

# Urogynecology

Evidence-Based Clinical Practice

Kate H. Moore

*Third Edition*



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Springer

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# Chapter 1

## Taking the History



Many urogynecology patients have multiple symptoms, for example, one person may have mixed stress and urge leak along with prolapse, while another person may have postoperative voiding difficulty with recurrent cystitis and dyspareunia. It is important to untangle or dissect the different problems and then tackle them one by one (although the total picture must fit together at the end).

To help you manage the patient, ask, “What is your main problem. What bothers you the most?” Only after you have sorted this question out fully should a systematic review be undertaken. Let the patient tell you her story. If you ask whether she can recall precipitating factors, she may guide you to the cause of her problem, and help direct her own treatment.

### History Taking for Urinary Incontinence

Stress Incontinence (leakage with cough, sneezing; see Fig. 1.1a). Note that stress incontinence is a symptom, common in women who play tennis, or go jogging, or just when they lift heavy shopping bags. She may recall precipitating factors such as difficult childbirth or weight gain. Stress incontinence is a physical sign (see Chap. 2). Urodynamic stress incontinence means that on urodynamic testing the

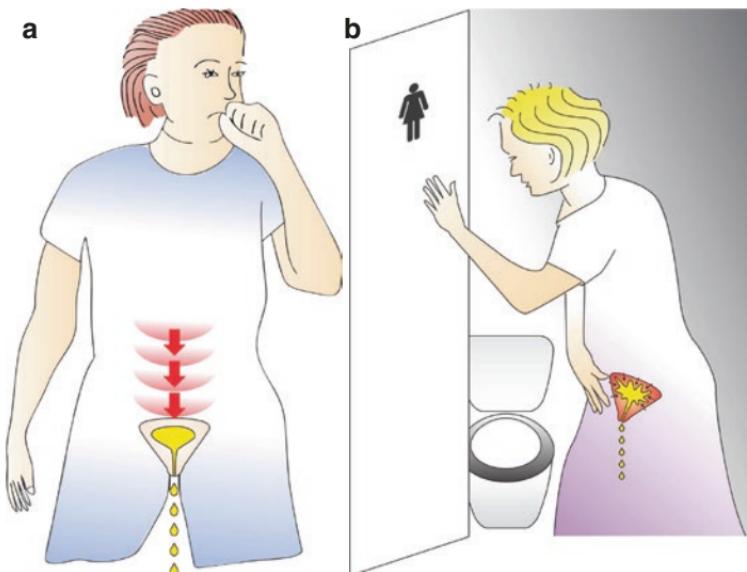


FIGURE 1.1 (a) Stress incontinence, leakage associated with raised intra-abdominal pressure. (b) Urge incontinence, leakage associated with a detrusor contraction

patient leaks with a rise in intra-abdominal pressure, in the absence of a detrusor contraction (see Fig. 1.1a and Chap. 4).

Urge incontinence is experienced as leakage with the desperate desire to void, or it may occur when the patient has waited just a little too long to go to the toilet, but then it all comes away from her onto her clothes, often just at the toilet door (Fig 1.1b). She may recall precipitating factors such as gynecological surgery with a prolonged urethral catheter, or recurrent cystitis. Urge incontinence is difficult to elicit on physical examination (see Chap. 2). On urodynamic testing, if the patient leaks when a detrusor contraction occurs, associated with urgency, it is termed detrusor overactivity (see Chap. 4).

Many patients will have mixed stress and urge incontinence but can tell you which one bothers them the most or makes them leak the most. Take the time to ask the patient, because this guides initial therapy and helps you to interpret urodynamic tests.

## Nonincontinent Symptoms of Storage Disorders: Frequency, Urgency, and Nocturia

Frequency of micturition is defined as eight or more voids per day.

The normal adult who drinks an average of 1.5–2 l/day will void five to six times per day.

If a woman has increased frequency, ask whether she voids “just in case”: before going shopping or going running, because many women with stress incontinence do this to avoid having a full bladder when they know they are at risk of leaking. The difference is important.

The woman with an overactive detrusor muscle will rush to the toilet frequently because she has an urgent desire to void, caused by bladder spasms, and she is afraid she will leak if she does not make the toilet on time. The urgent desire to void for fear of leakage is defined as “urgency.”

