Mobility of the patient

The next component of decision making is the mobility of the patient. Both in their ability to get to the toilet as well as good hand function and mobility. Treatment like timed voiding, self intermittent catheterization and catheter care might be impossible for certain patients. In other cases the patient might have access to support like nurses, family or institutions that can help with care of basic body functions, the decision making might differ according to circumstances.

Kidney Function

It is very important for the treating physician to remember the effect of the lower urinary tract symptoms on kidney function before decisions on treatment are made. Unstable bladder with detrusor sphincter dyssynergia (DSD) will lead to impairment of kidney function. If augmentation or diversion procedures are considered, kidney function and upper tract anatomy should be evaluated. Absorption of urea and electrolytes by the intestinal interposition can cause metabolic changes.

Conservative treatment

Conservative treatment entails triggered reflex voiding, bladder expression through crede or valsalva maneuver, timed voiding and fluid restriction. This treatment is normally given for supra-spinal lesions because of balanced bladder function. In the spinal lesions, diffuse neurologic conditions and lower lesions it must only be considered if the bladder is a low-pressure system. The reason is that there may be D-S-D with a risk to kidney function.

Conservative treatment must always form part of the total treatment of the patient, even in cases where more invasive treatment is indicated. It is difficult in the neurologic patient to completely restore normal function, therefore measures like timed voiding, fluid restriction and effort to empty completely need to be emphasized constantly. Pelvic floor exercise are normally not indicated in neurologic conditions but might give some improvement in patients with MS. Electric stimulation or biofeedback have the same limitations.

Catheters

Catheters are used to drain the bladder in patients where retention or incomplete voiding is present. They can also be used in incontinent patients, especially if cognitive function is impaired. Intermittent catheterization can be used if the storage pressures are low, the bladder has a good capacity and there is good hand control. Clean self-intermittent catheterization is still the best way to empty the bladder. It is important to motivate the patient to start doing it. Once they are used to it the result is usually good. The recommended frequency is 4-6 times per day with a bladder capacity of not more than 400ml and a 12-14-size catheter is used.

Indwelling catheters are inserted either suprapubically or trans-urethrally for patients where there is either a high-pressure system or the possibility of self-catheterization is not available, or in cases where patients lose mobility or cognitive function. There are significantly more risks with indwelling catheters compared to CISC and Silicone catheters should be used. Catheters normally need changing every 3 months but there are some patients that might need more frequent changing. Crystallization and blocking are the biggest problems

Recommendations On The Use Of Catheters

Self clean intermittent catheterization is superior to any of the other techniques as long as the bladder is not a high-pressure system.

Indwelling catheters are safe and sufficient for short-term management of urinary retention. The use of indwelling catheters routinely for the management of the neurologic bladder is not recommended.

Complications of supra-pubic

catheters are similar to those of urethral indwelling catheters. Apart from insertion, that has a higher risk, supra-pubic catheters have the possibility of bowel perforation and urethral catheters cause urethral incompetence over time.

Protective pads and diapers, protective clothing or pads for the incontinent patient is sometimes the only way to protect the patient from skin reactions and a bad odour.

Pharmacotherapy

Pharmacotherapy is mainly used for overactivity of the bladder. There are practical options for improving of bladder emptying. Again, as with the previous treatments, the detrusor function, as well as the urethral function have to be seen as separate entities and a decision on which pharmacotherapeutic agent will work best in each specific instance is important. Only broad guidelines will be given on which treatment modalities will work better for a specific condition.

Drugs Available For Treatment Of Neurologic Lower Urinary Tract Overactivity:

Detrusor muscle relaxing drugs:

- Oxybutynin
- Darifenacin
- Solifenacin
- Tolterodine
- Properverine
- Trosium
- Propantholene
- Flavoxate
- Tri-cyclic anti-depressants

Discussion

Drugs to reduce over activity of the bladder and increase the storage function of the detrusor. The mainstay of treatment in this group are the anticholinenrgic drugs. The newer anticholinergic drugs as in Oxybytinin, Darifenacin, Tolterodene and Solifenacin are all available as a long acting preparations. This gives better long-term effects and less side affects. The side effect profile of the different medications is well known as in central nervous system effects, cardio vascular effects, dry mouth and constipation. There are specific advantages and disadvantages of each of the long acting anticholinergic medications. It is important to decide which ones will work best in a specific case and it is important to make sure the patient complies with the intake of the medication and that the long term effect thereof is measured. With proper care and information the side effect profile is limited. Oxybutynin is also available as an intravesical installation as well as a transdermal absorption application. There is no clear recommendation that any of these drugs is superior in all cases of detrusor over activity.

Drugs work on nerve function

- Valinoïds eg. Capcacin and Resinoferatoxin blocks sensory nerves for afferent sensation to the brain.
- Botulinum toxin

Vaniloids

The study showed that Resinoferatoxin is a much more potent sensory antagonist than Capcacin and is superior in terms of efficacy. In studies it has been shown that the maximum cystometric capacity increased significantly but it did not change detrusor pressure significantly. It is currently recommended that further randomized trials must be done to determine the exact place for this treatment modality. It has been studied in neurogenic bladders and compared to Botox but shown to be less effective.

Botulinum toxin A

Botulinum toxin A is the most potent biologic toxin known to man. It binds the snap 33 docking protein in the nerve terminal. Inhibiting acetylcholine release from the nerve terminal and thus preventing muscle contraction. This can give clinical improvement for six to nine months in neurologic patients by lowering detrusor contraction and increasing bladder capacity. Numerous studies have been done which shows efficacy of the Botulinum toxin, starting within the first six days and has an optimum effect after six weeks. The individual response is fairly specific for a patient. If the effect lasts for six months the first time, the follow up injection will normally also last about that long. The current use in neurologic overactivity is 300 units as an intravesical injection. Two Botulinum type A toxins are available. Botox is most widely used in current studies. Botox is normally given as a 10 unit per m/L in 30 different sites of the bladder. It can be given under general, regional or local anaesthetic. No clear randomized study has been done to evaluate the specific treatment strengths. Botulinum toxin can also be used into the sphincter to reduce the outflow resistance. The dose used in the sphincter is 50 – 100 units. It was clearly shown to reduce the post void residual. The side effect profile is extremely low and systemic complications almost unheard of. Other form of Botulinium A (Dysport) has been studied but not as widely and is also effective with other possible side effects, and different dosage regimens.

Drugs to enhance sphincter function

- Alpha -adrenergic agonists
- Estrogens
- Beta-adronergic agonists
- Tri-cyclic anti-depressants

Several drugs including Alpha-Adronergic agonists, Estrogens, Beta-adrenergic agonists, as well as Tricyclic anti-depressants have been used to increase the bladder outlet resistance. There is no clear recommendation whether these can be used for long-term treatment of sphincter deficiency. A noradrenaline serotonin re-uptake inhibitor (duloxitene) has been well studied and will increase urethral resistance. The side effect of this is nausea and it is also used in the treatment of depression.

Drugs to facilitate bladder emptying

- Alpha adrenergic blockers – lowers urethral resistance e.g. Tamsulosin, alfuzosin,
- Cholinergic - increases detrusor contraction

Discussion

1. Alpha-Adrenergic blockers: Alpha-adreno receptors have been reported to be predominantly present in the bladder base and urethra. Alpha-blockers can therefore be used to lower the resistance of the bladder neck and urethra. They have been proven to lower the detrusor leak point pressure in children.
2. Cholinergic: In general Betanecol chloride seems to be of limited benefit of detrusor areflexia and for elevated residual urine. These drugs should not be used in the presence of detrusor sphincter dyssynergia.

Invasive treatment

Neuromodulation and electrical stimulation

Sacral nerve neuro modulation has been well proven to treat the refractory overactive bladder as well as the imbalance in pelvic floor stimulation. It is essential that there be normal neural connections for this modality to be effective. The efficacy of the sacral neuromodulation also includes afferent stimulation and therefore intact neuropathways are necessary. It does not work in the spinal cord injury or spina bifida patients. The sacral neuromodulation is an electrode placed usually at S3 foramina and left in as a temporary stimulation for 2 to 3 weeks. If there is a more that 50% improvement in their symptoms, a permanent generator is implanted on the lateral aspect of the buttock. This can be set with an external programmer. The placement of the electrode can be done in different positions, periurethrally or next to the pudendal nerve. Sacral root stimulation is currently the most extensively documented.

Electrical Stimulation

Sacral anterior root stimulation. This is not a technique that will normally be done at the urogynaecology clinic but is more for specialized spinal units. It is only performed on spinal patients where a posterior rhizotomy has been done. This is an exciting development but not for discussion at this level.

Augmentation procedures

Detrusor Myectomy: (auto-augmentation)

This will produce a diverticulum in the dome of the bladder if ±20% of detrussor muscle is removed. The urothelium is left intact. It is mostly done as an extraperitoneal procedure. Laparoscopic techniques are also described.

Enterocyctoplasty

It is the best reproducible operation to enlarge bladder capacity and increase storage function of the bladder especially in the small fibrotic bladders. Complications include infection, mucus production and incomplete bladder emptying. Absorption through bowel might lead to metabolic acidosis. Kidney function evaluation is very important before the procedure is considered. Ileum clam cystoplasty is done most often. The urotheluim can be left intact and the bowel muscle used to cover it. This will decrease the mucus production, and absorption.

Bladder replacement

New bladder can be preformed for patients with severely contracted and damaged bladders. Small or large bowel can be used and a good storage pouch will be formed. The pouch is connected to the sphincter. The majority of these patients will have to self-catheterize.

Procedures to enhance outflow resistance

Bulking agents can be used to increase passive urethral closing pressure. The result of bulking agents is ± 60% in improving the incontinence.

Mid-urethral slings

Mid- urethral slings are classically used for stress urinary incontinence (SUI). They are also very effective in the neurologic patient with SUI.

Mid urethral slings can also be used to obstruct the urethra in patients with a hypotonic urethra. It is better to use retropubic mid-urethral slings for obstructive procedures than trans-obturator routes or mini slings. The patient then has to self catheterized if the outflow is obstructed and the storage function of the bladder is normal.

Artificial sphincter

The artificial sphincter (AMS800) can be used to close the bladder outlet. It is opened using a special valve system and the patient can void spontaneously if she has normal detrusor function. Self-catheterization can also be used with the sphincter if she has voiding dysfunction.

Diversions

Continent urinary diversions: if the normal urinary tract cannot be used for storage and emptying function, a continence pouch can be formed, through which the patient will self-catheterize. The technique is fairly difficult and the complication rate in the long term is relatively high. These include infections, stone formation, mucus production, strictures of the stoma or ureter and metabolic disturbances. Small or large intestine can be used for the pouch and a number of valve mechanism can be formed

Conduit diversion: an incontinent diversion can be made with ileum and anastomosis of the ureter to a short piece of ileum. The classic Bricker Ileostomy is still used for patients where no restoration of normal urinary tract can be done.

Bladder disconnection

In cases where there is a damaged bladder with a hypoactive or dilated urethra and incontinence, a bladder disconnection should be considered, especially if the patient's mobility or hand function is not good. The urethra can be closed and a permanent supra pubic catheter placed. The urethral disconnection can be done as a vaginal procedure under local anaesthetic.

Chapter 12

Interstitial Cystitis (IC)

Dick Barnes

Incidence

This is a rare condition occurring mainly in middle-aged women with a female to male ratio of 10:1.

Etiology

There are many theories regarding the etiology of interstitial cystitis but a deficiency of glycosaminoglycans (GAGS) in the urothelium is best documented. GAGs are the polysaccharide macromolecules which cover the urothelium of bladder, preventing noxious substances in urine (such as potassium) penetrating urothelium and the bladder wall. GAG deficiency leads to urine penetrating the bladder wall, release of neuropeptides resulting in pain.

Clinical Features

Pain

- very debilitating
- suprapubic pain
- worse with a full bladder
- improved after voiding (doesn’t disappear)
- may also have perineal pain and dysuria

Irritative Voiding Symptoms

- severe frequency (day and night)
- severe cases may void half-hourly

Urine

- may have a sterile pyuria

Diagnosis

Usually confirmed on cystoscopy (under general or regional anaesthesia):
Petechial bleeding is seen from the bladder wall (particularly after second filling of the bladder with

irrigation fluid). There is usually a small bladder capacity and rarely an area of ulceration of the bladder wall (Hunner's ulcer)

Differential Diagnosis

IC is a diagnosis of exclusion

1. Cystitis – urine dipstick and culture
2. TB – urine for AFBs and TB culture
3. Bladder carcinoma (particularly CIS) – urine cytology
4. Bladder stone – U/S and cystoscopy
5. Pelvic infection
6. Endometriosis

Intravesical Potassium Test
If instillation of a solution with high potassium concentration reproduces the patient's pain this is diagnositic of IC.

Treatment

Medical Treatment

- Sodium Pentosan Polysulphate (Tavan SP): This is a synthetic form of GAG that replenishes the deficient GAG layer
- Amitryptiline: Useful for pain control
- Hydroxyzine (Aterax): (Antihistamine) Some cases of IC are associated with an allergic response and hence an antihistamine may prove beneficial.

It is recommended that above three agents are used together to maximise effect.

- Anticholinergics: Usually ineffective in this condition

Intravesical Treatment

- Dimethylsulphoxide (DMSO)
- Heparin based solutions

Surgery

- Bladder hydrodistention: Bladder distention under anaesthesia often gives good temporary symptomatic relief and can be repeated.
- Surgery: Only in highly selected cases and includes cystoplasty to increase bladder capacity and occasionally cystectomy and urinary diversion.

Chapter 13

Introduction to Pelvic Organ Prolapse

Peter de Jong

Introduction

Despite prolapse being a concept readily grasped by generations of medical students, a basic understanding of the concept has changed recently. This chapter will highlight some of the new developments in pelvic organ prolapse (POP), and examine modern surgical interventions with evidence supporting their use.

How Common Is Prolapse?

Pelvic organ prolapse (POP) is a distressingly common condition and 11% of women have a lifetime risk of surgery for this condition. Despite this, its aetiology is poorly understood, and the natural course of prolapse is grasped more in the anecdotal than scientific arena. With an aging population, reconstructive surgery for the management of pelvic organ prolapse (POP) will command increasing resources. Surgery is required to correct symptoms of POP, restore the anatomy, retain bowel, bladder and sexual competence, and be durable. We intuitively perceive that prolapse is the result of aging, vaginal parity, chronic elevation of intra – abdominal pressure and hysterectomy. Following novel anatomical insights occasioned by the cadaver dissections of Delancey and Richardson before him, a new description of prolapse and classification of the staging has emerged.

We have hitherto considered pelvic organ prolapse as consisting of a cystocoele (prolapse of the bladder), uterine or vault prolapse (depending on whether or not the uterus is present), or a rectocoele (prolapse of the rectum). Whilst we suppose that the cystocoele contains the bladder, a vault prolapse consists of the apex of the vagina and a rectocoele contains part of the rectum, this is not always the case.

New Definitions

Pelvic Organ Prolapse(POP) is the descent of one or more of anterior vaginal wall, posterior vaginal wall, and apex of the vagina (cervix / uterus) or vault (cuff) after hysterectomy.

Anterior vaginal wall prolapse (previously termed a “cystocoele”) is descent of the anterior vagina so the urethra – vesical junction (a point 3cm proximal to the external urinary meatus) or any anterior point proximal to this, is less than 3cm above the plane of the hymen.

Prolapse of the apical segment of the vagina (previously termed “vault prolapse”) is any descent of the vaginal cuff scar (after hysterectomy) or cervix, below a point which is 2cm less than the total vaginal length above the plane of the hymen.

Posterior vaginal wall prolapse (previously known as a “rectocoele”) is any descent of the posterior vaginal wall so that a midline point on the posterior vaginal wall 3cm above the level of the hymen or any posterior point proximal to this is, less than 3cm above the plane of the hymen.

Is Prolapse “Normal”?

Clearly some degree of prolapse is the norm, especially in a parous population. Women with prolapse beyond the hymenal ring have a significantly increased likelihood of having symptoms. In a general population of women between 20 – 59, the prevalence of prolapse was 31%, whereas only 2% of all women had prolapse that reached the introitus. Some estimations suggest that a degree of prolapse is found in 50% of parous women, and up to 20% of these cases are symptomatic. An estimated 5% of all hysterectomies result in vaginal prolapse.

Apical prolapse is a delayed complication of hysterectomy, and follows vaginal and abdominal hysterectomy in equal numbers: it’s occurrence may be the result of damage to the upper vaginal supports occurring at the time of surgery.

Urinary Incontinence And Prolapse

Urinary incontinence and POP are separate clinical entities that may or may not coexist. Significant protrusion of the vagina may obstruct voiding and defecation. Surgical repair of one pelvic support defect without repair of concurrent asymptomatic pelvic support defects appears to predispose to accentuation of unrepaired defects and new symptoms. Women with POP may have to digitally reduce their prolapse in order to void or defecate. Although pelvic anatomy can now easily be measured accurately and reliably, the relationship of these anatomic findings with functional abnormalities is not well understood. Support abnormalities of the anterior vaginal wall are common in vaginally parous women; but stress incontinence is not consistently associated with this finding. Distal posterior vaginal wall support abnormalities may exist with or without defecation abnormalities. The relationship between anatomy and function is one of the most pressing research priorities in the domain of physical examination of women with POP.

When To Operate?

Prolapse is not always progressive, and will not necessarily worsen with the time. Thus it may be an over simplification to suggest surgery to avoid an operation “at a later stage”.

POP symptoms are vague and correlate poorly with the site and severity of prolapse. They include:

- Pelvic pressure
- Vaginal heaviness
- Irritative bladder symptoms
- Voiding difficulty
- Urinary incontinence
- Defecatory difficulty
- Back – ache
- Coital problems

Back – ache and pelvic pain may or may not be associated with POP. The level of evidence to support the notion that surgery consistently alleviates these symptoms is poor. When physiotherapy fails to alleviate symptoms of POP, or vaginal pessaries are unsuccessful or complicated by ulceration, then surgical POP repair may be indicated in symptomatic individuals. Up to 30% of operations for prolapse fail. It is probably unrealistic to use weakened native tissue to restore fascial defects. Ligaments and tissues are attenuated by age and childbirth, and further traumatised by the dissection and de – vascularisation of prolapse repair. Healing by fibrosis is unpredictable, and the further insults of age, obesity and estrogen deprivation makes the temptation to succumb to prosthetic repair seem attractive.

Route Of Surgery

There are hundreds of operations described for the correction of POP, with either an abdominal or a vaginal approach. Most textbooks suggest that prolapse surgeons be adept at both abdominal and vaginal procedures, but in reality the majority of POP surgery is performed via the vaginal route. However there are no good data on which to base the decision as to route of surgery. Reviewing prolapse literature is difficult because of the heterogeneous nature of the condition, variability in inclusion and exclusion criteria, the variety of procedures, non – standardized definitions of outcomes, lack of independent reviews and short term follow – up.

In general terms, there is good level 1 evidence that the abdominal approach is more robust, effective and durable for correcting the anatomy and preserving vaginal and lower urinary tract function. The vaginal route has fewer serious perioperative complications. Maher demonstrated that vaginal sacrospinous colpopexy was faster and cheaper with quicker return to normal activities, but has a significantly higher risk of recurrent anterior or apical prolapse than abdominal surgery using a mesh or sacral colpopexy technique. The vaginal approach is commonly preferred for the obese, chronic strainer who smokes and suffers obstructive pulmonary disease.

Prolapse And Concomitant Hysterectomy

Although hysterectomy is frequently a bedfellow of POP repair, there is no evidence that it improves prolapse surgery outcomes. In three studies it appeared that uterine preservation or removal did not affect the risk of POP recurrence. Some authorities feel that hysterectomy is a major contributor to the occurrence of POP, and is part of the problem rather than the solution. Theoretically at least, cervical conservation at abdominal hysterectomy should maintain apical support and prevent vault prolapse. Randomized trials will be needed to asses whether cervical conservation prevents vault prolapse in the long term.

Procedures For Prolapse

Apical (Vault) Prolapse Procedures

A well supported vaginal apex is the cornerstone of pelvic organ support, and recognition of apical defects is critical prior to prolapse correction.

Apical Support Procedures With The Uterus Present

Establishment of vaginal support at the time of vaginal hysterectomy is recommended and may be achieved by a "prophylactic" attachment of the vaginal cuff to the uterosacral or sacrospinous ligaments (level 4 evidence).

When women with a uterus have apical vaginal prolapse and wish to conserve the uterus, options are restricted and evidence to support specific procedures is very limited.

Recently a number of novel techniques have been described involving Type 1 Prolene mesh placement vaginally, with fixation through the obturator foramen and sacrospinous ligament. (ProliftR: Johnson & Johnson Womens Health Urology, PerigeeR, ApogeeR, American Medical Systems). There is no specific need for vaginal hysterectomy when these mesh kits are used. Lateral prolene straps pass through ligamentous structures to provide support for central mesh hammocks placed without tension vaginally. The mesh systems are safe and minimally invasive but at present long term data are not available. Efficacy in the short term appears to be promising with few side – effects being encountered, but review of larger studies is desirable. Although these procedures using propriety kits are easily mastered by proficient prolapse surgeons, proper training and expert instruction is mandatory.

If the surgeon does not wish to use a propriety mesh kit, there are a few reports of uterine preservation with apical support procedures, being small retrospective case series involving fewer than 50 cases with short follow – up and poorly defined outcomes. (Level 3 evidence)

Vaginal obliterative procedures (colpocleisis) have a role to play in stage III – IV POP in cases where women no longer wish to preserve coital function, and surgery is balanced by a positive impact on daily activities. The vagina is obliterated, the enterocoele is not addressed and the uterus is left in – situ unless there is separate pathology. The procedures are gentle with a speedy return to normal activity, with good success rates described (level 3 evidence). The distal anterior vaginal wall should be spared and not drawn into the operation, to reduce the risk of stress urinary incontinence.

Apical Support Procedures Post Hysterectomy

Transabdominal procedures
Sacrocolpopexy is durable with level 1 evidence supporting its use, and several workers have reported that concomitant hysterectomy is safe without any increase in surgical risks. Mesh erosions range from 3% to 40%. There is at present no data to clarify the use of routine culdoplasty with the procedure, and there are no standardized outcome measures to assess sacrocolpopexy success.

Level 1 evidence suggests an apical prolapse cure in 85% - 90% of cases, but quality of life data in these cases is very limited. Surgery may result in a dysfunctional vagina with dyspareunia, and so anatomical support does not necessarily equate to patient satisfaction. The risk of prolapse at other sites subsequently has not been sufficiently studied.

Abdominal sacrocolpopexy may also be approached by means of the laparoscopic route, but vast experience and patience is required to achieve good results within reasonable time frames. At present little published data evaluates laparoscopic vault support procedures.

In this country, Cronje has performed perineo – colposacrosuspension (PCSS) in many hundreds of cases, when women have stage 3 or stage 4 prolapse, or stage 2 symptomatic prolapse - particularly with obstructive defecation (sometimes combined with a STARR procedure). This comprehensive repair represents major surgery, and is beyond the scope of the “generalist” gynaecologist. The recurrent prolapse rate is 10%, with a 5% occurrence of de – novo dyspareunia.

Vaginal Suspensory Procedures

The sacrospinous ligament suspension

Sacrospinous ligament suspension (SSLS) or fixation is popular, allowing simultaneous repair of anterior or posterior vaginal wall defects with less postoperative bowel dysfunction. Infrequent complications include buttock pain or a sacral / pudendal nerve injury. The recurrence of a high cystocoele is around 22% and may be a problem. Randomized trials favour the robust abdominal approach of the sacrocolpopexy, with the reservations mentioned previously.

High uterosacral ligament suspension (HUSLS) was first reported in 1997, and suspends the vaginal apex to the remnants of the uterosacral ligaments at the level of the ischial spines, and maintains the vaginal apex in the midline. However ureteric injury occurs in up to 11% of cases, with post – op bowel dysfunction due to recto - sigmoid narrowing. But it optimizes vaginal length and provides good vaginal support. This procedure has the same principle of action as the Mayo or McCall culdoplasty, although no comparative data exist.

Anterior Prolapse Procedures

The surgical management of anterior vaginal prolapse is controversial with limited and often conflicting data available. The traditional vaginal repair for cystocoeles was first described by Kelly in 1913, and in controlled trials has a 57% chance of curing cystocoeles. An abdominal approach is also feasible with the abdominal paravaginal repair having a success rate of up to 97%. But the abdominal approach may carry significant complications – including ureteric obstruction, bleeding, haematomas and abscess formation.

No randomized control studies have evaluated and compared the abdominal, laparoscopic or vaginal route of repair in isolation. Goldberg and co – workers demonstrated in a case control study in women with anterior prolapse and stress incontinence, that the addition of a pubovaginal sling to the anterior colporrhaphy significantly reduced the recurrence of a anterior prolapse from 42% in the control group to 19% in the anterior repair and sling group. Which begs the question – does the addition of type 1 soft mesh to a vaginal repair make the procedure more robust, with an acceptable complication rate? It has already been established that the type 1 large pore prolene mesh is extra – ordinarily well tolerated in the vagina with very few long term complications. Workers have proposed that a tension – free mesh buttress may serve as a scaffold for collagen ingrowth and so reduce the incidence of repair failure.

The ProliftR and PerigeeR systems have been developed for this purpose and allow minimally invasive vaginal techniques anchoring a mesh hammock in situ by means of mesh extensions emerging through the obturator foramen. These novel procedures have no long – term follow up data in the published literature at present, and the results of studies are awaited with interest. The use of mesh would be particularly useful where conventional techniques have already failed, in large defects or in individuals with obstructive pulmonary disease or other predisposing causes of prolapse.

The surgeon should bear in mind that a certain percentage of women develop stress incontinence following anterior repair procedures. About 15% - 20% may need urinary continence procedures, and all patients having anterior repairs must be councelled to this effect.

Posterior Prolapse Procedures

Nowdays several approaches are feasible for the repair of posterior wall prolapse.

The Abdominal Route

The abdominal approach is well described, and involves placement of a mesh buttress anterior to the rectum behind the posterior vaginal wall fascia, commonly as part of a sacrocolpopexy procedure. However a significant number of failures are still reported, with 10% of women needing surgery for complications specific to the surgery. The laparoscopic approach to the posterior prolapse requires further evaluation.

The Vaginal Route

Variations abound in transvaginal techniques. The traditional Jeffcoat levator ani plication produced an acceptable anatomical result, but 50% of patients described significant dyspareunia. Continuous midline plication of the rectovaginal fascia recognized the problems of the levator plication and was an advance on this earlier technique. More recently Richardson attributed rectocoeles to breaks in the rectovaginal fascia, and advocated the isolated repair of the focal defects. Discrete fascial repair offers good anatomical outcome with acceptable sexual function, but midline fascial plication is superior in correcting obstructed defecation in 80% of cases. Site - specific repair is less robust and durable than midline fascial plication, with less entrapment of faeces on straining (grade A evidence). The recent introduction of mesh kits for prolapse of the posterior vaginal wall has been alluded to, and these prolene mesh hammocks with supporting straps which pass through the sacrospinous ligament are being evaluated.

The Transanal Route

A number of papers have appeared describing a novel procedure to deal with posterior compartment prolapse and obstructed defecation. The STARR procedure, or “stapled transanal rectal resection for outlet obstruction”, employs a double – stapled circumferential resection of the lower rectum together with any associated rectocoele, intusseception or mucosal prolapse. The procedure is popular in continental Europe, and uses two ProximateR PPH – 01 stapling guns (Ethicon Endosurgery, Ohio, USA). However evidence to support its widespread implementation is tenuous at this stage. On the basis of two randomized trials,8 with 3 series of transanal stapled resections published to date, it seems that this novel procedure is of potential benefit but needs careful evidence – based evaluation. Level 1 evidence demonstrates that the vaginal approach to rectocoele repair is superior to the transanal method.

Prosthetic Materials And Surgery

There are insufficient data at present to draw any evidence - based conclusions with regard to the role of prosthetic materials in prolapse surgery. Part of the problem arises from the paucity of baseline data regarding the efficacy of “traditional” anterior and posterior vaginal repairs. As a result of this the efficacy of adding prosthetic material for primary or recurrent prolapse affecting these compartments is difficult to assess. While adding synthetic type 1 mesh grafts suggests a theoretical advantage, this must be balanced against increased cost and potential morbidity.

There is also a need for further long – term prospective studies, ideally in the form of randomized controlled trials as well as from structured personal series audits, in order to determine the long – term efficacy and potential morbidity associated with the use of prosthetic materials in primary or recurrent prolapse repair. Standardized criteria for staging POP, adequate follow – up and assessment of effects of surgery on bladder, bowel and sexual function are required to determine whether or not the use of these grafts confers advantage over standard prolapse repair, and in which category of patient they should be employed.

This will allow appropriate selection of both the type of prosthesis and the optimal surgical approach in women requiring reconstructive pelvic floor surgery. However, synthetic prostheses will not compensate for poor surgical techniques or a poorly conceived procedure. A host of “copy – cat” prostheses are available on the market, riding the wave of more established mainstream product usage. A prudent surgeon will evaluate published data on specific products before using “me – too” operations.

Conclusions

New insights classification systems have modified previously held beliefs in the field of pelvic organ prolapse. POP is a vast and amorphous field of surgery. Different causes of prolapse and a host of confounding variables makes one approach and any one standard procedure unscientific. The “one – operation fits all” methods of the past must be eschewed, and a more thoughtful and evidence – based approach cultivated. If necessary, specialist knowledge and expertise may need to be consulted in an approach to difficult cases of POP.

Pathoaetiology of Prolapse and Incontinence

Paul Swart and Etienne Henn

Prolapse and Incontinence are the result of physiological and anatomical failure. The mechanisms involved are complex with multiple factors playing a role. Because this is such a diverse field, these aspects are addressed by two authors in this chapter.

Part 1 - Paul Swart

The Aetiology of Prolapse

The aetiology of pelvic organ prolapse (POP) and stress urinary incontinence (SUI) are inseparable. These two conditions are different sides of the same coin and share common aetiological variables. Detrusor overactivity and urinary urgency, dry or wet, may co-exist in women with SUI and POP, but is a separate condition with different aetiological factors beyond the scope of this discussion.
Pelvic organ prolapse (POP) is not caused by a single event or deficiency, but is the culmination of an interplay between complex multifactorial aetiologies which vary between women. It would not be wise to reduce the end result to a specific event and the best science can offer us, until we have greater understanding of these complex interactions, is to analyze different risk factors in a population and assign relative risks or odds ratios. It is difficult to counsel women regarding the ideal mode of delivery using the currently available evidence.

Risk factors for POP can be classified into predisposing, inciting, promoting or decompensating. Predisposing factors include congenital anomalies, race, gender and hereditary defects such as Marfan’s syndrome. Inciting factors include pregnancy and vaginal delivery, surgical procedures and certain myopathies and neuropathies. Factors outside the pelvis that could elicit POP, include obesity, smoking, pulmonary disease that leads to chronic coughing and lifestyle variables including repetitive heavy lifting during occupational duties or during recreational activities. These would be considered to be promoting causes. Decompensatory mechanisms include aging, menopause, neuropathy, myopathy, debilitating diseases and medication such as cortisone. A combination of factors each influence the development of this disease to a greater or lesser degree. Overall, the risk factors most strongly associated with prolapse include advanced age, high gravidity and parity, number of vaginal deliveries and previous hysterectomy.

Pregnancy

Although increasing parity is a risk factor for prolapse, nulliparity does not provide absolute protection. In the Women's Health Initiative (WHI) study nearly 20% of nulliparous women had some degree of POP. There is, however, no doubt that both pregnancy and the delivery of a baby play a role in the aetiology of POP and SUI. Francis et al found that 40% of primigravid women had some SUI before falling pregnant, which always worsened during the pregnancy, improved after the pregnancy and recurred with later pregnancies. This would eventually become a problem even when they were not pregnant. The hormonal changes associated with pregnancy have an effect on the elasticity and distension of the pelvic contents by their effect on the muscle and collagen content as well as the changes in circulation of the pelvic floor. In addition there is the added stress of increased intra-abdominal pressures and distension by the fetal presenting part.

There are three mechanisms whereby labour influences the integrity of the pelvic floor and the continence mechanisms. Firstly, mechanical distension and tearing of muscle and connective tissue invariably occur. Secondly, vascular compression with the potential for hypoxic damage to the same structures as well as the urinary tract, and subsequent replacement of active tissue by scar formation, has also been shown to occur. The third mechanism is compression, stretching or hypoxic damage to nerve structures including both motor and sensory. EMG studies and pudendal nerve terminal motor latency (PNTML) studies have demonstrated defects after vaginal deliveries which are not apparent following elective caesarean section. Strong associations are described for long labours, macrosomic babies, forceps deliveries, 3rd degree tears and multiparity. There are numerous studies that confirm these findings.

Among premenopausal women, those who have delivered at least one baby, have a higher prevalence of both SUI and urgency than nulliparous women. In contrast, among postmenopausal women, pregnancy and childbirth seem to have a smaller impact on SUI. Older nulliparous females have been shown in some studies to have the same prevalence of SUI as parous women. Co-morbidities, particularly aging, outweigh the effect of previous pregnancies in these women. Goldberg and Abramov report interesting findings after looking at pelvic floor dysfunction in a group of identical twin sisters, with a mean age of 47 years (range 18 and 85 years). The sibling who had at least two vaginal births was three times more likely to report faecal incontinence and four times more likely to report urinary incontinence than her nulliparous twin sister. In the WHI study, it was concluded that a woman having a history of at least one delivery had double the risk of POP when compared to nulliparous controls.

(i) Myogenic damage:
We have histological confirmation and radiological evidence, using ultrasound and MRI, demonstrating that the mechanical trauma of delivery leads to rupture of the pelvic muscles. Imaging studies have also shown an inverse correlation between prolapse and the total volume of levator muscle and muscle strength.

(ii) Neuromuscular damage:
The mechanism of neurological damage during labour is unknown, but pudendal nerve compression certainly plays a significant role. Snooks et al have shown that after vaginal delivery there is prolonged PNTML and this correlates with greater perineal descent during straining. Forceps deliveries appear to make the greatest impact on PNTML whereas subjects having an elective caesarean section were no different from nulliparous controls. Most women will recover as innervation is re-

established but in some women it never returns to normal. Viktrup et al, in a study on the risk of incontinence after delivery, report that most patients who are incontinent after the birth of their babies improve but are at a greater risk of developing incontinence a few years later. Of the women who had SUI three months after the delivery, the majority of whom were dry 1 year later, 92% became incontinent 5 years later. Sultan et al have also shown that a caesarean section performed after the onset of labour is less protective than an elective section. In the Term Breech trial, 4.5% of patients who had a caesarean section were incontinent after 3 months compared to 7.3% of the women that delivered vaginally with a relative risk (RR) of 0.62 and a confidence interval of 0.41 to 0.93.

Data from the EPINCONT study, suggest that after one baby, the RR for SUI becomes 2.4 in women aged 20-34 years but only 1.8 when they are between 35 and 64 years of age. In both age groups, however, the associations are statistically significant. Once the patients were over 65 years of age, there was no significant association between delivery and the risk of SUI. There was, however, the same trend with a larger RR for a parity of two or more.

(iii) Damage to the endopelvic fascia:

During labour, tears develop in the connective tissue. This might not be immediately apparent but with continuous trauma and aging it plays an important role in the development of prolapse. It would appear that some women have a more vulnerable collagen. Studies have shown that there is a decreased collagen content in nulliparous women with SUI. There is also an increase in the concentration of weak cross-linked collagen in women with prolapse compared to the strong cross-linked collagen in women without prolapse. These differences are quantitative as well as qualitative on histo-chemical level. Furthermore, there is an increase in the metalloprotease enzyme activity in patients with prolapse suggesting an increase in the breakdown of collagen of these patients.

There is thus no question that pregnancy and the mode of delivery influences subsequent prolapse and SUI. However, most women have pregnancies and deliveries without residual long-term POP or SUI. The scientific challenge is therefore to identify a subgroup of women who are vulnerable to the consequences of pregnancy and to offer appropriate counselling and possible intervention. Currently the only available intervention is caesarean section but the influence of this on subsequent pregnancies has to be accepted.

Epidural analgesia is possibly associated with subsequent POP or SUI. It may indeed increase the use of forceps in some institutions and this in turn might have deleterious effects on the pelvic floor but it seems unlikely that the epidural block per se has any deleterious role.

The use of episiotomy to prevent pelvic floor damage has no support in the literature. There is no evidence that first or second degree tears are associated with later POP. Third degree tears do appear to be associated with subsequent POP and SUI. In some studies, episiotomies contributed to third and fourth degree tears.

Aging

Virtually all studies that address the relationship between aging and POP find a positive association. There is however controversy as to the role of the menopause.

Constipation

There certainly appears to be an association between POP and constipation. Posterior compartment prolapse can lead to difficult rectal emptying, due to herniation of the rectocele into the vagina. It has been shown that chronic constipation with repetitive straining leads not only to pelvic floor muscular damage, but also to neuropathy. Constipation appears to be significantly more common in women developing POP.

Occupational Stresses

There are studies from Italy and the USA reporting a correlation between a patient’s income and the prevalence of POP. The lower the income, the higher the prevalence of POP. The authors postulated that this was probably due to harder manual labour. Nursing has also been shown to be a risk factor. A study looking at 28,000 Danish nurses found an odds ratio of 1.6 for developing POP or a herniated lumbar disc compared to same-aged controls.

Obesity

Obesity increases the intra-abdominal pressure significantly and chronically. Most studies have found a positive correlation between obesity and POP as well as a greater risk for surgical failure in the obese.

Hysterectomy

According to the Oxford Family Planning Study, the incidence of POP is higher in women who undergo a hysterectomy for reasons other than prolapse. If a woman undergoes surgery for POP the subsequent risk appears to be even higher. It is uncertain whether a sub-total hysterectomy carries the same risk.

Previous Prolapse Surgery

There is little doubt that certain surgical procedures predispose patients to prolapse in other compartments. Two examples include an increase in posterior compartment prolapse after a Burch colposuspension and a greater number of cystocoeles after sacrospinous ligament fixation. There are also reports of prolapse of the vaginal vault after transection of the uterosacral ligaments for chronic pelvic pain.

Collagen Synthesis Abnormalities

As already stated above there are qualitative and quantitative differences in the connective tissue of women with and without POP. These would also include differences in the muscle actin, myosin and extra-cellular matrix proteins.

Variations In Skeletal Anatomy

Increases in thoracic kyphosis and decreases in lumbar lordosis both increase the risk for POP. The same is true for a wider transverse pelvic inlet.

Race

It would seem that POP is more common in women from European descent than African women but older publications show bigger differences than more recent publications. Access to health care facilities might play a role but quantitative and qualitative histochemical differences in collagen and muscle tissue are awaited.

Part 2 - Etienne Henn

Pelvic floor damage due to childbirth

Pelvic floor disorders (PFD) include urinary incontinence (UI), anal incontinence (AI), and pelvic organ prolapse (POP). It has been shown on numerous occasions, that one of the main causes of female pelvic floor dysfunction is vaginal childbirth. The consequences can be short term or lifelong. The potential space in the female pelvis is limited and has been shown, in relative terms, to have decreased over time. Human evolution theory, postulates that the fetal head has enlarged significantly over time, and thus a larger fetal head has to pass through the female pelvis at childbirth. About 1.5 million years ago, Homo erectus had a cranial capacity of 900 cm3 while Homo sapiens now has a cranial capacity of approximately 1800 cm3. It is therefore not surprising that the structures of the pelvic floor are damaged due to pregnancy as well as childbirth. Some studies have shown that one in two parous white women will suffer pelvic floor dysfunction, to varying degrees, due to vaginal childbirth. Of these women, up to 60% of will undergo surgery. It is important to note that although vaginal birth is the most important etiological factor in pelvic floor dysfunction, other factors contribute including advancing age, vascular disease, spinal cord injury, primary bowel disease, molecular and genetic factors. This chapter shall focus on the impact of childbirth and delivery factors on the development of pelvic floor dysfunction. We shall divide the available evidence into different compartments to enable a thorough overview of this impact on the pelvic floor.

Trauma to the nervous system

Neuromuscular function of the pelvic floor is dependent on the integrity of the nervous system. Pelvic floor peripheral nerves, such as the nerves to the levator ani, and the pudendal nerves are at greatest risk of injury during pregnancy and childbirth. The pudendal nerve is particularly prone to damage where it curves around the ischial spine and enters the pudendal canal. Ample evidence links neurologic injury with PFD. Prolonged pudendal nerve motor latency (PNML) has been reported after delivery in 42% of women delivering vaginally, but not in those women delivered by planned caesarean section. PNTML returned to normal in 60% of these women at two months postpartum. Another study found evidence of pudendal nerve denervation in 80% of women after vaginal delivery. The mechanism of injury is most likely to be a combination of direct trauma and traction injury during delivery. Risk factors included a long second stage (> 56.7 minutes), a large baby (> 3.41 kg), and a forceps delivery. Weakness was shown in both the levator ani muscle and the external anal sphincter after vaginal delivery. This is the result of a combination of loss of total motor units as well as asynchronous activity in those that remained. Sensory nerve function is also likely to become impaired by nerve damage. This will be clinically most evident in the anal canal, with its many afferent nerve endings, resulting in anal incontinence or faecal urgency. Caesarean section has been shown to be protective, but only in women who delivered electively.

Trauma to the pelvic floor muscles

Anatomical and functional changes to the pelvic floor can develop secondary to pelvic floor distension during descent of the fetal head and maternal expulsive efforts during the second stage of labor. The most important muscles of the pelvic floor are the puborectalis, pubococcygeus and anal sphincter muscles. The genital hiatus in nulliparous women measures 6-36 cm2 during valsalva while the surface area of the fetal head is 70-100 cm2. This clearly demonstrates the extent (± 300%) that the levator ani muscle is required to stretch during childbirth. Partial levator avulsion has been shown to occur in 15% of women during delivery (Figure 1). These women are at an increased risk for severe pelvic organ prolapse, urinary incontinence and even recurrent prolapse after surgical treatment. Studies on MRI of the pelvic floor did not identify any levator ani defects in nulliparous women, in contrast to the findings in 20% of primiparous women, who had a visible defect in the levator ani muscle. These defects were usually in the pubovisceral portion of the levator ani muscle. Reported risk factors include higher maternal age (>35 yrs), large babies, prolonged second stage, and forceps delivery. Pelvic floor muscle strength has been also been shown to decrease by 25-35% following vaginal delivery compared to caesarean section. Interestingly, 6-10 weeks postpartum there is however no significant difference from antenatal values, excepting for a lower intravaginal pressure in multiparous women.

Injury to the anal sphincter during childbirth occurs either as a result of direct disruption of the muscles or due to injury to the pudendal nerves. The incidence of anal sphincter damage varies between 0.5 – 2.5% where mediolateral episiotomies are used, and 7% where midline episiotomies are used. The use of endoanal ultrasound has demonstrated a much higher incidence of anal sphincter injuries (Figure 2) in asymptomatic women, the so-called occult injuries with as many as 35% of primiparous and up to 44% of multiparous women having evidence of sphincter disruption. Risk factors for both the overt and occult sphincter injuries include forceps delivery, prolonged second stage, large birth weight, midline episiotomy, and occipitoposterior positions.

Figure 1: Levator avulsion injury on ultrasound, the vagina reaching the pelvic sidewall (arrow) with no intervening muscle, unlike the healthy contralateral side.

Figure 2: Two-dimensional endoanal ultrasound image of anal sphincter disruption secondary to obstetric injury.

Connective tissue trauma

Pelvic organ support essentially consists of or relies on the endopelvic fascia and the condensations of this fascia that forms the ligaments (uterosacral, transverse sacral). Increased pelvic organ mobility (POM), manifesting as pelvic organ prolapse (POP), occurs as a consequence of weakness of these supports. It is far more common in parous women (50%), compared to nulliparous women (2%). During vaginal delivery, the mechanism is most likely due to mechanical trauma of these supporting structures with subsequent degrees of disruption. Spontaneous healing might also lead to weaker collagen and so predispose to incontinence and prolapse.

Effect of childbirth on specific pelvic floor disorders

Urinary incontinence

Urinary incontinence is a common symptom in pregnancy and has been reported in up to 85% of women. Women reporting antenatal stress urinary incontinence (SUI) are at an increased risk for future SUI. De novo SUI has been reported to develop in 7% of primigravid women immediately following vaginal delivery but this only persisted in 3% at one year. The most likely mechanism is a combination of nerve and tissue damage. At five-year follow up, 19% of women without urinary symptoms after the first delivery reported SUI. In contrast 92% of women reporting stress incontinence three months after delivery, had SUI five years later. Antepartum incontinence has also been reported to strongly predict postpartum incontinence. It is remains unclear as to whether it is the pregnancy or specifically the vaginal delivery that is the risk factor for developing urinary incontinence. It would appear that vaginal delivery roughly doubles a woman's chance of developing UI. It is important to remember that after adjusting for other potential causes of pelvic floor damage, a woman's risk for moderate to severe incontinence decreases from about 10% to 5% if all of her children are delivered by caesarean section. The protective effect of caesarean delivery and nulliparity dissipates around the sixth decade of life, such that the women have the same incidence of UI regardless of their delivery status.

Anal incontinence

AI is a distressing social handicap and vaginal delivery is a major etiological factor. AI occurs in as many as 29% of women nine months after delivery. The reported incidence of AI following anal sphincter rupture is in the region of 16-47%. There is some evidence to suggest that elective caesarean section is protective against AI but the impact of delivery mode appears to decline with age. The use of forceps is the single independent risk factor associated with anal sphincter damage and the development of AI. The first vaginal delivery has been suggested to be the most significant event leading to damage of the anal sphincter. Retrospective studies have reported that the prevalence of

AI 30 years after delivery was comparable, regardless of mode of delivery.

Pelvic organ prolapse

Pelvic support defects appear to occur before delivery. Pregnant women have been shown to be more likely to have POP than their nulliparous counterparts. Parity increases the risk for POP and is the variable most strongly related to surgery for POP. We await prospective studies on the impact of vaginal delivery and intrapartum management, on the development and prevention of defects in the connective tissue and levator muscles that lead to pelvic organ prolapse.

Conclusion

There appears to be a strong association between the development of pelvic floor disorders including UI, AI and POP and pregnancy and childbirth. Mechanisms of injury include direct muscular trauma, disruption of connective tissues, and denervation injury. The first vaginal delivery is the most significant event impacting of the development on subsequent pelvic floor dysfunction. Other risk factors include advanced maternal age at first delivery, prolonged second stage of labour, delivery of a large baby, midline episiotomy, and the use of a forceps for delivery. Less pelvic floor damage may occur after elective caesarean section, but not necessarily with emergency caesarean section. The advantage of caesarean section appears, however, to dissipate in the long term in the majority of women and it is therefore not recommended in all women. It will not only be unnecessary in at least 50% of parturients, but many women desire the experience of vaginal delivery. Ideally, women should be offered strategies to reduce pelvic floor injury such as pelvic floor exercises. Adequate management of labour is essential and elective caesarean section should only be offered to women at high risk for pelvic floor damage.

Chapter 15

Conservative management of pelvic organ prolapse

Trudie Smith

Pelvic organ prolapse is common and is seen in 50% of parous women .One recent community survey by Slieker-ten et al found that 40% of the general female population aged 45 to 85 years had evidence of pelvic organ prolapse of at least stage two.

Pelvic organ prolapse is rarely life-threatening, but may have a significant impact on a woman’s quality of life. Choice of treatment for prolapse depends on the severity of prolapse, its symptoms, and the woman’s general health and preference. Options available for treatment can be categorized as conservative, mechanical and surgical. Conservative or mechanical treatment is generally considered for women with a mild degree of prolapse, those who wish to have more children, the frail or those unwilling to undergo surgery.
The interventions which could be considered in conservative management consist of the following:

- Lifestyle interventions
- Physiotherapy
- Pessaries

1. Life Style Interventions

Several studies have addressed the association of heavy lifting and strenuous physical activity in the causation of pelvic organ prolapse. Jorgensen and colleagues compared the incidence of surgery for prolapse in 28 619 Danish nursing assistance compared to a staggering 1652533 female population controls. The nursing assistants occupation constantly exposed them to repetitive heavy lifting. He found that these nursing assistants where 1.6 times more likely to undergo surgery than their controls. This study did not however adjust for parity and other contributing factors. In another study by Spernol et al they found that 68% of women with prolapse reported heavy to medium work compared to 0% of controls. Again there was no adjustment for parity, mode of delivery, or other contributing factors.

Body weight was also considered a risk factor in the British Oxford Family Planning Association Study. All of these studies unfortunately were cross -sectional studies and do not control for parity, degree of prolapse or other confounding factors.

Constipation and a history of irritable bowel syndrome were strong and independent risk factors for symptomatic prolapse in an epidemiological trial done by Guri Rortveit et al. This association between constipation and prolapse has not been observed in other studies that included the condition as a potential risk factor for prolapse. Straining with chronic constipation may damage the pelvic floor; alternatively, constipation may be a symptom of posterior prolapse. This was however, a cross-sectional study and did not allow any inference about causal relationships.

There is no conclusive evidence that lifestyle changes are going to improve the degree of prolapse or the symptoms associated with the prolapse.

2. Physiotherapy

Pelvic muscle training (Kegel exercises) is a simple, noninvasive intervention that may improve pelvic function. Whether Kegel exercises can resolve prolapse has not been adequately studied in good randomized controlled trials since Kegel's original articles. While systematic reviews and randomized controlled trials (RCT) have shown a convincing effect of pelvic floor muscle training for stress and mixed urinary incontinence, there seems to be a paucity of data for other conditions associated with pelvic floor dysfunction. It is commonly recommended as adjunct therapy for women with prolapse, often with symptom directed therapy. The POPPY Trial, a multi-centre randomized controlled trial of a pelvic floor muscle training for women with pelvic organ prolapse, which is currently being conducted in Australia, may address this issue.

Prevention
Harvey et al in a systematic review on the role of pelvic floor exercises in preventing pelvic floor prolapse, failed to validate its use as a preventative measure. Piya-Anant et al performed a cross sectional study in 682 women and an intervention study of 654 of the same cohort . Seventy percent of the subjects in the cross sectional study had POP. Thirty percent were classified as severe and 40% as mild prolapse. The women were randomly allocated to an intervention or a control group. Women in the intervention group were taught to contract the pelvic floor muscles 30 times after a meal every day. Women not able to contract were asked to return to the clinic once a month until they could perform corrected contractions. They were also advised to eat more vegetables and fruit and to drink at least two liters of water per day to prevent constipation. They were followed-up every six months throughout the 2-year intervention period. The results indicated that the intervention was only effective in the group with severe prolapse. The rate of worsening of POP was 72.2 and 27.8% in the control group and in the pelvic floor muscle training group, respectively.

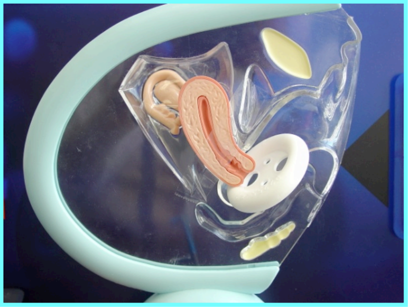
The two main hypotheses on the mechanism of action of PFMT include morphological changes occurring after strength training and the use of a conscious contraction during an increase in abdominal pressure in daily activities. There is an urgent need for good quality RCT's, preferably using the POP-Q system and using standardized exercise programmes.

3. Vaginal Pessaries

Pessaries have been manufactured from many materials including silicone, rubber, clear plastic, soft plastic and latex. Most pessaries today are made of silicone and as a result are non allergic ,do not absorb odours or secrete substances. Silicone is resistant to breakdown with repeated cleansing and autoclaving. Pessaries are often used in pregnant patients, the elderly and in patients who do not want or are too frail to undergo surgery. Pessaries may also be used to facilitate preoperative healing of vaginal and cervical ulcers in patients who present with a procidentia. Another useful advantage of these devices is that they can be used to elicit occult stress incontinence before surgical repair of genital prolapse. A pessary can also predict whether surgery will correct problems such as pelvic and back pain.

While pessary manufacturers provide suggestions for different pessary shapes to manage different types of prolapse, experience suggests that trial and error is really the only way to determine the best fit for each patient . This depends on factors such as the site, severity and the symptoms associated with the prolapse. Other factors, such as the patient's physical capacity and willingness to participate in the care of the pessary, together with the size of the introitus, the patient's weight and her physical activity also play a role when choosing a pessary. Fritzinger et al stated that there is no scientific data outlining the standards of care for users of vaginal pessaries. However, most authors agree that routine follow up of women using pessaries is necessary to minimize the risk of complications associated with their use. At each visit the pessary should be removed and cleaned using mild antibacterial soap and warm water. It should be examined to ensure that the integrity of the silicone is intact .The vagina should also be examined for signs of constant pressure.

Patients should be advised that intercourse may be possible with a ring in situ. She should be aware that it may cause some discomfort to both partners in the beginning but this often settles as the patient and her partner become comfortable with it. Women who are able to remove and reinsert the pessary should be encouraged to do so prior to intercourse.



A simulated picture depicting the position and placement of the pessary

Contraindications to Pessary Insertion

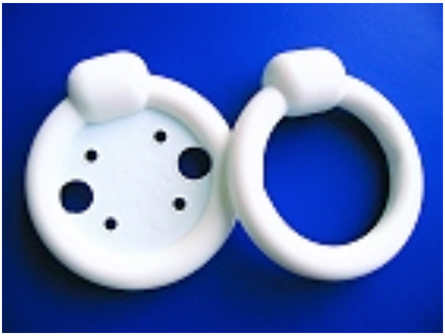
- Severe untreated vaginal atrophy
- Vaginal bleeding of unknown

origin
- Pelvic inflammatory disease
- Abnormal pap smear
- Dementia without possibility of dependable follow-up care
- Expected non-compliance with follow-up

Types of Pessaries

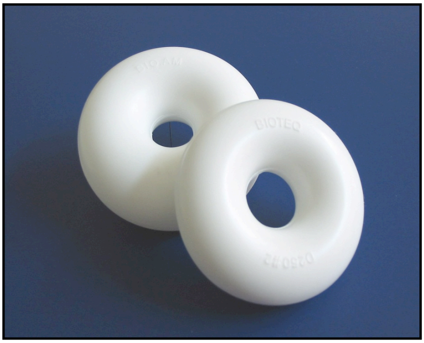
Often referred to as the "incontinence ring" since it has been designed for use in women with stress incontinence.

- Has a membrane to support prolapse.
- Has holes for drainage.
- Knob applies pressure to the urethra against the pubic bone.



Soft silicone, donut shaped.

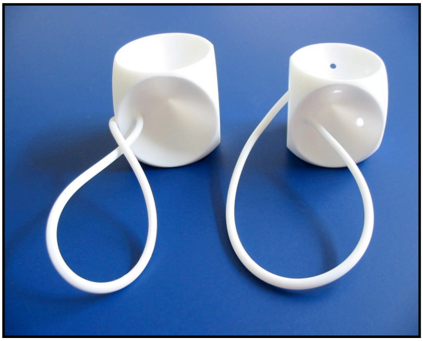
- Occludes upper vagina and supports a uterine prolapse
- Useful for cystocele or rectocele
- May be used for vault prolapse
- Adequate tone of the introitus is necessary for the pessary to remain in place



White silicon cube

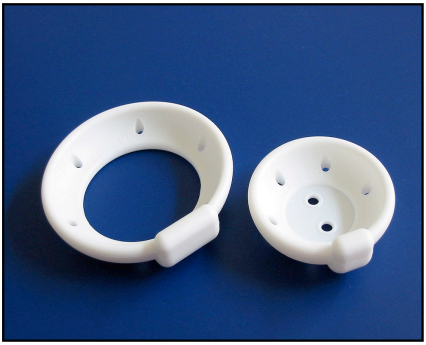
Indications: Third-degree prolapse, cystocele or rectocele, with or without good vaginal tone.

- Often this is the only satisfactory support for women with a complete prolapse
- Excellent for vaginal wall prolapse in that it keeps the vaginal walls from collapsing at the six pressure points.
- May be used by an athlete and removed after exercise.
- Mucosa molds to the concavities creating a negative pressure



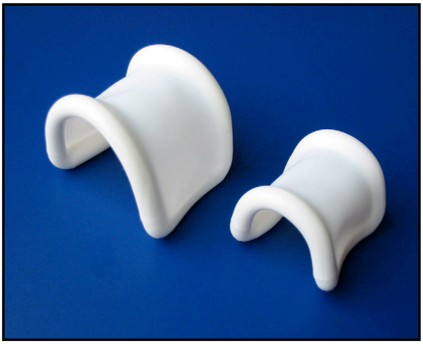
Incontinence Dish

- Dish-shaped pessary with holes to allow for drainage.
- The flexible membrane of the dish supports and elevates a mild cystocele.
- Used in patients with stress urinary incontinence with 1st or 2nd degree prolapse, or a mild cystocele.



Arch Heel Gehrung

- U-shaped device that provides support to the anterior vaginal wall. The heel rests flat on the vaginal floor
- It avoids pressure on the rectum while supporting the anterior wall



- It is malleable and can be shaped to suit the shape of the vagina
- Creates a “bladder bridge”

Ring - with and without support

- Helps support the urethra and bladder neck.
- Membrane provides additional support for a cystocele.
- Useful for a first or mild second-degree uterine prolapse associated with a mild cystocele.

Complications of pessaries

All authors listed vaginal discharge and odor as the most common complication. Other complications which may occur are pelvic pain, bleeding and development of urinary incontinence. Failure to retain a pessary in the vagina, or failure of the pessary to hold the prolapse properly is an obvious disadvantage. Flood and Hanson described erosions of the vaginal wall as being a common problem. They state that early intervention using an estrogen-based cream or vaginal lubricant are essential to proper pessary care. Severe complications such as vesico-vaginal fistulae, hydronephrosis, sepsis, and even small bowel incarceration were cited in the literature as the result of inadequate follow-up. Poma, reports in a review of 2,341 vaginal cancers, that 10.1% were associated with a pessary .It is debatable if this is a risk factor for vaginal malignancy.

Conclusion

There is paucity of good randomized controlled trails that evaluate the use of conservative methods for the management of pelvic organ prolapse. Perhaps with the POP Q scoring system for prolapse and renewed interest in non surgical management, this will change in the future.

Chapter 16

Surgical Management of Urogenital Prolapse

Stephen Jeffery

Introduction

Urogenital prolapse is a common condition and though not life-threatening, it has a significant impact on the quality of life of women. Its treatment is one of the most common surgical indications in gynaecology, accounting for 20% of elective major surgery with this figure increasing to 59% in the elderly population. Despite numerous modifications to the traditional surgical techniques and the recent introduction of novel procedures, the permanent cure of urogenital prolapse remains one of the biggest challenges in modern gynaecology.

Surgical Management

The following factors need to be taken into account when considering surgical intervention for prolapse:

- Bothersomeness of symptoms and extent of prolapse
- Desire for future pregnancy
- Sexual function
- Age
- Fitness for surgery and anaesthesia
- Associated incontinence symptoms
- Patient's wishes

Important point

There is as yet no surgical technique that can guarantee 100% success in treating prolapse and some procedures such as anterior colporrhaphy carry failure rates of up to 30%. This important point needs to be emphasized whenever counselling patients regarding the management of prolapse.

General principles

All women should receive prophylactic antibiotics to cover gram-negative and gram positive organisms, as well as thromboembolic prophylaxis in the form of low dose heparin and thromboembolic deterrent (TED) stockings.

Patients having pelvic surgery are positioned in lithotomy with their hips abducted and flexed. To minimise blood loss, local infiltration of the vaginal epithelium is performed using 0.5% xylocaine and 1/200 000 adrenaline although care should be taken in patients with co-existent cardiac disease.

1. Surgical options for Anterior Compartment prolapse

1.1. Vaginal Approach

Anterior Vaginal Repair (Anterior Colporrhaphy)

An incision is made in the vaginal epithelium below the urethral meatus to the cervix or vaginal vault. A diamond-shaped incision is sometimes made. The cystocele is dissected off the overlying vaginal skin using scissors and blunt dissection. The underlying pubocervical fascia is then reduced using vicryl 3/0 sutures, known as fascial plication. Many surgeons place an additional plication layer of support using a delayed absorbable suture such as PDS in the levator connective tissue medial to the iscniopubic rami. Skin edges are trimmed and closed using polyglycolic sutures (Vicryl, Ethicon).

Mid-urethral tapes such as the TVT or TOT should be placed through a separate incision to prevent the tape from migrating up towards the bladder neck.

Vaginal Paravaginal Repair

Some surgeons perform an extensive dissection stretching from the pubis anteriorly to the ischial spine posteriorly. Up to four sutures are placed along the white line. This is the vaginal paravaginal repair.

1.2 Abdominal Approach

Abdominal Paravaginal Repair

This is the abdominal approach to anterior compartment prolapse.
It is employed when another intra-abdominal procedure eg. sacrocolpopexy or hysterectomy is being performed.
Through a Pfannenstiel incision, the retropubic space is opened and the bladder swept medially,

exposing the pelvic sidewall, very similar to a burch colposuspension procedure. Two fingers are placed in the vagina and it is elevated digitally. The pubocervical fascia is reattached to the pelvic sidewall using interrupted polydioxanone (PDS, Ethicon) sutures from the pubis to just anterior to the ischial spine.

2. Surgical Options For Posterior Compartment Prolapse

Traditionally this compartment is approached vaginally when operated on by the gynaecologist. It is important to remember that the colo-rectal surgeons also operate on the posterior compartment using a transanal approach. The patient should be referred to a colorectal surgeon for assessment if the following are present: concurrent anal or rectal pathology such as hemorrhoids, rectal wall prolapse or rectal mucosal redundancy.

Posterior Colpoperineorrhaphy Procedure

Two allis or littlewood forceps are placed on the perineum at the level of the hymenal remnants, allowing the calibre of the introitus to be estimated. Following infiltration, the perineal scarring is excised and the posterior vaginal wall opened using a longitudinal or triangular incision. The rectocele is mobilized from the vaginal skin by blunt and sharp dissection. The rectovaginal fascia is then plicated using either an interrupted or continuous absorbable suture (Vicryl 3/0), to repair the defect. This is often called the site-specific repair. Care should be taken not to create a constriction ring in the vagina which will result in dyspareunia. The redundant skin edges are then trimmed taking care not to remove too much tissue and thus narrow the vagina. The posterior vaginal wall is closed with a continuous Vicryl 2/0 suture. Many surgeons, in addition to the site-specific plication, place a number of interrupted lateral sutures that incorporate the Levator Ani muscles. This Levator plication has been shown to be associated with significant dyspareunia and is no longer recommended. Finally a perineorrhaphy is performed by placing deeper absorbable sutures into the perineal muscles and fascia thus building up the perineal body to provide additional support to the posterior vaginal wall and lengthening the vagina. Injury to the rectum is unusual but should be identified at the time of the procedure so that the defect can be closed in layers using an absorbable suture and the patient managed with prophylactic antibiotics, low residue diet and faecal softening agents to avoid constipation.

3. Middle Compartment

3.1 Uterovaginal prolapse

3.1.1 Vaginal hysterectomy

The cervix is circumscribed and the utero-vesical fold and pouch of Douglas opened. The uterosacral and cardinal ligaments are divided and ligated first, followed by the uterine pedicles and finally the tubo-ovarian and round ligament pedicles. In cases of procidentia, care should be taken to avoid kinking of the ureters which are often dragged into a lower position than normal. The most important part of the procedure is support of the vault since these women are at high risk for post-hysterectomy vault prolapse. The uterosacral ligament sutures are therefore tied in the midline and brought through the posterior part of the vault and tied after the vault has been closed. For additional support, a high uterosacral ligament suspension can be performed by placing additional PDS sutures through the lateral aspects of the vaginal vault on each side and securing these to the ipsilateral uterosacral ligament. This procedure places the ureters at risk and therefore ureteric patency should be confirmed post-operatively by cystoscopy. These sutures are also tied after the vault has been closed. An alternative to the high uterosacral ligament suspension is a McCall suture. This is a purse-string suture that goes through both corners of the vaginal vault, through the uterosacral ligaments and also through the posterior peritoneum to obliterate the pouch of Douglas to prevent enterocele formation.

3.1.2 Uterine preservation procedures

Sacrohysteropexy
(See a separate chapter on Sacrocolpopexy)

This technique involves

attaching the uterus to the sacral promontory using a broad piece of prolene mesh. Through a Pfannenstiel incision the peritoneum over the sacral promontory is opened. The prolene mesh is attached to the posterior aspect of the uterus with the sutures secured at the level of insertion of the uterosacral ligaments. The mesh is then attached to the anterior aspect of the sacral promontory using either an Ethibond suture or screw tacks. The perioneum is then partially closed over the mesh. This operation can be combined with an abdominal paravaginal repair in a women with a cystocele and a colposuspension in a patient with stress incontinence.

Manchester repair (Fothergill repair)

This procedure is only rarely performed nowadays. Cervical amputation is followed by approximating and shortening the cardinal ligaments anterior to the cervical stump and elevating the uterus. This is combined with an anterior and posterior colporrhaphy. The operation has fallen from favour as long term problems include infertility, miscarriage and dystocia in addition to recurrent uterovaginal prolapse and enterocele formation.

3.2 Enterocele repair

An enterocele repair is normally performed using a vaginal approach. The vaginal epithelium is dissected off the enterocele sac which is then reduced using two or more polyglycolic (Vicryl, Ethicon) or polydioxanone (PDS, Ethicon) purse string sutures. It is not essential to open the enterocele sac although care should be taken not to damage any loops of small bowel which it may contain. The vaginal skin is then closed.

An abdominal approach may also be used although this is much less common. The Moschowitz procedure is performed by inserting concentric purse string sutures around the peritoneum in the pouch of Douglas thus preventing enterocele formation, although care must be taken not to 'kink' or occlude the ureters.

3.3 Vaginal vault procedures

Risk of post-hysterectomy apical prolapse is about 0.36% per year; or 1% (at 3yrs) and 5% (at 17yrs). The vaginal vault can be supported vaginally or abdominally.

Vaginal procedures that suspend the apex
Sacrospinous ligament fixation (Sacrospinous colpopexy)
Modified McCall cul-de-plasty (Endopelvic fascia repair)
Iliococcygeus fascia fixation
High uterosacral ligament suspension with fascial reconstruction
Vaginal obliterative procedures
Colpectomy & colpocleisis
Abdominal procedures that suspend the apex
Sacralcolpopexy
New techniques
Transobturator- procedures including Prolift, Apogee and Avaulta

3.3.1 Vaginal Procedures

Sacrospinous Ligament Fixation (SSF)

A longitudinal posterior or anterior vaginal wall incision is performed to expose the ischial spine using sharp and blunt dissection. The sacrospinous ligament may then be palpated running from the ischial spine to the lower aspect of the sacrum. A delayed absorbable suture (PDS) is passed through the ligament. A number of techniques are available to do this. A standard long needle holder or a specially designed Miya hook ligature carrier can be used. Most recently, the Capio® ligature carrier (see picture) has been launched which makes the procedure significantly easier. Both right and left Sacrospinous ligaments can be used to support the vagina. Some surgeons employ only one ligament but there is no evidence to suggest that a uni-or bilateral is better.

Care must be taken to avoid the sacral plexus and sciatic nerve which are superior to the ligament, and the pudendal vessels and nerve which are lateral to the ischial spine. The sacrospinous sutures are then tied to support the vaginal vault from the sacrospinous ligament. Since the vaginal axis is changed by the procedure there is a risk of post-operative dyspareunia and development of stress incontinence. Success rates for this procedure are in the region of 80-95%.

Complications of SSF:

- Haemorrhage
- Buttock pain
- Nerve injury
- Rectal injury
- Stress incontinence
- Vaginal stenosis
- Anterior vaginal wall prolapse

3.3.2 Illiococcygeus Fixation

In this procedure, the vaginal vault is fixed to the illiococcygeus muscle fascia on both sides, just anterior to the ischial spines. The procedure can be performed through either an anterior or posterior vaginal incision. A delayed absorbable suture is used and secured to the vaginal vault and is associated with a good anatomical result with an adequate vaginal length with no deviation. A trial comparing illiococcygeus fixation and sacrospinous fixation found similar outcomes and comparable complication rates.

3.3.3 Abdominal Procedures

Abdominal Sacrocolpopexy

See separate chapter

3.4 Obliterative Procedures

Colpocleisis

Colpocleisis is an excellent option in patients who are certain that they will not want to be sexually active in the future. This is often a last resort in many women who have had recurrent procedures for vaginal prolapse. In partial colpocleisis (so-called Le Fort colpocleisis), the vagina is obliterated by excising rectangles of vaginal epithelium from the anterior and posterior aspects of the prolapse. These raw areas are then sutured together, thereby burying the cervix and obliterating the vagina. In total colpocleisis all the vaginal skin is removed and the anterior and posterior vaginal walls approximated. In both these procedures, an aggressive perineorrhaphy is performed. There is a high incidence of stress incontinence (up to 42%) following these procedures and therefore a concomitant mid-urethral tape is mandatory. These procedures are performed on an outpatient basis with an immediate return to normal activities, and success rates as high as 100% have been described.

Chapter 17

Sacrocolpopexy

Hennie Cronjé

Definition

Sacrocolpopexy (SCP) is the suspension of the vaginal vault to the sacrum. A synthetic mesh is usually used which is fixed to the vaginal vault and to the anterior longitudinal ligament of the sacrum opposite S1 – S2. The mesh is usually placed retroperitoneally and the procedure is done abdominally by laparotomy or laparoscopy.

Variations

There are numerous variations:

1. Tension

The tension of the mesh can vary from tension-free to a moderate tension. Due to fibrosis the mesh shrinks and therefore, excessive tension should be avoided.

2. Length

The length of mesh along the vagina can vary:
From:
Introïtus or mid-vagina or Vault
Vagina to Sacrum or Perineal body or mid-vagina or Vault

The longer the mesh extends along the vagina, the lower the recurrence rate for prolapse. However, complications such as overactive bladder symptoms and mesh erosion increase with longer mesh.

3. Material

Type 1 macroporous monofilament synthetic mesh is recommended.

4. Rectum

Rectum mobilization with elevation and fixation of it to the mesh (rectopexy) is recommended but not proven to be beneficial.

Indications

Any type of prolapse, stage 3 or 4 (POPQ). It is particularly useful for vault prolapse and large enterocoeles. It is also performed for anterior compartment prolapse, but the larger the cystocoele, the greater the extent of bladder mobilisation.

Contraindications

Patients too young (<40 yr)
Patients too old (> 70 yr)
Marked obesity
Medical problems that may create post-operative problems such as deep vein thrombosis.
Patients on anticoagulants, including Disprin.

Age group

The ideal age group is 45 – 65 years.

Recommended technique

The operation consists of a laparotomy and can be divided in three parts:

(i) Abdominally

Separate the bladder from the vagina to the level of the bladder neck.
Open the peritoneum medially to the rectum from the sacral promontory to the vagina.
Open the rectovaginal space for a short distance.
Open the presacral space and aggressively mobilize the rectum down to the pelvic floor.

(ii) Vaginally*

Open the bladder neck area.
Open the space already made from above (between bladder and vagina).
Insert a strip of mesh (about 15 x 3 cm) into the abdomen.
Fix the bottom of the mesh to the arcuate ligament below the symphysis pubis and surrounding vaginal wall.
Close the anterior vagina.
Open the posterior vaginal wall.
Open the rectovaginal space and join it with the abdominal cavity.
Insert a second strip of mesh.
If necessary, perform a perineal body repair.
Fix the mesh to the perineal body and surrounding vaginal wall.
Close the vagina.

*Hydrodissection is recommended before incision. Use 200ml saline with 2 ampules Por-8 (omnipressin). It is injected between the vagina and bladder or rectum.

(iii) Abdominally

The two strips of mesh are fixed to the vaginal vault and then to the sacrum at level S1-2. Moderate tension should be applied. Thereafter the rectum is pulled upwards and along its medial side fixed to the mesh. Finally, the peritoneum is pulled over the mesh (it is often trimmed) and sutured to the rectum. A markedly elevated pouch of Douglas is characteristic of this operation.

A suprapubic catheter is usually inserted for determining the residual volume on day 3-4 postoperatively. It should be less than 70ml. A vaginal plug is inserted after the operation and removed 36-48 hours postoperatively. The skin stitches are kept in for 2 weeks. Anticoagulant therapy is applied from the first day after the operation.

Bowel action is important postoperatively and when she is discharged. Initially, laxatives should be given. Antibiotics are also given for the first few days.

Results:

The main results of SCP as described above are the following:
Recurrent prolapse about 10% (depending on the surgeons' experience and the type of prolapse).

Mesh erosion about 10-15% of which 95 – 98% can be treated in the consulting room by excision of the exposed mesh followed by vaginal estrogen cream 1 – 2x/ week.

Overactive detrusor 40-60%, but the incidence decreases over time. Stress urinary incontinence in about 10% of cases. Physiotherapy or a mid-urethral tape should be considered.

Abdominal pains during the first 6 months.

Vaginal bleeding during the first month.

Dyspareunia 5 – 6% (the same figure as preoperatively). Although the bowel action improves markedly in most patients, a minority of women have persistent constipation. If obstructive defaecation persists after the operation, a defaecogram should be done (very similar to a barium enema). If a rectocoele (particularly with rectal intussusception) is demonstrated, a STARR procedure could be considered (consult a colorectal surgeon).

Outcomes

1. Cronjé HS. Colposacrosuspension for severe genital prolapse. Int J Gynecol Obstet 2004; 85: 30-35.

Recurrent prolapse:	8%
Repeat surgery:	4%
TVT /Ob-tape postoperatively:	12%

2. Cronjé HS, De Beer JAA. Abdominal hysterectomy and Burch colposuspension for uterovaginal prolapse. Int Urogynecol J 2004; 24: 408-413.
Recurrent prolapse: 10%
Repeat surgery: 9%
TVT/Ob-tape: 3%

3. Cronjé HS, De Beer JAA. Vault prolapse treated by sacrocolpopexy. S Afr J Obstet Gynaecol 2007; 13: 80-83.
Recurrent prolapse: 14%
Repeat surgery: 8%
TVT/Ob-tape: 8%

4. Cronjé HS, De Beer JAA. Combined abdominal sacrocolpopexy and Burch colposuspension for the treatment of stage 3 and 4 anterior compartment prolapse. S Afr J Obstet Gynaecol 2007; 13: 84-90.
Recurrent prolapse: 16%
Repeat surgery: 6%
TVT/Ob-tape: 8%

5. Cronjé HS, De Beer JAA. Culdocele repair in female pelvic organ prolapse. Int J Gynecol Obstet 2008; 100: 262-266.
Recurrent prolapse: 10
Repeat surgery: 5
TVT/Ob-tape: 13

6. Cronjé HS, De Beer JAA, Nel M, Picton AJ. The length of mesh used in sacrocolpopexy and subsequent recurrence of prolapse. (In press).
Mesh from vaginal vault to sacrum: 24% recurrent prolapse.
Mesh from mid-vagina to sacrum: 9% recurrent prolapse.
Mesh from vaginal introitus to sacrum: 8% recurrent prolapse.

Chapter 18

Pelvic floor muscle rehabilitation

Corina Avni

Introduction

Interest and expertise in pelvic floor function and rehabilitation has expanded markedly over recent years. While the field of Women's Health physiotherapy is not yet deemed mainstream, it is a growing specialty and is increasingly included as a first line of investigation and management in conditions ranging from non-resolving lower back pain (LBP) to urinary urgency/frequency. It is now accepted as standard treatment for female urinary incontinence and pelvic floor re-education is included as routine care in many obstetric services.

This popularization within physiotherapy can be partially attributed to an improved understanding of the pressures in the pelvis and lumbar spine, and how these relate to pelvic floor loading and the associations with movement and visceral function.

Work on muscle rehabilitation was profoundly impacted by Andre Vleeming's description of forces around the sacroiliac joint (SIJ). The concept of form closure and force closure as they apply to the body (skeletal vs. muscular and fascial systems) resulted in a rethink of the transmission of pressure between the central core of the lower spine and the abdomen (intra-abdominal pressure (IAP)), the thorax (breathing) and limbs (activity). Evidence based research describes the types of muscle function under varying degrees of load, looking at the different muscles that stabilize and mobilize the body. Muscle function is further divided into local and global systems, each having partner muscles working within functional slings. Control and quality of movement are now central treatment objectives, whereas the older benchmarks of strength and range of motion (ROM) are simple progressions.

This chapter aims to examine the diverse roles and functions of the pelvic floor. We will address the need for specificity in assessment and rehab selection and outline treatment options and techniques used to quantify and qualify PF function.

The scope of physiotherapy and aims of pelvic floor rehabilitation

A broad range of complaints and conditions occur as a result of pelvic floor dysfunction and may therefore respond to pelvic floor rehabilitation.

- Bladder dysfunction:
  - stress incontinence (SI),
  - overactive bladder (OAB),
  - frequency/urgency, nocturia,
  - post void residuals (PVR) and other voiding dysfunction,
  - hesitancy, interstitial cystitis,
  - leaking with intercourse, recurrent urinary tract infections (RUTIs)

- Sexual dysfunction:
  - pain on penetration,
  - dyspareunia,
  - post-coital pain,
  - orgasmic disorder,
  - vaginismus

- Bowel dysfunction:
  - faecal incontinence (FI),
  - flatus, urgency,
  - incomplete evacuation,
  - constipation,
  - disordered ano-rectal function,
  - anismus

- Pelvic organ prolapse (POP)

The scope of physiotherapeutic management extends from conservative measures, including behavioural modification, pelvic floor muscle rehabilitation to electrotherapy.
Recent additions to the pelvic floor rehab repertoire include myofascial techniques, trigger points and low load vs. high load muscle activation.

Pelvic floor function and dysfunction

Characteristic	Function	Dysfunction
Base element of core	Control changes in IAP	Poor generation of IAP with function e.g. weak cough
Lumbar and pelvic load	Lumbopelvic stability	Low back pain and chronic pelvic pain/pelvic girdle pain
Fast twitch muscle activity High load	With activity and physical stress	SI, POP
Slow twitch muscle activity Low load	For antigravity support, bladder inhibition, anorectal angle	POP, OAB, FI
Eccentric muscle activity	Release pelvic sling whilst supporting ano-rectum during defaecation	Obstructed defaecation, POP
Tone and elasticity	Supportive sling	POP
Sexual participation	Sexual awareness/enjoyment	Dysparuenia, decreased sexual enjoyment

The physiology of micturition as it relates to the pelvic floor

- **The pelvic floor co-ordinates cortically stimulated activities (when and where to void). Other functions are mediated at the spinal level.**
- There are a number of reflexes acting between the pelvic floor and the bladder:
- The Perineodetrusor inhibitory reflex inhibits detrusor activity in response to increasing tone in the pelvic floor muscles. (Storage phase - early)
- The Perineobulbar detrusor inhibitory reflex inhibits contraction of the detrusor in response to contraction of the perineal and pelvic floor muscles. (Storage phase - late)
- The Urethrosphincteric guarding reflex stimulates a powerful contraction of the external striated urethral sphincter in response to urine in the proximal urethra and/or increasing tension in the trigone. (Storage phase - under stress)

Abdominopelvic synergy

The pelvic floor has been shown to have ‘partner muscles’ that co-activate to form functional slings.

Some of the notable partners are:

Abdominal Muscle	Pelvic Floor
Transversus Abdominis (TA)	Pubococcygeus (PC) & anterior PF
Obliques	Levator ani
Rectus Abdominis (RA)	Puborectalis

NB: Whilst the PF is defined along anatomical lines, its function should be considered as part of a greater unit. Indeed, the associated abdominal co-contraction may be more important than contracting the PF in its entirety.

The pelvic floor as a pressure mediator

The normal pelvic floor, with intact fascia, needs little more than its inherent elasticity and reflex activity to function adequately. When the normal fascial attachments, however, are compromised by pregnancy and other factors increasing IAP, forces are exerted unequally through the pelvis, hence loading different compartments selectively and repeatedly. The pelvic floor therefore usually requires selective rehabilitation to ensure appropriate activation for either SI, OAB or POP.

The pelvic floor as a pressure mediator for Stress Incontinence Rehabilitation aims to enhance the mechanical functioning of the pelvic floor, particularly speed and strength. The woman needs to learn to recruit the guarding reflex, which consists of a concomitant PF contraction with increasing IAP, when coughing or any other similar events. This is a focal contraction.

The pelvic floor as a pressure mediator for OAB rehabilitation aims to normalize detrusor activity via tonal changes in the PF (see reflexes above). Functional use of the PF to mediate detrusor activity is usually focal. Postmenopausal women invariably have decreased pelvic floor tone secondary to atrophic changes, and therefore in this group particularly, prophylactic PF focused advice and education will be of benefit. If the inhibitory reflexes are insufficient, harnessing S2-4 dermatomes and myotomes may also improve the PF contraction. It is important that these are not used in place of, but in conjunction with an appropriate PF contraction

Dermatomes for S2-4	Myotomes for S2-4
Saddle area (sitting on e.g. arm of chair)	Gluteus Muscles (buttocks gripped)
Back of legs (rubbing back of legs)	Adductors (knees together)
Clitoris (manual perineal pressure)	Plantar flexors (up on toes)
	Intrinsic foot muscles (up on toes)

Ill S2-4 Dermatomes and Myotomes

The pelvic floor as a pressure mediator for frequency/ urgency Rehabilitation aims to differentiate urgency secondary to decreased detrusor inhibition as opposed to urgency secondary to abnormal pelvic floor firing (autonomic up-regulation, disturbing normal detrusor activity) as a result of pelvic floor trigger points.

The pelvic floor as a pressure mediator for hesitancy and incomplete emptying rehabilitation aims to normalize inappropriate PF activity with voiding (dyssynergia). Voluntary relaxation is essential and this usually co-exists with a functional inability to de-activate abdominal bracing.

Objective Assessment

An objective assessment with clearly defined parameters is essential, to formulate a patient specific rehab programme.

Posture changes over time. Repeated incorrect posture over time becomes habitual progressing into a movement pattern. Poor spinal posture inhibits appropriate use of the core.

Breathing habits as with posture, become habitual. The normal muscle ratio of breathing is mostly diaphragmatic with a smaller lateral thoracic component and the least from the thoracic apex. This becomes disordered and the normal bellows-action of the lungs, filling from the oxygenated bases rather than the apices, is compromised. The decrease in diaphragmatic work (often due to splinting) results in less efficient breathing. Furthermore, the core is loaded from the top leading to greater dysfunction.

Abdominal wall

The abdominal wall is assessed for skin changes, muscle tone and integrity, and myofascial trigger points (TPs). Many abdominal TPs will refer to the abdominopelvic area. Symptoms of pain and discomfort include vulvodynia, coccydynia, levator ani syndrome, vulvar vestibulitis, dyspareunia, vaginismus and pelvic floor tension myalgia.

Visceral effects include frequency-urgency syndrome, interstitial cystitis and irritable bowel syndrome (IBS). TPs can exacerbate, and in extreme cases, cause pudendal neuralgia/nerve entrapment.

Neurological testing of dermatomes is mandatory and if any abnormality is detected, warrants further testing of S2-4.

External perineal examination

Observations of skin, mucosa and scarring are noted. The movement relationship between the perineal body and PF is observed.

Internal digital examination

A digital vaginal exam is indicated in all patients except those who cannot give consent, and those who are not yet sexually active. The international guidelines are continually being updated to include qualitative measures. As with all assessments, quantitative outcomes are recorded.

Palpation – anterior, lateral and posterior walls are assessed for laxity and movement in response to changes in IAP. Physiotherapists do not grade according to POPQ although should be familiar with the scale. Any areas of focal tenderness are explored as trigger points.

Perfect Score

The subject performs a maximal contraction against the therapist's index finger.
P records power according to a Modified Oxford Scale
With a brief consistent rest between contractions, the following are assessed:
E records endurance to a max of 10seconds at said power
R records repetitions to a max of 10 repetitions at said power and endurance.

After 1 minute rest:

F records fast contractions to a max of 10 before fatigue
ECT reminds us that every contraction is timed to formulate a patient specific formula
Therefore: 4/8/4//7 records a good contraction, held for 8 seconds, repeated 4 times before fatigue;

Score	Response on fingers
0 = nil	Muscle bulk present/absent
1 – flicker/very weak (min)	Very weak/fluctuating
2 – weak (poor)	Increase in tension
3 – moderate (reasonable)	Lift
4 – some strength (good)	Lift + resistance
5 – strong (max)	Lift + strong resistance

IV. Muscle Testing – the Modified Oxford Scale

and after a minutes rest, 7 quick contractions before fatigue.

Initiation and stability

The speed and control of initiation and the stability of the contraction are noted, along with any coupled movement and breathing patterns.

Voluntary contraction – absent/present

Is the subject able to perform a satisfactory PFC?

Involuntary contraction - absent/present

Does the PF automatically kick-in with increased IAP?

Voluntary relaxation - absent/present

Is the subject able to relax appropriately?

Involuntary relaxation - absent/present

Does the PF relax with defaecation?

Technique

An overall assessment of the ease of activation and appropriate co-activation of the abdominopelvic unit is recorded. A strong PF contraction with breath-holding is non-functional and therefore needs rehab.

QOL question

A quality of life questionnaire allows the subject to self-grade. If you were to spend the rest of your life with your symptoms as they are now how would you feel?

If indicated – spine, hip/pelvic girdle, myotomes, reflexes, sensation, biofeedback

Behaviour

Two consecutive days (48 hour) of behaviour are charted, be it fluid intaket/output or food diary. Symptoms (notably leakage) are noted.

Treatment

Behavioural modifications

1. Fluid/diet management; diaries are of great use as behaviour sensitisers.
2. Education and counselling are of particular importance in identifying triggers and breaking psychological sensitisers.
3. Bladder training using the PF as an inhibitor of detrusor activity helps to decrease urge incontinence, control urgency, delay voiding, increase bladder capacity and decrease nocturia. Often, in that order!
4. Defaecatory technique teaching correct positioning and pressure transmission can alleviate the signs and symptoms of obstructed defaecation.
5. Disability management; although the aim is a clean dry subject, there will be times when management of disability is the best short-term solution; this includes the use of pads and occlusive devices in sports women.

QOL	Delighted	Pleased	Satisfied	Fence sitting	Dissatisfied	Unhappy	Terrible
Score	0	1	2	3	4	5	6

V. QOL scale

PF Muscle Rehab

Physiotherapists specialise in muscle function and rehabilitation. PF rehab follows very similar guidelines to general muscle rehab, relying on the same physiological responses of exercise and overload (without fatigue) to cause muscle hypertrophy. All aspects of muscle function need to addressed. Furthermore, the specific function of that particular component needs to be considered e.g. fast twitch work of the compressae urethrae. The PF, working as it does as a low load support (bladder inhibition, support of pelvic viscera, support of rectum during defaecation) and a high load resistor (fast twitch activity with rapid changes in pressure/speed), needs to be rehabilitated through a variety of diverse functions. A balance needs to be found between power and endurance training. Pure technique needs to be offset against functional outcome and skill acquisition. The PF muscles, like the fascial muscles, control a number of openings, through a range of activites, for a variety of functional outcomes. The challenge with the PF lies in sensory motor integration. Virtually all other muscle rehab can be mediated by some form of feedback, usually visual. The PF and its actions cannot be seen or mediated. Biofeedback remains an invaluable tool for the PF specialist physio.

Re-ed breathing

All rehab should begin with basic body awareness and breathing. Some form of automatic speech e.g. counting is often beneficial as it mediates the breath whilst giving auditory feedback.

Re-ed PF

In the 1940s Kegel described a basic contraction of the PF musculature. To date, aspects such as stablility and ease of activation are as important as strength and endurance. Despite enjoying a certain popularity (notoriety?) in the media (women's magazines), many medical staff remain dubious about the benefits of specific rehab for the PF. Whilst there is increasing emphasis on ante and post natal care and education, many women are not being advised that there is something that they can do before medication or surgery need to be explored. A basic rehab program would progress as follows:

Rehab	Outcome
Assessment	Baseline
Active exercise	Muscle conditioning
Skill training	Functional
Recruitment of muscle and reflexes	Patterning for automatic function
Sensory awareness	Improved efficiency
Biofeedback, preferably EMG	Enhanced awareness
Neuromuscular stimulation	Enhanced awareness and function

Rehabilitation of Muscles

Not all subjects will require the full scope of rehab.

Re-ed abdopelvic synergy

Research in the field of orthopaedic manual therapy (OMT) is increasingly showing coupled relationships between the PF and abdominal muscles. This research is ongoing. At a glance:

Abdominal Muscle	Pelvic Floor
Transversus Abdominis (TA)	Pubococcygeus (PC) & anterior PF
Obliques	Levator ani
Rectus Abdominis (RA)	Puborectalis

Abdominopelvic Partners

These muscle pairings allow for different types of spinal load (low load, rotation, high load) to be distributed evenly through the pelvis.

Rehab any objective deficits Biofeedback, a useful tool in any rehab setting, is invaluable in rehabilitation of the PF due to the lack of other forms of sensory feedback.
If the deficit includes a marked motor component (<Gr3 Modified Oxford Scale) then some form of artificial stimulation may be indicated.

Rehab whole body A strong PF that cannot contract at precisely the right time is insufficient for daily life. The stresses, strains and pressures of individual subjects need to be assessed. Gyrokinesis, Pilates, Yoga and Tai Chi (amongst others) offer exercise within functional limits. In particular, an excellent PF may still be insufficient for the rigours of long distance road running, and certain jumping activities.

Home Exercise Programme (HEP)
A combination of PFEs, core work and sports specific training will achieve a certain level of skill acquisition. A maintenance programme is invaluable. Many women choose to include PF work to improve their current sporting function or to enhance another form of exercise

Biofeedback
In cases of poor sensation and proprioception, biofeedback serves as an external mediator of internal function, allowing the subject to create ‘movement memories’.
The age old ‘jade egg’ has morphed into today’s weighted vaginal cone. Of major significance is the conical end, which stretches the introitus as it descends with increased IAP, hence cueing a PF contraction.

Pressure biofeedback and some of the simple EMG options offer real time imaging. Many EMG options allow for viewing on a workout session via recorded imaging

Electrotherapy

As with all evidence based practices, the strength of the research methodology is paramount when selecting a treatment modality. Differing patient populations, protocols and outcome measures make clear guidelines difficult. Electrotherapy should not be considered as a single treatment option, but the next level of conservative management. Different settings on the equipment can select for slow or fast twitch neuromuscular activation. EMG in combination with NMS allows accurate feedback of response to stimulation.

EMG biofeedback

Electromyography (EMG) is the undisputed gold standard of biofeedback. Ideally, it shows a range of work over a period of time, allowing assessment of:

- Maximum/minimum contraction
- Maximum/minimum relaxation
- Stability contraction/relaxation
- Speed of initiation/release
- Endurance and fatigue resistance
- Concentric and eccentric control

EMG is best performed with a shaped vaginal (or anal) electrode. It may used across a range of PF tonal abnormalities from the up-scaling of a PF contraction to the down-regulating of high resting tone.

A neuromuscular stimulation unit – The Myomed 932

Neuromuscular Stimulation

Where the PF has a strength of less than Grade 3, or has very poor sensory awareness (pudendal nerve latencies), neuromuscular electrical stimulation is indicated. Electrical impulses set up an action potential in the pudendal nerve, causing it to fire and contract the PF. This improves nerve conduction, activates the neuromuscular junction and stimulates a muscle contraction. It also promotes synapse formation, protein production and muscle hypertrophy.

Depending upon the symptoms and aims of treatment, the settings are selected according to wavelength and frequency. A classic ‘fast twitch’ training would include active assisted contractions with the machine (NMS) for speed and strength.

A classic ‘slow twitch’ treatment would be passive and would improve sensory conduction, resting tone and normalize bladder reflexes.

Conclusion

The pelvic floor physiotherapist

has the necessary skills to assess muscle function and dysfunction and rehab according to sound evidence based principles. Highly developed palpation is needed to differentiate between subtle differences in tone and strength. We are, essentially, working blind! Special insight into the psychological implications and management of behaviour make the Pelvic Floor Physio an excellent conservative one-stop-shop.

A clear assessment, with a patient specific programme and regular monitoring of compliance and motivation can yield excellent results; better than standing in the corner doing 100 squeezes per day, but not contracting with a cough!

Physiotherapy for pelvic floor disorders does not compete with medication or surgery. It finds its niche somewhere between patient responsibility and doing the best you can with what you’ve got.

Investigation and management of faecal incontinence

Douglas Stupart

Faecal incontinence is a common condition, affecting up to 10% of adults, with about 0.5 to 1% having regular symptoms that significantly affect their quality of life. Unsurprisingly, in view of the social stigma attached to this problem, it may be underreported, and patients often present late.

It is important to understand that faecal incontinence is a symptom, not a diagnosis in itself, and that incontinence is usually multifactorial in origin. Adequate continence requires higher mental function, intact sensory and motor nerve pathways, an adequate rectal reservoir and an intact anal sphincter complex. In addition, the consistency of the stool and the patient's general mobility play an important part in maintaining continence. For example, any person who has sufficiently severe diarrhoea will experience urgency (having to 'run to the toilet'). The same person, if he has a fractured femur and cannot move to the bathroom quickly enough, will, by definition, experience urge incontinence, despite having completely normal anal sphincter function. Also, a patient with damaged sphincter muscles may be able to cope for many years until the injury is unmasked by new onset diarrhoea or weakening of the pelvic muscles with age. The table below summarises the common causes for faecal incontinence.

History taking

The severity of incontinence, as well as its impact on the patient's lifestyle should be assessed. Numerous scoring systems for incontinence exist, but a simple and useful classification is simply to determine if the patient is incontinent to flatus (least severe), liquid stool (more severe), or solid stool (most severe). One should also ascertain whether the problem is urgency or passive incontinence (in which the patient is unaware of the passage of stool).

The patient should be asked about any general medical conditions, as well as their mobility. Diabetes and many neurological and spinal diseases can affect pudendal nerve and therefore sphincter function. Obstetric history is especially important, particularly any history of instrumental deliveries, episiotomies or perineal tears.

Common causes for facial incontinence

Anatomical site	Disorders
Anus/ perineum	Anal sphincter injury, pudendal neuropathy, rectal prolapse.
Colon and rectum	Inadequate rectal reservoir due to e.g. Radiation or inflammatory bowel disease.
Stool quality	Diarrhoea or mucus production from any cause. This includes inflammatory bowel disease and faecal impaction or colorectal neoplasms with overflow diarrhoea. Numerous medications.
Sensorimotor pathways	Diabetes, neurological disorders
Brain	Dementia, psychological disturbances
General	Impaired mobility

One should ask about the patient’s bowel habits and stool consistency with particular attention to any recent change in bowel habits, as well as any other symptoms suggesting bowel cancer or inflammatory bowel disease (such as blood or mucus per rectum or weight loss).

Examination

Apart from a general clinical examination, one should examine the perineum for signs of rectal or vaginal prolapse and perineal descent. Examination of the perineum and anus may reveal a palpable anal sphincter defect.
A digital anal examination is important not only subjectively to assess sphincter tone (both resting and ‘squeeze’), but also to exclude anorectal neoplasms, and to detect faecal loading. Where appropriate,

a full neurological or cognitive assessment should be performed.

Investigation

All patients with new onset faecal incontinence who are over 50 years old, or who have experienced changes in bowel habits should be referred for a colonoscopy in order to exclude colorectal neoplasms or inflammatory bowel disease.

Endo- anal ultrasound is a non-invasive procedure which allows visualisation of the anal sphincters, and is indicated in all patients in whom anal sphincter damage is suspected. It will identify the group of patients with isolated sphincter injuries (almost all of which are due to obstetric injuries) who may suitable for surgical sphincter repair. The illustration below is a typical example of an obstetric sphincter injury involving the anterior part of the external and internal sphincters.

Anorectal manometry is commonly performed to document anal sphincter function. Measuring resting sphincter pressures provides information about the function of the internal sphincter, while the quality of the (consciously controlled) ‘squeeze’ pressure is dependant on external anal sphincter function. One may also gain information about the compliance of the rectum, and the anorectal inhibitory reflex (which causes the anus to relax during defecation). It is unusual, however, for this to change the management of an incontinent patient, and its usefulness is mainly in research and in documentation for medico legal purposes.

Sacral nerve latency testing aims to detect sacral neuropathy (which is common in incontinent women, and usually due to obstetric injury). The test has poor inter- observer reproducibility in most operators’ hands, and seldom gives results that change management.

MRI scanning provides detailed imaging of the anal sphincters. It can not only detect sphincter injury, but also gives information about sphincter muscle atrophy. At present it is not widely used in the assessment of anal sphincter injuries, but may become more so in the future.

Management

Treatable specific conditions
Patients with sphincter injuries should be referred for possible repair. Although the long- term results of anal sphincter repairs

are disappointing (about 25% of patients will be continent for liquid stool after 10 years), this offers the best hope of cure in this group of patients.

Faecal impaction is common, especially in the elderly, and should be treated with enemas and oral laxatives (and manual disimpaction under general anaesthesia if necessary) until the rectum is empty.

Rectal prolapse may require surgical correction.

Bowel diseases such as colorectal neoplasms or inflammatory bowel disease should be treated as usual.

Conservative management

Unfortunately, most patients with faecal incontinence do not have curable diseases. They should initially be treated with conservative measures aimed at reducing the impact of the incontinence on the patient’s lifestyle.

Bowel habits may be improved by modifying fibre intake (some will improve by increasing the fibre in their diet, others by decreasing it). Reducing caffeine intake may decrease bowel frequency. If the patient is receiving chronic medication, one should try to stop any with side effects on gastrointestinal motility.

If the patient has loose stools in the absence of an identifiable colorectal pathology (on colonoscopy), loperamide is the drug of first choice to firm the stool and decrease stool frequency. Tricyclic antidepressants may also have a role in reducing stool frequency.

Rectal washouts may be helpful to motivated patients. They can empty their rectum at a convenient time, and hopefully not soil themselves during the intervening time.

Other surgical options

Patients with incontinence due to pudendal nerve dysfunction or surgically non- repairable anal sphincter injuries may benefit from sacral nerve stimulation. Short term data for this intervention are encouraging, but long- term outcomes are not well known.

Neosphincter construction, whether with a prosthetic sphincter or gracilis muscle transposition, are complex operations with significant complications. These should only be performed in highly specialised centres.

In summary, the management of these patients remains difficult. It is important for the patient and the clinician to realise that the prognosis for cure is poor, and that treatment must be aimed at improving long- term quality of life.

Chapter 20

The use of mesh, grafts and kits in Pelvic Organ Prolapse Surgery

Stephen Jeffery

Failure of surgery for pelvic organ prolapse is a reality facing every vaginal surgeon, despite the numerous modifications and innovations to surgical technique over the past century. As many as 29% of women will require an additional operation following primary prolapse surgery. With second and subsequent procedures these figures increase.

Surgical failure may be the attributed to a number of factors. Surgical technique is rudimentary and inattention to important aspects such as tissue handling, correct choice of suture material and strict asepsis will have an important impact on the outcome of the prolapse repair. Thorough pre-operative assessment is also crucial in ensuring the appropriate procedure is performed and support in all three vaginal compartments is addressed. In addition there is now evidence to suggest that factors distinctive to a specific patient will predispose to a recurrence of the prolapse. This includes inherent deficiencies in tissue quality or healing, persistent increases in intra-abdominal pressure and exogenous factors, like steroid use.

Despite thorough pre-operative assessment and meticulous surgical technique, pelvic organ prolapse will recur. In an attempt to improve outcomes, gynaecologists involved in reconstructive pelvic floor surgery have looked to the general surgeons, who have employed various graft materials for the correction of abdominal wall hernias. A wide variety of synthetic and biological grafts are currently available. The synthetic grafts have shown some promise in the prevention of recurrent prolapse but unfortunately have a tendency to erode, extrude or become infected. The biological grafts have been developed to avoid these complications. The autografts, derived from the patient's own tissue, unfortunately have the disadvantages associated with harvesting from the thigh, vagina or abdominal wall, while the allografts which are harvested from cadavers, bring with them the risk of cross-infection. The newest development has been the introduction of xenograft materials, derived from animal sources, into prolapse surgery. These products carry a low infection risk and, in addition, have low erosion rates and do not need to be harvested. There are however reservations regarding the longevity of these grafts.

The introduction of new prostheses into practice has regrettably been marketing rather than evidence driven. It is vital that practitioners involved in reconstructive pelvic floor surgery are aware of the efficacy, limitations and potential morbidity of these products. In this chapter we will briefly review the failure rates following anterior, apical and posterior compartment surgery. In addition, we will classify and assess the properties of both synthetic and biological prostheses employed in reconstructive pelvic floor surgery and evaluate surgical outcomes and peri-operative morbidity following the use of these materials.

Failure Of Primary And Secondary Prolapse Procedures

Anterior Compartment (See table 1)

Ahlfelt in 1909 stated that the only problem in plastic gynaecology left unresolved was the permanent cure of the cystocele. In 1913 Kelly described the anterior colporrhaphy, which involved plication of the urethral muscle. A number of other procedures advocated for the repair of the cystocele have subsequently evolved and these include: vaginal para-vaginal repair, colposuspension and abdominal paravaginal repair. The success rates of anterior colporrhaphy in the management of cystoceles range from 70-100% in retrospective series. Much higher recurrence rates have, however been reported. In two randomized control trials, Weber et al and

Table 1: Failure rates of anterior compartment prolapse repair

Procedure	Follow-up	Failure (variably defined)
Midline fascial placation	1 – 20 yrs	3-58 %
Site-specific fascial repair	6 mths – 2 yrs	10-32 %
Vaginal-paravaginal repair	6 mths – 6 yrs	30-67 %
Abdominal paravaginal repair	6 mths – 6 yrs	20 %
Concomitant sling support	17 mths – 4 yrs	2-57 %

Sand et al reported the anterior colporraphy to be successful in only 42% and 57% respectively. Success rates of the vaginal paravaginal repair for cystoceles in various case series range from 1-33%. In addition, this procedure has significant morbidity including ureteric ligation, retropubic haemorrhage and abscess formation. Colposuspension has a failure rate of up to 33% and abdominal paravaginal repair fails in up to 24%.

In addition to the traditional risk factors, recurrence of anterior compartment prolapse may be related to failure of the initial procedure to identify and repair all support defects. Adequate support of the vaginal apex is essential in ensuring the longevity of an anterior compartment procedure.

Posterior Compartment (See table 2)

Reports of recurrence after rectocele repair range from 7% to 67%, depending on the type of operation. Rectocele repair can be approached vaginally, transanally or abdominally. The vaginal procedures include: site –specific repair, fascial plication and levator plication repair. For the vaginal

Table 2: Failure rates of posterior compartment prolapse repair

Procedure	Failure	Persistent POP symptoms	Dyspareunia
Levator plication	10-20 %	<20 %	27-50 %
Midline fascial plication	7-13 %	7-20 %	4.2 %
Site-specific fascial repair	10-32 %		
Trans-anal repair	30-67 %	17-30 %	
Laparoscopic rectocoele repair	20 %	20 %	

approach, failure rates are quoted at between 7-32%.

Midline fascial plication during the vaginal approach seems to be more successful than site specific repair. The transanal repair, the colorectal surgeon's route of choice, has reported failure rates of up to 67%.

Apical Prolapse

The vaginal apex, be it uterus or post –hysterectomy vaginal cuff, is the keystone of pelvic organ support. Appropriate attention to apical support is crucial in the prevention of posterior and particularly anterior vaginal wall prolapse.

A number of procedures; including the vaginal, abdominal and laparoscopic approaches are employed for apical prolapse. Objective failure rates vary from 24% to 47% in various studies on sacrocolpopexy, bilateral iliococcygeus fixation and sacrospinous fixation.

Classification And Properties Of Graft Materials

Prostheses may be derived from synthetic materials, biological tissues or mixed synthetic and biological grafts. The biological grafts include autologous grafts, which are derived from the individual's own tissues, allografts from human donor tissue and xenografts from an animal origin. Recently, a mixed synthetic and biological graft has been produced. The pelvic reconstructive surgeon needs a working understanding of these grafts. Important aspects that should be considered when selecting a graft include the inherent strength, surgical handling, its reaction within human tissues and potential morbidity. The properties of the ideal graft for pelvic reconstructive surgery are listed in table 3.

Table 3: Properties of the ideal graft

Biocompatible
Inert
Hypoallergenic
Hypoinflammatory
Resistant to mechanical stress
Sterile
Non-carcinogenic
Affordable
Accessible
Easy to handle
Flexible

Synthetic Grafts

Synthetic grafts are durable, easy to handle and readily available. They do not require harvesting as with the autografts and they do not carry the infection risks of the allografts.

Over the past few years, there has been extensive research and development in an attempt to identify the properties of an ideal synthetic prosthesis. A number of different grafts have been manufactured, each with its own properties and in-vivo responses. Mesh prostheses have been used to reinforce abdominal hernia repair by general surgeons for a few decades now. When placing mesh through a vaginal incision, additional factors need to be considered in prosthesis selection.   The risk of infection is four times higher if placed vaginally rather than abdominally. The sexual function of the vagina also needs to be retained and the mesh should therefore be soft with smooth edges. Erosion is the greatest risk of synthetic mesh and infection of the graft is the most common cause of this complication, however it may also result from inadequate vaginal closure, superficial placement of the graft or vaginal atrophy. Injection of local infiltration, which increases tissue volume, may also increase the risk of extrusion by placement of the graft at an insufficient tissue depth. The pelvic reconstructive surgeon therefore has an important responsibility - since the incorrect choice of mesh and inappropriate technique will doom a woman to possible dyspareunia, erosion, chronic pain or recurrence of the prolapse.

Classification of Synthetc Mesh (See table 4)

Synthetic mesh prostheses were classified by Parvis Amid into 4 Types, based on filament type and pore size. Based on data drawn from a number of animal and clinically based studies, the following factors need to be considered when selecting a synthetic prosthesis.

Material Type

Absorbable and non-absorbable materials have been used with varying success rates.
The absorbable mesh used is almost exclusively Polyglactin 910 (Vicryl). Recently, concerns have been expressed regarding the longevity of the absorbable prostheses and the trend is now towards the use of non-absorbable products. The most common non-absorbable materials used include polypropylene, polyester, polytetrafluoroethylene, and polyamide. (Table 5) The in-vivo tissue response to polypropylene appears to be the most favourable. Comparative studies have shown the inflammatory response elicited by this product to be significantly lower than with the other materials and it also appears to have a higher resistance to infection. It is the general surgeon's mesh of choice and it is now used in more than 1 million hernia repairs annually. It therefore appears to be the ideal selection when choosing a synthetic material for pelvic floor repair.

Weave and Porosity

Synthetic mesh can be woven, knitted or non-woven and non-knitted. Microscopically, a woven mesh would resemble a wicker basket whereas a knitted mesh would look like a fishing net.

Table 4: Classification Synthetic Grafts

Type	Component	Pore Size	Trade Name	Fibre Type
Type I Totally Macroporous Pore size>75um	Polypropylene	Macro	Prolene (Ethicon,Summerville.NJ)	Monofilament
	Polypropylene	Macro	Marlex (Bard,Cranston,RI)	Monofilament
	Polypropylene	Macro	Atrium (Atrium,Hudson,NH)	Monofilament
	Polypropylene	Macro	Apogee, Perigree (AMS)	Monofilament
	Polypropylene	Macro	Prolift (Gynecare)	Monofilament
	Polypropylene	Macro	Posterior IVS (Tyco)	Monofilament
Type II Totally Microporous Pore size <10	Expanded PTFE	Micro	Gore-Tex (Gore, Flagstaff, AZ)	Multifilament
Type III Macroporous with multifilaments or microporous component	Polyethylene	Micro/ macro	Mersilene (Ethicon, Summerville, NJ)	Multifilament
	Polypropylene/ Polyglactin 910	Macro	Vypro (Ethicon,Summerville,NJ)	Mono/Multi
	Polyglactin 910	Macro	Vicryl (Ethicon,Summerville,NJ)	Multifilament
Type IV Submicronic pore size Pore <1um	Polypropylene sheet	submicro	Cellgard (not used in gynae surgery)	Monofilament

Non-woven and non knitted mesh resembles a piece of plastic sheeting. The structure determines the pore size of the mesh. Pore size is an extremely important property of any prosthesis since it influences its susceptibility to infection, the flexibility of the graft and the ability of the graft to become incorporated into the surrounding tissue.

The mean diameter of leukocytes and macrophages is 9–15 microns and 16–20 microns respectively while the average bacterium is <1um in size. Selection of a graft with a pore size that allows access to the leukocytes is therefore crucial in preventing sepsis and its sequelae.

Table 5

Material Type	Example
Polyglactin 910	VICRYL
Polypropylene	PROLENE GYNECARE GYNEMESH* PS GYNECARE TVT MARLEX, URETEX SURGIPRO, IVS SPARC
Polyester	MERSILENE
Polytetrafluoroethylene	GORETEX
Polyamide	NYLON

Pore size also determines angiogenesis and in-growth of collagen, which allow adequate incorporation of the graft into the native tissue. When these processes are suboptimal, the mesh will become encapsulated rather than incorporated into the tissues. A pore size of more than 75um is considered to be ideal for integration of the graft into the pelvic tissues. Therefore, a knitted mesh with pores measuring >75um, as in the Amid Type I, is considered to be the optimal configuration to prevent infection, promote integration and allow flexibility and softness. Table 6 summarises the percentage relative porosity of a number of the commonly available mesh prostheses.

Filament type

Mesh materials are either mono- or multi- filamentous. Multifilament grafts are made of multiple braided strands whereas in monfilament prostheses the individual strands of the mesh are solid. As with pore size, the interstices between the strands play an important role in a graft's predisposition to infection. A distance of less than 10 microns between the strands will allow the passage of small bacteria (< 1 micron) but not leukocytes and hence predispose to infection. [40] Monofilamentous grafts, e.g. Amid Types I and III, are monofilamentous and therefore considered to be a better choice.

Weight and flexibilty

The risk of erosion or vaginal

irritation is also likely to be influenced by the stiffness or flexibility of the graft. The latter is influenced by both the fibre and pore size. More recently, emphasis has been placed on the weight, expressed in milligrams per square centimeter, of synthetic mesh prosthesis. A graft with a lower weight will be softer and more flexible, both desirable qualities for a vaginal prosthesis. Again Type I mesh appears to have the greatest flexilbity with the newer Type Ib lightweight mesh having the greatest softness and flexibility

Shrinkage

Another clinically relevant property of the synthetic grafts is shrinkage. Excessive contraction of a mesh leads to erosion and extrusion. Most grafts will shrink by about 20% and enough excess should therefore be left when using these materials.

Biological Grafts (see table 7)

Erosion rates of up to 25% have been reported for the synthetic grafts. Biological grafts have therefore been used and industry continues to develop newer grafts derived from biological tissues, to overcome this problem.

Autologous grafts

Autologous grafts may be harvested from the patient's vagina, fascia lata or rectus fascia. The latter options, however, are associated with increased peri-operative morbidity. Walter et al reported an incidence of 4% haematoma or seroma and 5% cellulitis following fascia lata harvesting in 71 women. In addition, 13% of the patients reported dissatisfaction with the technique as a result of pain, cosmesis or both.In addition, in women with prolapse, these tissues may be inherently weaker than normal, predisposing to fragmentation and surgical failure.

Allografts

Allografts include cadaveric derived fascia lata, dura mater and acellular dermal matrix (AlloDerm®). These materials have the advantage of avoiding the morbidity of harvesting autologous tissue and a significantly reduced risk of graft erosion. Fascia lata and dura mater allografts are harvested using an aseptic technique and are then soaked in antibiotics. The grafts are cultured and screened for HIV, Hepatitis B and C and T-Lymphocyte virus type 1. The graft is then freeze-dried and sterilized using gamma irradiation in keeping with FDA guidelines. The freeze-drying process leaves a significant amount of cellular material on the prostheses and there is still a small risk of prion or HIV transmission. A newer processing technique, the solvent-drying Tutoplast process, involves soaking the graft in sodium hydroxide followed by peroxide. This reduces the risk of viral and prion transmission significantly and provides an acellular collagen matrix graft. In the older –type allografts, where there is residual antigenic expression, a 'host versus graft' type immunological reaction may occur resulting in autolysis of the graft and surgical failure. Surgical failure may also arise due to intrinsic deficiencies in the strength of the graft.

The newer acellular dermal matrix (AlloDerm®) is derived from human skin tissue. In the USA, the tissue is supplied by tissue banks approved by the American Association of Tissue Banks (AATB) and FDA guidelines. The FDA has classified it as banked human tissue. The graft is prepared by a process that removes the epidermis and the cells that lead to tissue rejection and graft failure, without damaging the matrix. This matrix provides a template for revascularization, cell repopulation and normal tissue regeneration, a similar principle to the xenograft collagen matrices.

Xenografts

The most widely used xenografts are porcine and bovine in origin. They include porcine dermal grafts (Pelvicol), small intestinal submucosa (SIS) and bovine pericardium (Veritas). They lack the ethical implications associated with cadaveric grafts and are more readily available. The idea behind the use of these prostheses is to provide a stable three-dimensional structure that ideally attracts host cells and acts as an interactive scaffold for host cell migration, neovascularization, and tissue remodelling. Various animal studies have however shown that this does not always occur and the implanted graft materials may also undergo either encapsulation with graft fibrosis or breakdown with loss of support. The manufacturing processes of the graft prior to implantation may alter its structural integrity and the host cell may identify the implant as a foreign body rather than a matrix for remodelling.

There are also the religious implications of using porcine and

Table 6: Relative porosity of various synthetic meshes

GYNEMESH PS	65,6
MERSILENE	62,7
PROLENE	53,1
GYNECARE TVT	52,1
MARLEX	49,3
IVS	37,7
SURGIPRO	37,7

bovine products. This is, however, open to individual interpretation and the women should obtain counsel from her local religious leader.

The two most commonly employed xenografts include SIS® and Pelvicol®. Pelvicol® is a porcine dermal collagen. It comprises fibrous acellular collagen and its elastin fibers that are cross-linked by hexamethylene – di-isocyanate to resist degradation by the collagenases. It is durable and easy to work with and readily available. Recently the product has been modified (Pelvisoft) after a number of reports have suggested that this graft may predispose to encapsulation rather than integration. This has involved changing the structure to a netting –type configuration rather than a solid sheet. Another porcine dermal collagen product (InteXen) claims to have up to 25% more strength than pelvicol.

Bovine pericardium (Veritas) is another acellular product used in prolapse surgery. Recently fetal bovine pericardium (Cytrix) has been marketed and is reported to have no risk of transmission of prion disease.

Table 9 and10 summarises some of the differences between the various grafts.

Evidence For The Use Of Graft Materials In Prolapse Surgery

There is regrettably very little robust evidence to either support or refute the use of these grafts in vaginal prolapse surgery. It is principally based on observational case series and case-control studies with limited long-term

Table 7: Classification of Biological Mesh

Xenograft	Porcine Small Intestinal Submucosa	SymphaSIS (8-ply) SurgiSIS (4-ply) StrataSIS (Cook, Letchworth, UK)
	Porcine dermal collagen	Pelvicol Pelvisoft (Bard, Cranston, RI) InteXen (AMS)
	Bovine pericardium	Veritas Braille biomedical Industria Commercio E representacoes S/A Cytrix (TEI Biosciences)
Allograft	Dura Mater	
	Fascia Lata	Suspend (Tutoplast) Mentor Corp Santa Barbara California
	Acellular Dermal Matrix	AlloDerm Lifecell, Branchberg , NJ Axis Mentor Corp Santa Barbara California Duraderm (Boston Scientific) Replform (Boston Scientific)
Autologous	Rectus Sheath	
	Fascia Lata	
	Vaginal Mucosa	

outcome data. Many of these are retrospective studies and report on relatively small numbers of patients. Only a few small, randomized control trials have been performed. In addition, in many of the studies the patient cohort was heterogenous with significant confounding variables. For example, many of the studies included women with both primary and recurrent prolapse in the same cohort. Some reports compare a mixture of women who had procedures in addition to graft insertion, e.g. vaginal hysterectomy and repair of prolapse in other compartments. This would have impacted on outcomes including recurrence and erosion rates. For example, it has been shown that performing a vaginal hysterectomy at the same time as anterior insertion of a graft will increase the risk of erosion.

Criteria used to define recurrence also vary greatly between studies, with some authors using validated objective data and others, unvalidated subjective observations.

There is therefore an urgent need for large, multicentre, randomised control trials with strict inclusion criteria and results based on objective observations and validated questionnaires.

Anterior Compartment

Synthetic Materials (See tables 11 to 13)

Prosthetic reinforcement has been employed in women undergoing anterior colporrhaphy for both primary and recurrent cystocoele. Most of the studies on grafts and cystocele repair have investigated the type 1 polypropylene mesh. Julian [45] was the first to publish a clinical study evaluating cystocele repair with prosthetic re-enforcement in 1996. In this, the only randomised controlled trial on Type I monofilament polypropylene mesh (Marlex), 24 women with recurrent cystocoeles (Grade 1) were allocated to anterior colporrhaphy alone or reinforcement with the graft. At 24 month follow-up, the success rate was 100% in those who underwent prosthetic reinforcement, compared to only 66% in those who underwent anterior colporrhaphy alone. Despite this significant improvement in outcomes in the group having the mesh it was coupled with a very high erosion rate of 25%.

There have only been an additional three randomised control trials looking at the use of synthetic mesh in anterior repair and these have all been done on absorbable mesh Polyglactin 910 (Vicryl) with conflicting results. Sand performed a study on 161 women with cystocoeles more than grade 1. At 12 months of follow-up, those undergoing fascial plication alone had a recurrence rate of 43%, compared to (p = 0.2) 25% in those women whose repairs were re-inforced with vicryl mesh. Koduri et al also found that the addition of a Polyglactin graft improved outcomes with a recurrence rate of 1% in those with the prosthesis compared with 13% in those without. However, in a prospective RCT by Weber [14], 140 women were assigned randomly to three different techniques of anterior repair: standard anterior repair, standard plus polyglactin and ultralateral anterior colporrhaphy. After follow-up of 83 women (76%) at a median of 23.3 months, the author concluded that the three techniques for anterior colporrhaphy provide similar symptomatic and anatomic cure rates and that the addition of polyglactin 910 did not confer any advantage over standard anterior repair. It should also be mentioned that in the Weber and Sand studies, recurrence rates were particularly high in all the groups.

Table 8

MIXED BIOLOGICAL and SYNTHETIC	Monofilament polypropolene mesh coated with hydrophilic porcine collagen	Pelvitex (Bard) Avaulta Plus	Monofilament	Macro
	Monofilament polypropolene coated with atelocollagen, polyethelene glycol and glycerol	Ugytex (Sofradim France)	Monofilament	Macro

There have been a large number of non-randomised studies of polypropylene mesh in anterior compartment prolapse reporting recurrence rates ranging from 0-8.4% and erosion rates up to 9%. There are, however difficulties in interpreting and comparing these data. The techniques differed significantly between the studies, ranging from surgeons who sutured the graft firmly in placed to a tension –free approach. In addition, different criteria were used to define recurrence and duration of follow-up also varied significantly.

Combined absorbable and non-absorbable prostheses (eg Vypro: Polyglactin 910 / Polypropylene) were introduced in an attempt to further reduce mesh complications. The results using this graft have

Table 9: Biological responses to the different graft materials

	Prolene	SIS (4 ply)	Pelvicol
Structural integrity	Fully intact at 1 year	Not recognisable at 60 days	Partially recognisable at 1 year
Collagen Deposition At one year	Dense, fibrous organised	Thin layer fibrous collagen	Thin layer fibrous collagen
Neovascularisation	Numerous and wide calibre	Smaller and fewer	Smaller and fewer
Inflammatory resonse	Mononuclear High level response to 1 year	Mononuclear and polymorponuclear with low level response at 1 year	Mononuclear and polymorponuclear with low level response at 1 year

however been disappointing.
It is hypothesized that the polyglactin component provokes an inflammatory reaction leading to erosion and poor healing with resultant recurrence of the prolapse. Denis et al used Vypro to treat prolapse in 106 women. 50 % of the women experienced a recurrence after a mean follow-up of only 7.9 months. Moreover, there was a very high erosion rate of 40%.

Biological materials (Tables 14 and 15)

Again there is very little robust evidence for the use of biological grafts in anterior compartment prolapse.

Gandhi et al have recently completed a randomised control trial investigating the use of solvent dehydrated fascia lata (Tutoplast) in recurrent cystocele in 153 women. Failure was defined as prolapse of Stage 2 or more (Aa or Ba more than or equal to -1). At 12 month follow-up there was no difference in recurrence between the women who had the patch (21%) compared with those that did not have a patch (29%). As with many of these studies, most of women had concomitant prolapse procedures and this may have confounded the results.

Other observational studies looking at fascia lata have reported good outcomes but this was dependant on the criteria used to define recurrence. Kobashi used the outcome measure of prolapse more than Grade 1 and reports a failure rate of 1.5% after 12 months. Powell however found objective recurrence (>Grade 1) of 19% versus only 2% subjective

Table 10: Properties of Biological vs Synthetic Graft Materials

	Biological	Synthetic
Tensile strength	+	+++
Antigenicity	+++	+
Tissue remodelling	+++	+
Erosion	+	+++
Cost	++++	++
Consistency of graft strength	+	+++
Availability	-	+++
Infection	+	+++
Stretch	+	+++

recurrence (ie no symptoms of bulge). There was no reported erosion with these grafts which was very encouraging.

More recently, attention has turned to the use of xenograft materials in the anterior compartment. From the observational studies, they appear to have low reported erosion rates but variable recurrence rates. Recurrence rates for porcine dermis grafts (Pelvicol ®, Bard) are between 4 and 19%. The human dermal collagen grafts appear to have poorer outcomes than their porcine counterparts. It is also noteworthy that of none of the 21 women that were sexually active in Clemons' study reported any adverse outcomes. There is one preliminary report of a RCT evaluating the efficacy of Pelvicol® in primary cystocele repair. No significant difference has been detected but follow- up is still only 6 months. The long term results of this and other current studies on the xenografts in the anterior compartment are eagerly awaited.

Mixed evidence to support the use of grafts in women with primary cystocele.

Grafts should not be used to compensate for poor surgical technique.

Prosthetic reinforcement appears to improve short term outcomes in recurrent cystocele.

Expert opinion would support the use of grafts in recurrent cystocele and in primary cystocele at high risk for recurrence.

Summary

Posterior Compartment

Synthetic materials (Table 17)
There has been a justified reluctance to employ prosthetic material in the posterior compartment because of the risk of erosion and concerns regarding dyspareunia. A disturbing increase in dyspareunia in 64% of women after posterior repair using prolene mesh was recently reported by Milani et al. Despite very good anatomical outcomes, the authors feel that the prolene prosthesis should be abandoned.

In another study, de Tayrac et al performed a sacrospinous suspension with insertion of polypropylene mesh in 26 women with rectoceles. Cure was 92% after 22 months of follow up but again this was coupled with a high erosion rate of 12%. One of the 13 sexually active women reported increased dysparunia.

Adhoute et al [52] reported on the outcome of 52 non-consecutive women undergoing trans-vaginal rectocele and or cystocele repair using polypropylene mesh (Gynemesh®). Depending on the circumstances, the operation comprised anterior or posterior mesh implantation, hysterectomy and TVT insertion. After a mean

Table 11:
Anterior compartment grafts
Synthetic materials
Randomised control Trials Polyglactin 910

Study	Prosthesis Type	N	Study Type	Follow-Up	Recurrence	Erosion
Koduri 2000	Polyglactin 910	125	Prospective randomised	12 months	13% no mesh 1% mesh	
Weber [(2001)	Polyglactin 910 (Vicryl)	140	RCT	Mean 23.3 months	70% (no mesh) 58% ultralateral 54% mesh (non significant)	0%
Sand (2001)	Polyglactin 910 (Vicryl)	161	RCT Recurrent 21 Primary 140	12 months	25% (with mesh) 43% (no mesh) p=0.02	0%

Table 12:
Anterior compartment grafts
Synthetic materials
Randomised control Trial Polypropylene

Study	Prosthesis Type	N	Study Type	Follow-Up	Recurrence	Erosion
Julian (1996)	Marlex (Type1 Monofiliament polypropolene)	24	Prospective (recurrent)	24 months	0% (mesh) 34% (no mesh)	25%

follow-up of 27 months, the anatomical success was 100% in those who had rectocele repair and there was no reported erosion.

Other studies of synthetic mesh in the posterior compartment are small [69,70] and one revealed a very high erosion rate.

Recurrence rates following posterior repair using synthetic mesh do appear to be low, however erosion and dysparunia are common and the pelvic surgeon should take this into consideration when choosing to insert a graft in the posterior vaginal compartment.

Biological Materials (See table 18)

The newer xenografts have a much lower tendency to erode and fibrose. There have been a number of recent promising reports on their use in rectocele repair. Kohli and Miklos in 2003, described rectocele repair in 43 women using a dermal allograft to augment site-specific fascial repair. [72] No major complications were reported. Thirty-three women were available for follow-up (mean 12.9 months) with a 93% surgical cure rate defined by POP-Q evaluation. Moore also reports favorable cure and low erosion rates in a study looking at 195 women who received either a porcine or human dermis graft during a posterior repair. [73] A further case series of 188 women, by Chaudhry et al [74], employed a human dermal allograft (AlloDerm®) for posterior repair. They showed some very promising results after 18 months of follow up. There was a 5% recurrence and a 0.5% erosion rate.

Most recently Altman et al assessed quality of life and anatomical outcomes following posterior repair using a collagen allograft. There were significant improvements in several variables associated with quality of life and no change in sexual function or dypareunia rates. The anatomical outcomes were however unsatisfactory.

The biological grafts appear to have significantly lower rates of erosion and dysparunia than polypropylene mesh when used in the posterior compartment. However anatomical efficacy remains to be validated.

Apical Prolapse

Abdominal or laparoscopic sacrocolpopexy appears to be the procedure of choice for vault prolapse. It restores the normal vaginal axis whilst maintaining vaginal capacity and coital function. It has the lowest recurrence rate. A number of prosthetic materials have been used for this technique. Success rates range from 73-100% at a follow-up interval of 1-136 months (Table5) [31-33]. Because the mesh is being inserted abdominally, the risk of infection is significantly lower compared to the vaginal route. The majority of the studies reported in the literature involve the use of synthetic prostheses, with mesh or suture complications occurring in 0-12%. Erosion rates vary depending on the type of synthetic material used with the lowest seen with Polypropylenes and the highest with Goretex. In a review of 592 operations, Iglesia reports an overall revision and removal rate of 2.7%. Sacral osteomyelitis and bladder erosion were rare complications. The procedure involves the placement of numerous sutures around the vaginal vault and this may predispose to tissue ischemia and resultant prosthetic erosion.

There have been several small observational studies on laparoscopic sacrocolpopexy showing short-term outcomes and mesh complication rates comparable to the abdominal approach.

Due to the low erosion rates and extensive experience with the synthetic materials, the biological grafts have not been widely employed in abdominal sacrocolpopexy. In addition there are concerns regarding the longevity of the biological grafts. Fitzgerald in 1999 reported on a series of 67 women who underwent sacrocolpopexy using donor cadaveric fascia

Table13:
Anterior compartment grafts
Synthetic materials
Non Randomised Trials Polypropylene

Study	Prosthesis Type	N	Study Type	Follow-Up	Recurrence	Erosion
Adhoute 2004	Gynemesh	52 + hyste (28%) entero (9.5%) recto (28%)	Case series	27	5% cysto 0% recto	3.8% cysto
Flood (1998)	Marlex (Type1 Monofiliament polypropylene) Tension free	142	Retrospective (primary)	36 months	0%	2.1%
Natale (2000)	Polypropylene (Tension free)	138	recurrent	18 months	2.2%	-
Bader (2004)	Tension-free monofilament polypropylene mesh	40	Observational	16.4	-	7.5%
Yan (2004)	Synthetic mesh secured through obturator foramina	30	Observational	6.7 (2-12)	3%	7%
Korushnov (2004)	Polypropylene	45	RCT	<12 months	Not significant (trend towards better cure with mesh	14%
Dwyer 2004	Polypropylene (Atrium)	64	Retrospective review	6-52 mean 29	6%	Not stated but 9% for total cohort
de Tayrac 2005	Polypropylene	87 84 follow-up	Case Series	9-43 mean 24	8.4%	8.3%
Eglin 2003	Polypropylene Transobturator subvesical mesh	103	Case series	18	3%	5%

lata. Recurrent vault prolapse was recognised in 8% of women at a follow-up interval of 6-11 months. Absence or attenuation of the prosthesis was observed in the 7 patients requiring re-operation. This clearly questions the use of this allograft for use in sacrocolpopexy. Culligan et al, used an acellular human dermal graft for ASC in 32 patients with follow-up of 1 year. In contrast they report no post-operative complications and acceptable outcomes with this newer generation allograft.

Overview on complications when using mesh in POP surgery

There remains very little Grade 1 evidence for the use of mesh and grafts in POP surgery and more data is emerging regarding the complications. Sexual function is often not reported in the literature and those studies that do look at this aspect of vaginal function, usually confine it to a number of short sentences with very little questionnaire-based data. There are, however, concerning reports on a rise in dyspareunia following repair with synthetic mesh. Milani et al report a 63% increase in the number of women reporting dyspareunia following posterior repair and 20% increase following anterior repair. In a further study reporting on the use of polypropylene, Salvatore et al describe an increase in dyspareunia from 18 to 78%. Zhongguo et al also report a 64% incidence of dyspareunia following transobturator polypropyle mesh insertion.

Role of the Mesh Kits

Pelvic organ prolapse is often associated with a global weakness of support structures and in order to replace this tissue, the new mesh kits have been developed. Three companies have launched these devices and they are all available in South Africa. They consist of an anterior and posterior system. The anterior system consists of a central mesh portion and two lateral arms on each side that are placed through the obturator foramina. The posterior kit has a central mesh portion with bilateral arms that go through the buttock, traverse the ischiorectal fossa and enter the pelvis via the illiococcygeus muscle or sacrospinous ligament. The first of these devices to be launched was the Prolift System, marketed by Johnson and Johnson. American Medical Systems, AMS, have developed an anterior mesh system

Table 14:
Anterior compartment grafts
Biological grafts
Fascia lata grafts

Study	Prosthesis Type	N	Study Type	Follow-Up	Recurrence	Erosion
Kobashi (2000)	Cadavaric Fascia lata	132	Observational study	12.4 (6-28)	1.5% (cystocelee) 9.8% (apical)	0%
Groutz	Solvent-dehydrated cadaveric fascia	21	Observational	20.1	0%	0%
Powell 2004	Fascia lata	58	Case Series	24.7 12-57	Objective 19% subjective 2% Cystocele 4% enteroceles 12% symptomatic rectoceles	Not mentioned
Gandhi 2005	Solvent dehydrated fascia lata	162 76 patch 78 no patch	RCT	12	21% patch 29% no patch NS	0%

called Perigee and a Posterior Apogee system. Bard have also developed a system called the Avaulta. The Posterior Avaulta has two arms on either side. The superior arm is inserted in a similar fashion to the Posterior prolift and Apogee but in addition, it also has two inferior perineal arms. The Avaulta Solo is polypropylene, similar to the J&J and AMS product but the Avaulta Plus is a polypropylene coated with porcine collagen.

These products would appear to be a revolutionary step to improving outcomes in POP surgery. They have, however, been implemented with very little data to support their use. At the time of writing, there were six studies on the Gynecare Prolift system. (See table) The maximum follow up time in these studies was seven months. Failure rates ranged from 4-12%.

Table 15:
Anterior compartment grafts
Biological grafts
Human and porcine dermal grafts

Study	Erosion	N	Study Type	Follow-Up	Recurrence	Erosion
Salomon	Porcine skin collagen implant	27	Observational	14 (8-24)	19%	
Gomelsky 2004	Porcine dermis grafts	70 65 sling 50 BIF	Retrospective chart review	24	Grade 2 – 8.6% Grade 3 –4.3%	1 Superficial vaginal wound separation conservative Mx
Clemons	Acellular dermal matrix (Alloderm)	33	Observational study 6 recurrent II 24 prim + Recur III 3 Grade IV	18	41 % objective 3% subjective	64% sexually active - no problems no erosion
Oestergard 2004	Pelvicol (Porcine Dermis)	31	Observational Cystocele >Gr 2	6	13% (Grade 2)	Not mentioned
Arya 2004	Porcine dermal vs cadaveric dermal graft	Porcine 72 Cadaveric 45	Retrospective repeated measures study	Cadaveric 22 (19-28) porcine 18 (7-22)	Cadaveric 69% Porcine 4%	None
Meschia 2004	Pelvicol		RCT primary cystocele	6.5 months	Optimal Ba 73% vs 65% P0.86	5 % defective healing

The AMS product features in two publications with varying failure rates from 7-13%.

These devices are associated with major complications including bladder and bowel injury. There is no data on sexual function pre or post surgery and this fact should deter any wise and prudent surgeon from using these products in a sexually active patient. These devices should only be inserted by a skilled pelvic floor surgeon who has selected the case appropriately.

Table 16:

Anterior compartment grafts
Synthetic materials
Randomised control Trial Polypropylene vs Acellular dermal collagen

Study	Prosthesis Type	N	Study Type	Follow-Up	Anatomical Failure	Symtomatic Failure	Erosion
Cervigni	Pelvicol® vs Prolene soft®	72	RCT	8.8 (Pelvicol) 8.1 (Prolene soft)	68% Pelvicol 58% Prolene soft	2.8% Pelvicol 8% Prolene soft	2.7% Pelvicol 8.3% Prolene soft

Table 17:

Posterior Prolapse
Synthetics

Study	Prosthesis Type	N	Study Type	Follow-Up	Recurrence	Erosion
Adhoute	Gynemesh	52	Observational	Mean 27 months	Cystocele 5% Rectocele 0%	3.8% (cystocele)
Stanton	Mersilene	29	Observational	14	0% of stage II and III	3%
De Tayrac**	Gynemesh	26	Observatioinal	22.7	8%	12%

Table 18:
Posterior prolapse
Biological Materials

Study	Prosthesis Type	N	Study Type	Follow-Up	Recurrence	Erosion
Kohli and Miklos (2003)	Dermal allograft	43	Prospective descriptive	12.9 months	7% follow-up in 33 (on POP-Q)	
Moore 2004	Porcine dermal graft vs Human dermal graft	195 porcine 100 human 95	Retrospective chart review	Porcine 14.2 Human 20.9	Porcine 1% Human 9.6%	no
Chaudhry 2004	Alloderm	188	Case series	18 3-32	5%	0.5% erosion 0.5 % abcess
Altman 2005	Collagen allograft	33	Prospective case series	12	39% objective Significant improvement in QOL scores	none

Table 19: Abdominal sacrocolpopexy – operative outcome and peri-operative morbidity.

Author	N	Prosthesis	Follow up (months)	Success	Complications
Rust [1975]	12	Mersilene	9-42	100%	Nil
Symonds[1981]	17	Teflon	60-360	88%	Nil
Addison[1985]	56	Mersilene	6-126	89%	Nil
Timmons	163	Mersilene	9m – 18 years	99%	Nil
Drutz[1987]	15	Marlex	3-93	93%	1 sepsis mesh removal
Baker[1990]	59	Prolene	1-45	86%	Nil
Snyder[1991]	147	78 Gore -Tex 65 Dacron	60	73%	4 mesh erosions
Creighton[1991]	23	Mersilene	3-91	91%	2 sinuses removal mesh
Van Lindert[1993]	61	Gore-Tex	15-48	?	1 erosion and fistula
Valaitis[1994]	43	Teflon	3-91	91%	1 sepsis removal mesh
Khohli[1998]	57	47 Marlex 10 Mersilene	2-50	100%	5 mesh erosions 2 suture erosions
Fitzgerald[1999]	67	Fascia lata	12	91%	6 fascial breakdown
Fox[2000]	29	Teflon	6-32	100%	1 sepsis removal mesh
Winters[2000]	20	Marlex	6-27	100%	Nil
Visco[2001]	273	269 Mersilene 4 Gore-Tex	1-87	?	15 erosions
Culligan 2001	32	Acellular human dermal graft	12	satisfactory	nil
Rocha 2003	32	Abdominal Fascia	12	97%	3 % Dysparunia
Lindeque 2002	262	Dura mater (18) Goretex (244)	16	98.9%	3.8%

Table 20: Results of Prolift

Study	N	Follow-Up	Recurrence	Ero-sion	Other Complications
Fatton	110	3 months	4.7%	4.7%	Bladder injury 1 Haematomas 2
Dalenz	41	7 months	Vault 5% Cystocele 2%	2%	Perirectal haematoma 1 Erosion 1
Altman	123	2 months	Anterior 13% Posterior 9% Total 12%		Pelvic organ perforation 3.2% Bladder injury 1 Rectal injury 1
Neumann	100	Not stated	1%	3%	Bladder injury 1
Lucioni	12	7 months	8% Enterocele		0
Abdel-fatteh	289	Not Stated	5%		

Table 21: Results of Apogee/perigee

Study	N	Follow-Up	Recurrence	Erosion	Other Complications
Garuder-Burmester	110 I6 vault	I3 m	7% of anterior No vault	3%	None
Shek	46		13%		

Chapter 21

Management of Third and Fourth degree tears

Stephen Jeffery

Obstetric anal sphincter injuries (OASI) are unfortunately a common event associated with vaginal delivery. If these third and fourth degree tears are not recognised and managed appropriately, these women are at high risk for developing a number of significant long-term complications including faecal incontinence, perineal pain and dyspareunia.

Incidence

The incidence of OASI varies. 40 000 women in the UK develop faecal incontinence related to sphincter injuries in the first year after birth. The RCOG guideline reports an incidence ranging from 0.6-9%, depending not only on obstetric practice but also on the vigilance exercised in their detection. A large number of OASI are not clinically apparent but are demonstrated at ultrasound either immediately post-partum or at follow up. These so-called occult sphincter injuries have been shown to occur in up to 35% of primiparous women.

Importance

Anal spincter tears are associated with significant morbidity. Failure to recognise and repair an anal sphincter injury is one of the top four reasons for complaint and litigation arising in labour ward practice in the UK. The sequelae of OASI affect women not only physically but psychologically as well. Johanson et al report that only one third of women suffering with faecal incontinence sought help.

Risk factors

A large amount of work has been done in an attempt to more clearly define risk factors for developing an OASI. Hudelist et al looked at 5044 women delivering vaginally. They report that 4.2% of these patients developed a sphincter defect. Risk factors emerging included low parity, prolonged first and second stage, high birth weight, episiotomy and forceps delivery. They analysed the same data, applying multivariate logistic progression analysis and only high birth weight and forceps delivery emerged as risk factors. Dandolu et al later defined this risk using odds ratios, reporting the risk associated with forceps to be OR 3.84 and for vacuum delivery 2.58. Occiptoposterior postion also appears to be associated with sphincter injury, with Wu et al reporting a fourfold increase compared to occipitoanterior positions. The relationship between episiotomy and sphincter injury remains unclear. Overall, 50% of third degree tears are associated with episiotomy and midline episiotomy is 50 times more likely to result in third degree tear. The greater the angle the episiotomy makes with the vertical, the smaller the risk of sphincter injury.

Recognition and diagnosis

All women following vaginal delivery must be thoroughly examined with a systematic inspection of the vulva, vagina and perineum. If any injuries are detected a rectal examination must always be performed. If the patient has had a instrumental delivery or if a large episiotomy was performed, she should be examined by an someone who is experienced in the diagnosis of sphincter injury. If in doubt, it is useful to ask the women to contract her anal sphincter while performing gentle PR examination and any loss of tone will suggest and underlying sphincter defect. Another useful manoeuvre is to "pill-roll" the sphincter with the forefinger in the rectum and the thumb in the vagina. This will enable the clinician to detect any loss of sphincter bulk – again suggesting an underlying third or fourth degree tear. If there is still a significant amount of uncertainty, it would be prudent to perform the repair under anaesthesia.

Classification of injuries

The nomenclature of OASI has been dogged with inconsistency for many years. Sultan and Thakar looked at every Obstetric Text in the RCOG library and17% of the books made no mention of a classification for OASI and of those that did, 22% classified a sphincter injury as a second degree tear. Recently consensus has been achieved and internationally OASI are now classified into four grades. The standardization of sphincteric injury has made it easier to compare data on outcomes and repair techniques.

The anal sphincter comprises:

External Anal Sphincter Sphincter (EAS)
- Subcutaneous
- Superficial
- Deep

Internal Anal Sphincter (IAS)
- Thickened continuation of circular smooth muscle of bowel

The classification of tears is as follows:

First degree: laceration of the vaginal epithelium or perineal skin only.

Second degree: involvement of the vaginal epithelium, perineal skin, perineal muscles and fascia but not the anal sphincter.

Third degree: disruption of the vaginal epithelium, perineal skin, perineal body and anal sphincter muscles. This should be further subdivided into:
3a: partial tear of the external sphincter involving less than 50% thickness.
3b: complete tear of the external sphincter.
3c: internal sphincter torn as well.

Fourth degree: a third degree tear with disruption of the anal epithelium.

Rectal mucosal tear (buttonhole) without involvement of the anal sphincter is rare and not included in the above classification.

Repair of Third and Fourth degree tears

General Principles

All third and fourth degree tear repairs should be done in an operating theatre. This recommendation is made for a number of reasons. Firstly, in theatre one has access to proper anaesthesia. A general or spinal anaesthetic makes it much easier to inspect the tissues and to adequately visualise the tear. The sphincter is usually more relaxed which makes it easier to retrieve if the ends are retracted. In theatre it is possible to position the patient in a more appropriate way. The surgeon also has access to better lighting and proper instrumentation and often it is easier to get an assistant if the procedure is being performed in theatre.

Inexperience of the operator significantly increases morbidity and may also predispose to litigation.

Overlap or end to – end repair of the Sphincter.

Repair of the sphincter following an acute obstetric injury has undergone a significant change over the past decade. Traditionally, the repair was done by an end-to-end approximation of the torn sphincter. The outcomes following acute repair of sphincter injuries are poor with some studies reporting faecal incontinence rates of up to 37%. (range 15-59%). Many women later require secondary repair of the sphincter. This is usually done by a colo-rectal surgeon and an overlapping technique is employed in the majority of cases. The reported success rates with an overlapping technique are better, with continence outcomes between 74 and 100%. For this reason, Monga and Sultan performed the first pilot study on an overlapping technique for acute OASI. In this trial, using matched controls, they report significantly improved outcomes with incontinence rates being reduced from 41% to 8%. In addition to recommending an overlap technique, Monga and Sultan also performed a separate repair of the internal anal sphincter and this may also profoundly impact on outcomes. A number of RCT's comparing end-to-end and overlap repair have been performed. In a trial by Fernando et al 24% of women who had an end-to-end repair reported faecal incontinence compared to no cases of incontinence in the overlap group. A vastly underreported complication of OASI is long term perineal pain. In the Fernando trial, 20% of the women who had an end-to-end repair reported this troublesome symptom compared to none in the overlap group. A recent cochrane systematic review addressed the issue of overlap versus end-to-end repair of OASI in 279 women. They report a statistically significant lower incidence in faecal urgency and lower anal incontinence score in the overlap group. The overlap technique was also associated with a statistically significant lower risk of deterioration of anal incontinence symptoms over one year.

Specifics of repair

The anal mucosa is repaired with

interrupted vicryl 3-0 sutures with the knots tied in the lumen. The torn muscle, including the internal and external sphincter, should always be repaired with a monofilamentous delayed absorbable suture such as PDS or Maxon 3/0. The internal anal sphincter should first be identified and then repaired using an interrupted suture. It is not possible or necessary to overlap the IAS and it is adequate to suture this muscle using an end-to-end technique. It is often difficult to identify the IAS, but usually it is paler in colour than the external sphincter.

If it is a Grade 3A tear, ie less than 50% of the EAS is torn, the muscle is repaired using and end-to end technique. If it is a 3B, an overlap technique is probably better and this is done as follows: The ends of the torn muscle are identified and clamped using Allis forceps. A double breasted technique is used to approximate these ends. It is important to identify the full length of the sphincter and this can stretch for up to 4-5cm. Whether an end-to-end or overlap technique is used, between three and four sutures are inserted and these are tied following insertion of all the sutures.

After the sphincter has been repaired, the vaginal skin is closed much like one would close an episiotomy, making every effort to reconstruct the perineal body.

Every woman should be given antibiotics and stool softeners following the repair.
Women sustaining third and fourth degree tears should always be offered a follow up appointment to assess them for faecal incontinence, perineal pain and dyspareunia.

Management of Urogenital Fistulae

Suren Ramphal

Urogenital fistulae typically involve a communication between the genital tract (vagina, cervix, uterus) and the urinary tract (ureter, bladder, urethra). They are described by their anatomical location (Table: I) and can be classified according to organ involvement, i.e simple fistulae (which involves 2 organs) or complex fistulae (involving 3 or more organs) (Table: II). The majority of urogenital fistulae occur between the vagina and the bladder (vesicovaginal) with urethrovaginal and ureterovaginal occurring less frequently. Communication between the lower urinary tract and the uterus or cervix are rare (Figure: 1)

The aetiologies of urogenital fistulae are shown in Table III.

Aetiology And Pathophysiology

In well resourced settings, urogenital fistulae occur as a consequence of surgery, most commonly following abdominal hysterectomy and more recently after laparoscopic hysterectomy. In most series, gynaecological surgery is responsible for 70-80% of urogenital fistulae with the remainder following urological, vascular and colorectal procedures. In a study of 303 women with urogenital fistulae from the Mayo Clinic, 82% of cases were caused by gynaecological surgery, followed by obstetric related fistulae in 8%, 6% related to pelvic radiation and 4% following trauma.

Most vesicovaginal fistulae (VVF) follow abdominal hysterectomy for benign conditions such as uterine fibroids, endometriosis or pelvic adhesions, with only a few occurring after vaginal hysterectomy. High risk intra-operative scenarios for fistula formation include excessive bleeding at the angles of the vault, pelvic adhesions, a previous caesarean section leading to difficulty in separating the bladder peritoneum from the uterus, and surgery for pelvic malignancies.

Fistula formation is postulated to result from unrecognized direct injury to the bladder or ureter, devascularization of tissue leading to ischaemia and avascular necrosis, and inadvertent suture placement between the bladder and vaginal cuff leading to erosions. Uncommon causes for urogenital fistulae include vaginal foreign bodies, trauma or a bladder calculus.   Radiation induced fistulae , especially radiotherapy for cancer of the cervix, may develop as a result of progressive endarteritis obliterans leading to tissue fibrosis and necrosis. Most radiation associated VVF develop 6 months after completion of therapy. There are reports of cases presenting many as five years after therapy.   It is imperative to investigate these women for a possible recurrence of the malignancy. Closure of the fistulae in these cases is particularly technically difficult and urinary diversion is the procedure for these patients, despite the guarded results of this operation. Fortunately, recent advances in radiation therapy have significantly decreased the occurrence of fistulae.

TABLE I: Urogenital Genital fistulae classified by anatomical location

Vesicovaginal
Vesicouterine
Ureterovaginal
Ureterourerine
Urethrovaginal

Ureterovaginal fistulae occur most commonly with laparoscopic or abdominal hysterectomy, usually when removing the adnexae. The pelvic portion of the ureter is most susceptible to injury at a number of places including the infundibulo-pelvic ligament when the ovarian blood supply is ligated, at the cardinal ligament, as the ureter passes beneath the uterine vessels and at upper vagina as the ureter crosses to enter the bladder base. The mechanism for ureterovaginal fistula formation is similar to that of VVF - unrecognized surgical

TABLE II: Classification according to organ involvement

Simple Fistulae
Vesicovaginal
Vesicouterine
Ureterovaginal
Ureterourerine
Urethrovaginal
Complex Fistulae
Uretero-vesico-vaginal
Uretero-vesico-uterine
Vesico-vagino-rectal

TABLE III: The Aetiology of Urogenital Fistulae

Surgery
Obstetrical
Trauma
Malignancy
Radiation
Infection
Foreign body

injury or ligation and tissue necrosis following ischaemia or inflammation.

Urethrovaginal fistulae may occur following surgery for urethral diverticulae, anterior vaginal prolapse, stress urinary incontinence and more rarely, radiation therapy.

In under-resourced countries, obstetrics is the leading cause of genitourinary fistulae usually as a result of prolonged obstructed labour causing ischaemic necrosis. The exact prevalence is unknown but they are particularly common in Africa and South Asia. The level at which the fetal head becomes impacted during labour determines the site of injury and type of fistula. For example, if the impaction occurs at the level of the pelvic inlet, the VVF may be intracervical, if the impaction occurs at a lower level, the urethra will most likely be involved. The urethra is involved in 28% of cases of obstetric related fistula with total urethral destruction in 5% of patients. Vesico-uterine fistulae contributed to 10.5% (4/42) of cases in a review of 42 patients with obstetric fistulae in Durban.

Symptoms

Symptoms of fistulae vary depending on the aetiology. A women who presents with fluid leaking from her vagina following pelvic surgery, should be suspected to have a fistula unless proven otherwise. Classically, patients complain of a continuous or intermittent watery vaginal discharge that smells like urine. Vesicovaginal and ureterovaginal fistulae may present in the first few days postoperatively. Fistulae that occur as a result of tissue ischaemia, infection, devascularization and necrosis typically present later between day 5 and 21. In these women, a foul smelling or persistent vaginal discharge often precedes the urine leakage. Febrile episodes are not common with uncomplicated VVF.

Ureterovaginal fistulae are also not infrequently associated with febrile episodes. If there is extravasation of urine into the abdominal cavity, patients may present with anorexia, nausea, vomiting, increasing abdominal pain, abdominal distension and postoperative ileus. Flank pain should alert the physician not only to a possible ureterovaginal fistula, but also to ascending infection complicating the urinary tract injury.

As a general rule, women who later develop an uncomplicated VVF, recover uneventfully from the initial surgery, the only complaint being a clear watery discharge that smells like urine. The amount of urine leakage varies depending on the size and location of the VVF, but most have continuous leakage independent of the body posture. On the other hand, patients with ureterovaginal fistula have intermittent but more profuse episodes of urinary leakage.

Women who develop obstetric fistulae, usually present with urinary leakage approximately one week following delivery (range day 5-21). There is usually a history of a prolonged and difficult labour resulting in a stillbirth. Unlike iatrogenic surgical fistulae which are characterised by a discrete injury, the pathophysiological effects of obstructed labour are wider and can result in a broad range of injuries including neurapraxia, lower bowel dysfunction, muscle injury and even rectovaginal fistula. The term “field injuries” has been coined to refer to this range of damage.

Examination

Patients with urogenital fistulae may be relatively well but often they will present with signs and symptoms of acute illness. Fever, anorexia, nausea, and vomiting are suggestive of acute sepsis and peritonitis, and require prompt admission and investigation. If the patient is not ill, evaluation and diagnostic investigation as an outpatient is acceptable. Other important findings include costovertebral angle tenderness, associated with ureteric injuries or infection of the upper urinary tract; and abdominal tenderness which is suggestive of an intraperitoneal urine collection or sepsis.

The pathognomonic finding is the observation of urine leaking into the vagina on speculum examination. The use of a Sims speculum with downward pressure on the posterior wall facilitates examination of the anterior vagina and apex. The majority of fistulae following abdominal hysterectomy are located near the vaginal apex and it is therefore difficult to determine clinically whether the origin of the leakage is the bladder or ureter. Following pelvic examination, the bladder should be always catheterized and a urine sample sent for microscopy and culture. The bladder is then filled with methylene blue and the diagnosis confirmed by observing the leakage of dye-stained urine into the vagina. If a ureteric fistula is suspected, the patient should ingest 200mg oral phenazopyridine (pyridium) 3 hours before examination. A tampon is then placed in the vagina and again methylene blue is instilled into the bladder via the catheter. If the tampon turns orange, a vesicouretric fistula is diagnosed. If the tampon turns both blue and orange, then a combined VVF and vesicouterine fistula should be suspected.

Investigations

The aims of the investigations are as follows:-

1. To confirm the discharge is urine
2. To establish that the leakage is extraurethral rather than urethral
3. To locate the site of leakage
4. To diagnose multiple fistulae

Biochemistry and microbiology

Initial laboratory investigations for urogenital fistula include:-

1. Urine for culture and microscopy to rule out infection
2. FBC – to assess the haemoglobin and white cell count (infection)
3. Urea and electrolyte – assess urea and creatinine level which may be elevated with ureteric

injuries
4. If the vaginal discharge is suspicious of urine, then it can be analysed for its urea and creatinine content. If the urea and creatinine level of the discharge is greater than the serum values, it is highly suggestive that the discharge is urine

Imaging

Cystography is not very helpful if a clinical diagnosis of a VVF has been made. It will, however, confirm a suspected vesicouavaginal, vesicouterine or complex fistula. It is good practice to image the upper urinary tract in all patients with VVF. An intravenous urography (IVU) is usually done to exclude a ureterovaginal fistula and ureteric obstruction. When the ureter is involved at the margins of a VVF, an IVU will demonstrate a standing coloumn of contrast within the ureter, extravasation of contrast around the distal ureter or gross hydronephrosis. With suspected ureterovaginal fistula, the diagnosis is confirmed by a dilatated ureter with extravasation of dye at the distal end and a normal cystogram. If the IVU findings are equivocal, contrast enhanced CT of the pelvis will aid in the diagnosis of vesicouterine fistula.

Retrograde pyelography is a reliable way to identify the exact site of a ureterovaginal fistula. Positive pressure urethrography may be needed to diagnose urethrovaginal fistulae, especially those following the insertion of midurethral tapes.

Examination Under Anaesthesia And Cystoscopy

Careful examination under anaesthesia and cystoscopy is required to determine the following:-
1. The site of the fistula and the proximity of the fistula to the ureteric orifii and bladder neck
2. To exclude intravesical sutures or other foreign bodies (stones)
3. To assess the bladder mucosa. In under-resourced countries schistosomiasis and tuberculosis should be excluded
4. To assess the mobility of the vaginal tissue and confirm surgical access if planning vaginal repair

5. To inspect the fistula margins and consider biopsy if one suspects a malignancy or infection (schistosomiasis, tuberculosis)
6. To assess whether graft tissue will be required for definitive surgery. With bladder neck and proximal urethral fistulae, there may be circumferential loss of the urethral sphincter mechanism. Usage of a Martius graft at definitive surgery will have beneficial effects with regard to assisting in urethral continence.

At cystoscopy, it may be necessary to digitally occlude the fistula to achieve distension. If the tissues are necrotic or there is substantial slough or induration, then definitive surgery should be delayed.

Preoperative Management

Patients should always be well informed, especially during the waiting period from fistula diagnosis to repair. The carers should always be sympathetic to these women's needs which should always include offering them incontinence pads, to prevent soiling of their clothes and to enable them to function socially. Silicone barrier creams should be applied to their vulval skin and perineum to protect them from urinary dermatitis. The preoperative use of oestrogen vaginal cream is recommended in postmenopausal women. These creams change the vaginal flora to aerobic bacteria thus improving the integrity of the vaginal wall and promoting vaginal healing. Counselling is pivitol in the management of these patients. It is important to remember that many of these women are healthy individuals who entered hospital for a routine procedure and by developing a fistula have ended up with worse symptoms than their original complaints.

Surgical Management

Timing Of Repair

The timing of the fistula repair is a controversial issue. Surgical success should not be compromised by operating too early. Advances in antibiotic therapy, suture material and surgical techniques have encouraged many surgeons to attempt early surgical repair which if successful avoids the prolonged morbidity and discomfort of delayed repair. Several published series support early attempts at repair. If surgical injury is recognized within the first 24 hours postoperatively, immediate repair can be attempted, provided the injury site is not too oedematous and extravasation of urine into the tissues has not been too extensive.

Small VVF discovered within 7 days of surgical injury can be treated with continuous bladder drainage to facilitate spontaneous closure. Although the optimal duration of drainage has not been established, it is reasonable to allow drainage for at least 4 weeks. If closure is not achieved, then a concomitant ureterovaginal fistula should be excluded and surgery planned 12 weeks later.

With larger fistulae, definitive repair should be planned at 3 months. This period will allow for the oedema and inflammation to resolve and improve the likelihood of a successful repair.

With obstetric related fistulae, most surgeons suggest waiting a minimum of 3 to 4 months to allow the slough to separate and the induration to settle, before embarking on definitive surgery. During this period, any evidence of cellulitis should be vigorously treated and the patient should maintain optimal nutrition and fluid intake to encourage healing. Recently, Waaldijk has advocated surgery as soon as the slough separates, but more studies are needed to justify this approach.12

With previous surgical failures, it is prudent to wait at least 12 weeks before re-attempting to repair the fistula. Surgery for urogenital fistula should only be undertaken by surgeons with appropriate training and skills since the first attempt will give you the best results.

Route Of Repair

Surgeons involved in fistula management should be skilled in both the abdominal and vaginal approach and should have the surgical expertise and versatility to modify their technique based on the individual case. When access is good and the vaginal tissue sufficiently mobile, the vaginal route is the preferred option (less invasive, less morbidity than abdominal approach). The abdominal route is favoured if the vaginal access is poor, the fistula is close to the apex , and the ureter is in close proximity to the fistula edge (anticipate ureteric reimplantation.) As a general rule, most surgical fistula arising from abdominal surgery require an abdominal approach, perhaps with the help of a skilled urologist.

Instruments And Sutures:-

Instruments that make your surgery easier include:

1. Fine scalpel blade on a number 7 holder
2. Potts-De Martel scissors and a Chasser Moir 30 degree angle-on-flat scissors
3. Lone star ring retractor for vaginal approach
4. Skin hooks to put the tissue on torsion during dissection
5. Turner – Warwick double curved needle holder

Absorbable sutures, including polyglactin (vicryl) 2-0 sutures on a 25 mm heavy taper cut needle are preferred for the vagina and a 2-0 vicryl suture on a round body for the bladder. For ureteric implants, a 4-0 polydiaxonone (PDS) on a 13 mm round bodied needle is the suture of choice.

Dissection

Great care must be taken over the initial dissection. The fistula should be circumscribed in the most convenient orientation. A longitudinal incision should be made around the urethral or midvaginal fistula while vault fistulas are better managed by a transverse elliptical incision. Because of the scarring, dissection close to the fistula is usually undertaken with a scalpel or Potts-De Matel scissors. It must be appreciated that the actual defect in the bladder may be larger than the visible defect because of the scarring and fibrosis. Wide mobilization of the bladder should be performed so that the repair is tension free. Caution should be exercised to avoid excessive bleeding and this is achieved by dissecting in the correct plane.

Principles Of Fistula Repair

1. Excision of all scar tissue around the fistula tract
2. Wide mobilization of the bladder
3. Tension free layered closure
4. Interposing tissue between the 2 organs
5. Obtaining a water tight tension free closure
6. Good haemostasis
7. Complete bladder drainage postoperatively
8. Prophylactic antibiotics

Vaginal Repair

1. Circumferential incision is

made around fistula using a size 12 blade. Initial incision can be aided by inserting a foleys catheter through the fistula, inflating the bulb and by exerting traction on the catheter. It allows for access to the fistula.
2. Sharp dissection around the fistula edges.
3. The bladder is separated from the vaginal wall and fully mobilised. Potts-De Matel scissors are used for the dissection.
4. The fistula edges are trimmed.
5. The bladder is sutured transversely. The first 2 sutures are inserted at the angles using vicryl 2-0. Additional sutures are inserted towards the centre from both angles with interrupted closure. The sutures are usually placed 3 mm apart (less interference with vascular supply as compared to continuous suturing).
6. Avoid penetration of the bladder mucosa during suture insertion and ensure that the knots are secure and cut short.
7. The second layer of sutures should invert the first layer. This is also done with interrupted suturing.
8. Confirm a water tight seal by instilling methylene blue dye into the foley catheter.
9. Close the vaginal epithelium with interrupted suturing along the vertical plane to avoid overlapping of the suture repair between the bladder and vagina.

Abdominal Approach

This can either be transvesical or transperitoneal.

Transvesical

This approach is extraperitoneal. The cave of Retzius is entered and a vertical incision on the dome of the bladder is made. The fistula is identified and the ureters are stented. A vaginal probe is inserted into the vagina and the fistula site is elevated. The fistula tract is circumscribed and the bladder is mobilised with the Potts De-Matel scissors. The vagina (VVF) or uterus (vesicouterine) is sutured with interrupted vicryl through the bladder and the bladder is then sutured at 90 degrees (interrupted vicryl) so that the repair sites do not overlap. The initial bladder cystotomy is then repaired with continuous vicryl. A disadvantage of this route is that no interposition graft can be used.

Transperitoneal

With this approach, the peritoneal

cavity is entered.

Indications are:-

1. complex fistulae
2. if the surgeon anticipates that a ureteric implant may need to be performed (because of close proximity of the fistula site to the ureter)
3. large/high fistula where there is poor vaginal access

With this approach, the cave of Retzius is entered. A midline split of the dome of the bladder is performed and extended to the fistula site resulting in a racquet shaped incision. The bladder is mobilised and the fistulous tract excised. Layered closure is then performed, first closing the vaginal epithelium and then the bladder.

Interposition Grafts

At times, fistula repair may require additional tissue to provide support, bring in new blood supply to the area and to fill dead space.

With the vaginal approach, one can use either a Martius graft or the Gracillus Muscle Graft. With the Martius graft, the labial fat pad is passed subcutaneously to cover the vaginal repair. This is particularly useful in bladder neck urethral fistula repair to provide bulk to maintain competence of the closure mechanism.

With the abdominal approach, an omental pedicle graft may be utilised to improve success. It is created by dissecting the omentum from the greater curve of the stomach and rotating it down into the pelvis on the gastro-epiploic artery. It is then secured to the repair site.

Postoperative Management

As a general principle, the best postoperative cure is a good intraoperative surgery. Furthermore, nursing care is critical during this period as poor nursing care can undermine what has been achieved by the surgical team. Important principles are as follows:-

1. Good fluid intake (approximately 3 litres/24 hours) and strict input and output.
2. Good bladder drainage. Free drainage is critical as bladder clots may obstruct the outflow resulting in distension of the bladder and disruption of the repair site.
3. The ideal is to have both a suprapubic and urethral catheter with abdominal approaches and a urethral 3 way catheter with

the vaginal approach. Following surgery, continuous bladder irrigation is instituted. Once the urine clears out with the 3 way foleys, a spigot is used to occlude the irrigation channel and the catheter is left in situ. With the Abdominal approach, the suprapubic is removed and the foleys is strapped to the inner thigh to avoid kinking or dragging of the catheter.

4. Prophylactic urinary antiseptic viz nitrofurantoin 100mg nocte is used as long as the patient has the catheter in situ.
5. Occasionally stool softeners are prescribed if the patient is constipated.
6. Patients are advised to be on bed rest during the period of catheterization and educated on catheter care.
7. With surgical fistula, 14 days of free drainage is recommended while with obstetric fistula, 25 days is recommended.

On removal of the catheter, patients are counselled that they should void more frequently initially and gradually increase the periods between voids aiming to be back to normal by 4 weeks postoperatively. Tampons, douching and penetrating sex must be avoided for at least 3 months postsurgery.

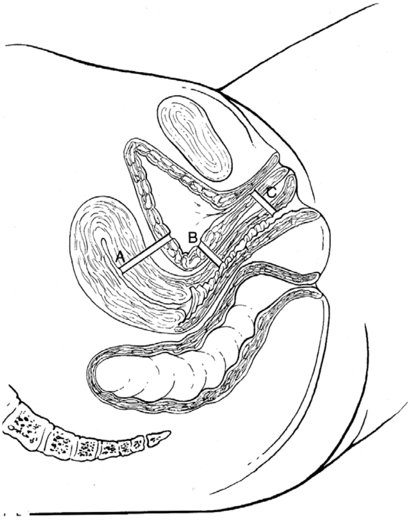


FIGURE I: Types and locations of common urogenital fistulae.
A: Vesicouterine, B: Vesicovaginal, C: Urethrovaginal

Chapter 23

The role of laparoscopy in urogynaecological procedures

Peter de Jong

Introduction

Ever since the introduction of high-fidelity endoscopic equipment in the field of gynaecological surgery in the early 1990's workers have performed traditional gynaecological procedures using minimally invasive routes. Generally, the endoscopic approach allows the surgeon the advantages of:

- Excellent surgical view
- Magnification of anatomical structures
- Bloodless dissection
- Precise haemostasis, less blood loss
- Lower incidence of adhesions
- Less post operative pain, shorter hospitalization
- Quicker return to normal activities
- Small incisions, cosmetic scars
- Lower incidence of infection

There is good evidence that the management of, for example, ectopic pregnancy, is superior using the endoscopic route, but this is not necessarily true for the use of laparoscopy in other fields of gynaecological surgery.

It is important that any surgeon using endoscopic tools:

- Be properly trained in the procedure
- Enjoy the use of quality equipment
- Have recourse to urological and surgical back-up
- Have an excellent appreciation of pelvic anatomy
- Counsel the patient fully in the spheres of surgical complications and the need for emergency laparotomy, otherwise the traditional approach is preferable

This chapter will consider the

role of endoscopy in the fields of prolapse and incontinence surgery.

Prolapse Surgery

Apical Prolapse

Laparoscopy to repair apical prolapse is well described and has been practiced for many years. The procedure is identical to traditional sacrocolpopexy with the use of mesh, and offers the patient the advantages of endoscopy as mentioned above.

However the operation is technically highly demanding and requires extensive experience in endoscopic surgery. The advanced endoscopist completes the procedure in around an hour, and in the hands of expert surgeons such as Wattiez, the outcome enjoys comparable results to standard open sacrocolpopexy. In terms of apical repair, at present the ICS benchmark is still for conventional open sacrocolpopexy – but in the hands of trained expert endoscopists, laparoscopic sacrocolpopexy using mesh is a well described acceptable alternative procedure.

Anterior Compartment Prolapse

First described by Vancaille in the early 1990's, in experienced hands the para vaginal repair may be performed laparoscopically by means of the placement of sutures with perfectly acceptable results. However it is not for the beginner, since suturing in this area is difficult laparoscopically.

Similarly, the use of mesh in the laparoscopic management of anterior or posterior compartment prolapse is well described, with acceptable long term outcomes, provided the surgeon is well trained and highly experienced in this art.

Urinary Stress Incontinence Surgery

The use of the laparoscopic Burch procedure was described in the 1990's with placement of sutures similar to the open route. However it is difficult to correctly place the sutures by laparoscopy, and the endoscopic Burch was beyond the reach of most endoscopists. Moreover its use was overshadowed by the introduction in the late 1900's of the mid urethral tapes, which were technically far easier to perform.

Long term results seem to be

equivalent to those of the traditional Burch, with equivalent cure and complication rates.

Nowadays the laparoscopic Burch procedure is confined to surgery by laparoscopic experts when performing prolapse operations, when the patient has concomitant stress incontinence.

Traditional Burch laparotomy procedures are similarly confined to cases where the patient undergoes a laparotomy for other reasons (for example, hysterectomy for large fibroids) and has concomitant stress incontinence.

Suture Options in Pelvic Surgery

Peter de Jong

Introduction

The gynaecologist is presented with a bewildering array of sutures and needles for pelvic surgery and wound closure. The article aims to narrow the choice to a few logical options that will meet most surgical requirements.

Wound Healing

Healing begins as soon as an incision is made, when platelets are activated and release a series of growth factors. Within minutes, the wound displays a mild inflammatory reaction characterised by the migration of neutrophils which are attracted by degradation products of fibrin and fibrinogen. During this time, and until the proliferative phase of healing begins, wound strength is low. Macrophages peak at 24 hours and produce lactate. This promotes the release of angiogenic endothelial chemo-attractants and increases the rate of collagen synthesis by fibroblasts. By the fifth day, fibroblasts are found in high numbers and the formation of a microcirculation begins. After the second week, although collagen synthesis and angiogenesis are reduced, the pattern of repair is reorganized and the strength of the wound increases, although never to its original level. Collagen synthesis and lysis are delicately balanced. During the first 12-14 days the rate at which wound strength increases is the same, irrespective of the type of tissue. Thus, relatively weak tissue, such as bladder mucosa, may have regained full strength, whereas fascia will only have recovered by 15%. Moreover, it takes three months for an aponeurosis to recover 70% of its strength and it probably never regains its full strength.

Factors Affecting Healing

Many factors influence healing, including age, nutrition, vascularity, sepsis and hypoxia. Some medical conditions, such as diabetes, malnutrition, use of steroids, uraemia, jaundice and anaemia effect healing adversely. Another factor of relevance to the gynaecologist is the menopause, since it has been shown that oestrogen accelerates cutaneous healing by increasing local growth factors. Postmenopausal women having vaginal surgery are therefore advised to use pre-operative topical oestrogen. Cigarette smoking can also affect healing adversely.

With regard to infection, the main source of contamination is endogenous, with only about 5% of infections being airborne. Most gynaecological operations are clean (0-2% rate of infection) or clean/contaminated when the vagina is incised (2-5% rate of infection). Other surgical factors in infection include local trauma from excessive retraction, over-zealous diathermy and operations lasting more than two hours.

Surgical Principles

Basic surgical principles influence the healing process, and the best sutures are useless unless meticulous attention to surgical detail is observed. There are a number of surgical guidelines which promote better outcomes of surgery:

The incision

A thoughtful surgeon plans the length, direction and position of the incision in such a way as to provide maximal exposure and a good cosmetic result, with a minimum of tissue disruption.

Maintenance of a sterile field and aseptic technique.
Infection deters healing, and the surgeon and theatre team must observe all proper precautions to avoid contamination of the operative field. Laparoscopic surgery affords a favorable environment to prevent contamination by extraneous debris and airborne infection. Gentle handling of tissue and precise dissection causes less tissue damage, with resultant fewer adhesions, and reduced post operative pain.

Dissection Technique

A clean incision with minimal tissue trauma promotes speedy healing. Avoid careless ripping of tissue planes and extensive cautery burns. Atraumatic tissue handling is the hallmark of a good surgeon. Pressure from retractors devitalizes structures, causes necrosis and traumatizes tissue and this predisposes to infection. Swabs are remarkably abrasive, and if used to pack off bowel, must be soaked in saline.

Haemostasis

Good haemostasis allows greater surgical accuracy of dissection, prevents haematomas and promotes better healing. When clamping, tying or cauterizing vessels, prevent excessive tissue damage.

Avoid tissue dessication

Long procedures may result in the tissue surface drying out, with fibrinogen deposition and ultimately adhesion formation. Periodic flushing with Ringer's lactate solution is a sound surgical principle.

Removal of surgical debris

Debride devitalised tissue, and remove blood clots, necrotic debris, foreign material, and charred tissue (secondary to cautery) to reduce the likelihood of scarring , adhesion formation and infection.

Foreign bodies

Avoid strangulating tissue with excessive surgical sutures. These represent a significant foreign body challenge and reduce tissue oxygen tension. Certain sutures such as chromic gut, provoke more inflammatory reaction than others, for example nylon.

Wound closure

Choice of material

The appropriate needle and suture combination allows atraumatic tension, free tissue approximation, with minimal reaction, and sufficient tensile strength.

Elimination of dead space

Separation of wound edges permits the collection of fluid which promotes infection and wound breakdown. Surgical drains help reduce fluid collections.

Stress on wounds

Postoperative activity may stress the wound during the healing phase. Coughing stresses abdominal fascia, and careful wound closure prevents disruption.

Excessive tension causes tissue necrosis, oedema and discomfort. The length of the suture for wound closure should be six times length of the incision to prevent excessive suture tension.

Choice Of Suture

Many surgeons have a personal preference for sutures both as a result of proficiency in a particular technique and the suitable handling characteristics of a suture and needle. Knowledge of the physical characteristics of suture material, the requirements of wound support, and the type of tissue involved, is important to ensure a suture used which will retain its strength until the wound heals sufficiently to withstand stress. While most suture materials cause some tissue reaction, synthetic materials such as polyglactin 910 tend to be less reactive than natural fibers like silk.

Suture Characteristics

The properties and characteristics of the “ideal” suture are listed in Table I

Table I: The Ideal Suture

Good handling and knotting characteristics
High tensile strength
Minimally reactive to tissue
Non capillary, non allergenic. The capillary action of braided material promotes infection, as opposed to non-braided sutures
Resistant to shrinkage and contraction
Complete absorption after predictable interval
Available in desired diameters and lenghth
Available with desired needle sizes

In general terms, the thinnest suture to support the healing tissue is best. This limits trauma and, as a minimum of foreign material is used, reduces local tissue reaction and speeds re-absorption. The tensile strength of the material need not exceed that of the tissue.

Monofilament vs. braided material

Monofilament sutures (for example nylon) are made from a single strand of material, and are less likely to harbor organisms than multifilament braided material (table II).

Because of its composition monofilament material may have a “memory” and care should be taken when handling and tying monofilament sutures – perhaps a few extra throws on a proper surgical knot would prevent unravelling.

Table II: Suture Properties

Material	Property	Composition	Made from	Trade Name	Tissue Reactivity	Strength Retention	Absorption
Natural	Absorbable	Spun	Plain gut		Considerable	7-10 days	70 days
			Chromic gut		Moderate	10-14 days	90 days
	Non absorbable	Braided	Silk		Acute Inflammation	6 months	2 years
		Monofilament	Stainless steel wire		Minimal	Maintained	Nil
Synthetic	Absorbable	Braided	Polyglactin	Vicryl*	Minimal	50% at 21 days	70 days
		Monofilament	Co-polymer	Monocryl*	Minimal	40% at 14 days	4 months
			Co-polymer	PDS II*	Slight	50% at 28 days	6 months
	Non absorbable	Braided	Polyester	Ethibond* Mersilene	Minimal	Maintained	Nil
		Monofilament	Nylon		Minimal	20% per year	Years
			Polypropylene	Prolene*	Minimal	Maintained	Nil
* Trademark							
Minimal=”very little”, Slight=”some”							

Avoid nicking or crushing a monofilament strand, as this may create a point of weakness. They have a smooth surface and so pass easily though tissue. Nylon sutures have high tensile strength and very low tissue reactivity and degrade in vivo at 15% per year by hydrolysis. Fine nylon sutures are suitable for use in micro-surgery applications, and slightly heaver grades are appropriate for skin closure.

Multifilament sutures consist of several filaments braided together, affording greater tensile strength, pliability and flexibility with good handling as a result. They must be coated to reduce tissue resistance and improve handling characteristics. Because of their inherent capillarity they are more susceptible to harbouring organisms than monofilament sutures.

Absorbable vs. non-absorbable materials

Absorbable sutures are prepared from the collagen of animals or from synthetic polymers. Catgut is manufactured from sheep submucosa or bovine serosa and may be treated with chromium salts to prolong absorption time. Enzymes degrade the suture, with an inflammatory response.
The loss of tensile strength and the rate of absorption are separate phenomena. A suture can lose tensile strength rapidly and yet be absorbed slowly. If a patient is febrile or has a protein deficiency, the suture absorption process may accelerate, with a rapid loss of tensile strength.

Non-absorbable sutures may be processed from single or multiple filaments of synthetic or organic fibers rendered into a strand by spinning, twisting or braiding. They may be coated or uncoated, uncoloured or dyed.

Specific Sutures And Applications

Surgical gut

Absorbable surgical gut may be plain or chromic, and spun from strands of highly purified collagen. The non –collagenous material in surgical gut causes the tissue reaction. Ribbons of collagen are spun into polished strands, but most protein-based absorbable sutures have a tendency to fray when tied. Surgical gut may be used in the presence of infection, but will then be more rapidly absorbed. Surfaces may be irregular and so traumatise tissue during suturing.

Plain surgical gut is absorbed within 70 days, but tensile strength is maintained for only 7-10 days post operation. Chromic gut is collagen fiber tanned with chrome tanning solution before being spun into strands. Absorbsion is prolonged to over 90 days, with tensile strength preserved for 14 days. Chromic sutures produce less tissue reaction than plain gut during the early stages of wound healing, but are unsuitable for certain procedures , such as in fertility surgery.

Recently, the use of sutures of

animal origin has been abandoned in many countries because of the theoretical possibility of prion protein transmission, thought to be responsible for Creutzfieldt-Jakob disease.

Synthetic absorbable sutures

Synthetic absorbable sutures were developed to counter the suture antigenicity of surgical gut, with its excess tissue reaction and unpredictable rates of absorption.

Polyglactin 910 (i.e. Vicryl) is braided copolymer of lactide and glycolide, allowing approximation of tissue during wound-healing followed by rapid absorption. At 3 weeks post-surgery 50% of its tensile strength is retained. The sutures may be coated with a lubricant to facilitate better handling properties of the material. Absorption is minimal until day 40, completed about 2 months after suture placement, with only a mild tissue reaction.

Occasionally it is desirable to have a rapid-absorbing synthetic suture, such as Vicryl Rapide™. The suture retains 50% of tensile strength at 5 days, and since the knot “falls off” in 7 to 10 days, suture removal is eliminated. It is only suitable for superficial soft tissue approximation where short-term support is desired, for example for episiotomy repair.

Polyglecaprone 25 (i.e. monocryl™) is a synthetic monofilament co-polymer that is virtually tissue inert, with predictable absorption completed by 4 months. It has high tensile strength initially, but all strength is lost after one month. It is useful for subcuticular skin closure and soft-tissue approximation, for example during Caesarean Section.

Polydioxanone (i.e. PDS II™) is absorbable and also monofilament composition, but has more tissue reaction than monocryl. It supports wounds for up to 6 weeks, and is absorbed by 6 months. Synthetic absorbable monofilament sutures are useful for subcutaneous skin closure since they do not require removal. This suture is suitable for sheath closure at laparotomy.

Non absorbable sutures

Surgical silk consists of filaments spun by silkworms, braided into a suture which is dyed then coated with wax or silicone. It loses most its strength after a year, and disappears after about 2 years. Although it has superior handling qualities, it elicits considerable tissue reaction, so is seldom used in gynaecology nowadays.

Synthetic non absorbable sutures

Nylon sutures consist of a polyamide monofilament with very low tissue reactivity. Their strength degrades at 20% per year, and the sutures are absorbed after several years. Because of the «memory» of nylon, more throws of the knot are required to secure a monofilament suture than braided sutures. Nylon sutures in fine gauges are suitable for micro-surgery because of the properties of high tensile strength and low tissue reactivity.

Polyester sutures are composed of braided fibers in a multifilament strand. They are stronger than natural fibres and exhibit less tissue reaction. Mersilene* synthetic braided sutures last indefinitely, and Ethibond* is coated with an inert covering that improves suture handling, minimises tissue reaction and maintains suture strength. They are unsuitable for suturing vaginal epithelium, as they are non-absorbable.

Polypropylene monofilament sutures are synthetic polymers that are not degraded or weakened by tissue enzymes. They exhibit minimal tissue reactivity, and maintain tensile strength. Prolene*, for example, has better suture handling properties than nylon, and may be used in contaminated or infected wounds to minimize sinus formation and suture extrusion. They do not adhere to tissue and are easily removed.

Topical skin adhesions

Where skin edges appose under low tension, it is possible to glue edges together with glue, such as Dermabond™. It is a sterile liquid, and when applied onto the skin (not into the wound) seals in three minutes. It protects and seals out common bacteria, commonly associated with wound infections, and promotes a favourable, moist, wound healing environment, speeding the rate of epithelialisation. The adhesive gradually peels off after 5 – 10 days with a good cosmetic result. Subcutaneous sutures need to be placed to appose skin edges if topical skin adhesions are to be used. It may especially be used in cases of Laparoscopy to close several small skin incisions, and obviate the need for suture removal. Skin adhesive use eliminates the pain occasionally associated with skin sutures, but is unsuitable for vaginal use.

Adhesive Tapes

Adhesive tapes are used approximating the edge of lacerations or to provide increased wound edge support and less skin tension. This is important if patients tend to form keloids during scar healing. In this case, the wound is closed with monofilament absorbable sutures, carefully cleaned, and sprayed with surgical spray to promote adhesive tape adhesion to the skin. The wound is closed with a sterile waterproof dressing after adhesive tapes are placed to provide skin support.

The dressing is removed after a week, but the adhesive tapes are allowed to fall off at a later stage. They have minimal tissue reactivity and yield the lowest infection rates of any closure method.

Tapes do not approximate deeper tissues, do not control bleeding, and are unsuitable for use on hairy areas or in the vagina. Apply them gently to avoid unequal distribution of skin tension, which may result in blistering.

Choosing A Surgical Needle

Fig 1 shows the anatomy of the needle. A cutting needle is designed to penetrate tough tissue such as the sheath or skin. Conventional cutting needles have an inside cutting edge on the concave curve of the needle, with the triangular cutting blade changing to a flattened body (See Fig 2).

The curvature of the body is flattened in the needle grasping area for stability in the needle holder, and longitudinal ridges may be present to reduce rocking or twisting in the needle holder.

Reverse cutting needles have a third cutting edge on the outer convex curvature of the needle, making for a strong needle able to penetrate very tough skin or tissue (See fig 3).

Taper point needles are round, and so pierce and spread tissue without cutting it. The body profile flattens to an oval or rectangular shape to prevent needle rotation in the needle holder. They are preferred for atraumatic work with the smallest hole being desirable, in easily penetrated tissue, but are not suitable for stitching skin (See Fig 4).

Tapercut needles combine the features of the reverse – cutting edge tip and taper point needle. The trochar point readily penetrates tough tissue, with a round body, moving smoothly through tissue without cutting surrounding tissue (See Fig 5).

Blunt point needles have a rounded, blunt point that does not cut through tissue. They are used for general closure of tissue and fascia especially when performing procedures on at-risk patients (See Fig 6).

Tissue trauma is increased if the needle bends during tissue penetration, and a weak needle damages structures and may snap. Reshaping a bent needle may make it less resistant to bending and breaking. Needles are not designed to manipulate tissue or to be used as retractors to lift tissue. Ensure the needle is stable in the grasp of a needle holder. The grasping area is usually flattened, and heavier needles are ribbed as well as flattened to resist rotating in the needle holder (See Fig 7). Most sutures are attached to swaged needles, without the need for an “eye” in the needle. Eyed needles need to be threaded, and create a larger hole with greater tissue disruption than a swaged needle. The swaged end of needle is securely crimped over the suture material, and may be available with the controlled release option. This feature allows rapid suture placement and a slight, straight tug will release it from the needle to allow tying. Avoid grasping the needle holder at the swaged end. This may be weaker than the flattened body and cause disintegration of the needle.

Abdominal wound closure

Modern sutures are uniform and strong and wound dehiscence will only be due to suture failure in exceptional circumstances, with improper tying of knots or damage to the suture by instruments. The suture can cut through if wide enough bites are not taken and if the suture is too tight. Premature loss of strength only occurs with absorbable sutures, especially catgut.

The closure of low transverse incisions is simplified by the fact that they generally heal well, with a low incidence of dehiscence and hernia whatever suture is used. Closure of midline incisions presents more problems. The integrity of any wound is completely dependant on the suture until reparative tissue has bridged the wound. First principles therefore indicate that rapidly absorbable sutures will have a greater tendency to fail than non-absorbable sutures. Studies have shown that catgut is associated with an unacceptably high risk of evisceration and incisional hernia and should not be used.

Experimental work on rats has shown that mass closure with monofilament nylon significantly reduces the dehiscence rate compared with braided suture, as bacteria reside in the interstices of infected multifilament sutures. However, in some patients, removal of suture material will be required due to sinus formation. Delayed absorbable sutures have been assessed for abdominal wound closure and it was found that wound dehiscence is similar without the problem of sinus formation. A randomised controlled trial of polyglyconate (Maxon™) versus nylon in 225 patients showed that polyglyconate was as effective at two-year follow-up. Suture length should be approximately four times to six times the length of the wound to allow for the 30% increase in abdominal circumference postoperatively. Permanent sutures should still be considered where the risk of wound failure is particularly high.

Closure of the peritoneum was shown in 1977 to be unnecessary, this was confirmed in 1990 by a randomised controlled trial.

Skin closure

In gynaecological practice, there are many options for skin closure, but cosmesis is more important than in general surgery where the avoidance of infection is more of a concern. Lower transverse incisions heal well because of the lack of tension. Full-thickness interrupted stitches must not be too tight as oedema may lead to disfiguring crosshatching, particularly if infection forms along the track. Very thin monofilament absorbable or non-absorbable sutures are preferable but a subcuticular stitch leaves less of a scar (Figure I). Similar assessment of laparoscopy scars suggests that subcuticular polyglactin (Vicryl™) is better than transdermal nylon. Staples are popular because there is less chance of bacterial migration into the wound, although the risk of infection in most gynaecological surgery is low. Properly conducted clinical trials have shown the only benefit of staples to be speed, there is more wound pain and a worse cosmetic result compared with subcuticular sutures.

Hints And Tips

Personal preference will always play a part in needle and suture selection, but the final choice will depend on various factors that influence the healing process, the characteristics of the tissue and potential post-operative complications.

Close slow-healing tissues (i.e. fascia or sheath) with non-absorbable or long-lasting absorbable material, i.e. Pds or vicryl.

Close fast-healing tissue such as a bladder with rapidly absorbed sutures. Non-absorbable sutures such as nylon form a nidus for stone formation. Foreign bodies in potentially contaminated tissue may convert contamination into infection. So avoid multifilament, braided sutures under these circumstances – rather use monofilament material.

Where cosmetic results are important, close and prolonged skin opposition is desired, so thin, inert material such as nylon or polypropylene is best. Close subcutaneously when possible, and use sterile skin closure strips to secure close opposition of skin edges when circumstances permit. Try to use the finest suture size commensurate with the inherent tissue strength to be sutured.

Conclusion

With a little thought and preparation we should use the suture and needle best suited to the surgery which is being performed. It is essential that we are aware of what is available and how it may best be utilized. Surgical training should include the characteristics and applications of sutures and needles.

Chapter 25

Thromboprophylaxis in Urogynaecological Surgery

Barry Jacobson

When the gynaecologist decides that a woman requires surgery for prolapse or incontinence, it is essential that a decision be made as to whether she requires peri-operative thromboprophylaxis.

The first decision is based on the risk factors for that particular patient. Any patient who has had a previous venous thromboembolic (VTE) event is obviously at high risk. Other important risk factors include an underlying malignancy, age more than 76 years, use of an estrogen containing product and obesity. A relatively simple scoring table promoted by the Southern African Society of Thrombosis and Haemostasis has been devised. (See attached table). Note that smoking is not a risk factor.

There is a paucity of randomized data on the risk of thrombosis after gynaecological surgery, especially non oncological gynaecological surgery. Patients should be divided into open versus laparoscopic surgery. Patients undergoing "open" surgery, including vaginal surgery, should be given low molecular weight heparin prophylaxis routinely. The debate arises in laparoscopic surgery, which appears to have a very low risk of VTE. Furthermore prescribing anticoagulation to these patients increases the risk of minor bleeding and this therefore could potentially increase the rate of having to convert a laparoscopic procedure to an open procedure.

Although there is little data to support the use of intermittent pneumatic compression devices, the European Association for Endoscopic Surgery has recommended that they be used routinely for all prolonged laparoscopic procedures. The American guidelines mandated that patients undergoing laparoscopic procedures who do not have additional risk factors should not be offered any thromboprophylaxis other than early and frequent ambulation.

The Author suggests that the European recommendation should be followed. All patients who have additional VTE risk factors should be offered LMWH as well as the graduated compression stockings.

So in summary, any patient having a laparotomy ought to receive LMWH thromboprophylaxis, generally given 6 hours after surgery.

Thrombosis Risk Factor Assessment

Choose All That Apply

Each Risk Factor Represents 1 point	**Each Risk Represents 3 points**
• Age 41 – 60 years • Minor surgery planned • History of prior major surgery (< 1 month) • Varicose veins (large) • History of inflammatory bowel disease • Swollen legs (current) • Overweight (BMI >25 kg/m2) • Acute myocardial infarction • Congestive heart failure (CHF) (<1 month) • Sepsis (< 1 month) • Serious lung disease including pneumonia (<1 month) • Abnormal pulmonary function (COPD) • Medical patient currently at best rest	• Age > 75 years • History of DVT/PE • Family history of thrombosis • Positive factor V Leiden • Positive prothrombin 20210A • Positive lupus anticoagulant • Elevated anticardiolipin antibodies • Other congenital or acquired thrombophilia

Risk Factor Score

Total Risk Factor Score	Incidence of DVT*	Risk Level
0 – 1	< 10%	Low Risk
2	10 – 20 %	Moderate Risk
3 - 4	20 – 40 %	High Risk
5 or more	40 – 80 %	Highest Risk

Prophylaxis Safety Considerations: Check box if answers if “yes”

Anticoagulants: Factors Associated with Increased Bleeding
Is patient experiencing any active bleeding?
Does patient have (or had a history of) HIT?
Is patient’s platelet count < 100.000/mm 3?
Is patient taking oral anticoagulants, platelet inhibitors (e.g. NSAIDS, Clopidogrel, salicylates)?
Is patient’s Creatinine clearance abnormal? Please indicate value:
If any of the above boxes are checked, the patient may not be a candidate for anticoagulant therapy and should be considered for alternative prophylactic measure.

Intermittent Pneumatic Compression (IPC)
Does patient have severe peripheral arterial disease?
Does patient have CHF?
Does patient have an acute/superficial DVT?
If any of the above boxes are checked, the patient may not be a candidate for IPC therapy and should be considered for alternative prophylactic measures.

The field of urogynaecology has expanded dramatically over the past decade with the advent of a number of new medical and surgical treatment modalities. The evidence base on pelvic floor dysfunction has also grown extensively. This multi-contributor text, authored by a multi-disciplinary team of experts from around South Africa, concisely summarises the most up-to-date concepts and management strategies in urogynaecology. It will prove invaluable to gynaecology, urology and surgery registrars and specialists. Physiotherapists and nurses working in the field of urogynaedcology will also find it extremely useful.