Nocturia is defined as the regular need to pass urine once or more per night, after going to bed to sleep, in women aged 60 years or less. One further episode of nocturia may be allowed thereafter, e.g., twice per night in the 70-year old may not be abnormal (as renal perfusion in the elderly improves at night when the patient lies down and blood flow to the kidneys increases). You need to assess whether the patient’s sleep is disrupted by the nocturia (if she wakes once at 6 am, but then sleeps until rising at 730 am, it may not be disruptive). People need at least 4 h of uninterrupted sleep per day to allow normal brain rest at night and avoid daytime drowsiness, so 3 episodes of nocturia are generally quite disruptive and abnormal.

The overactive bladder (OAB) is a clinical syndrome, not a urodynamic diagnosis. It comprises frequency, urgency, and nocturia, with or without urge incontinence (in the absence of bacterial cystitis or hematuria). It was defined by the International Continence Society (ICS) in order to help general practitioners to identify patients likely to have detrusor overactivity, so that they could be treated in the general practice setting without recourse to urodynamic testing. Note that the ICS makes a distinction between OAB Dry (people who do not leak but have bothersome urgency and frequency +/- nocturia)

and OAB Wet (people who generally leak, thought to be on the more severe end of the spectrum of the syndrome).

## The Bladder Chart

This chart (Fig. 1.2) is very helpful in assessing whether the patient suffers from urge incontinence with daytime frequency or nocturia and how much urine she generally can store (her functional bladder capacity), or stress incontinence (or a mixture of both). The average patient has difficulty remembering exactly how often she voids and of course has no idea of the volume she can store. Most urogynecologists send out a blank bladder chart to patients prior to the first visit, so she can complete it before the first visit (see Chap. 5, Outcome Measures

**BLADDER CHART**      Date: / /

TIME	AMOUNT & TYPE OF FLUID IN	TIME	AMOUNT OF URINE PASSED	COMMENTS
7/5am	400 ml orange			EG leakage, urge, pain, burning etc.
730		730am	580 ml	leak getting out of bed
745	250 tea			
		830	190	(before going to work)
10am	350 tea			
		1030	350	-
12 noon	250 water			
		1330pm	410 ml	leak carrying books upstairs
1pm	150 coffee			
		1450	130 ml	(before going home)
6pm	350 beer			
7		8pm	360 ml	leak loading dishwasher
945pm	200 camomile tea			
		1015	200	-

FIGURE 1.2 Bladder chart showing a patient with good bladder volumes, adequate fluid intake, and typical stress leak. Note the “just in case” voiding before going to work (08:30) and coming home (4:50 P.M.) on the train

for more detail). This is a crucial part of starting bladder training for patients with overactive bladder (see Chap. 7).

## Other Types of Leakage

These may denote a more complex situation.

Leakage when rising from the sitting position can be due to stress incontinence (relative rise in abdominal pressure when standing) or due to urge incontinence (gravitational receptors in the wall of the bladder trigger a detrusor contraction upon standing).

“Leakage without warning” is a nonspecific but important symptom. It may indicate detrusor overactivity, when a patient reaches her threshold bladder volume triggering a detrusor contraction. It may also indicate stress incontinence that the patient cannot verbalize; for example, she leaks with the slightest movement.

Leakage when arising from bed at night to go to the toilet is also nonspecific but important. Nocturia usually is associated with an overactive bladder. However, some patients with a very weak sphincter and other causes for nocturia (such as night sweats, obstructive sleep apnea, or a snoring husband) may leak as soon as they get up to go to the toilet.

Leakage during intercourse is seldom volunteered. Ask this question tactfully. Coital incontinence that occurs during penetration is most likely due to stress incontinence, whereas leakage during orgasm is more likely due to detrusor overactivity.

Nocturnal Enuresis indicates that the patient actually wets her bed. She may wake up as she is just starting to leak (urine is still coming away, pajamas are not soaked), or she may wake in the morning in a soaked bed. In adults, this almost always indicates detrusor overactivity.

## How Bad Is the Problem?

Some patients use only a damp panty liner once daily, but their mother was grossly incontinent in her old age, and they do not wish to become like her. Other patients use many

large pads fully soaked per day but have put up with it for years owing to embarrassment. It is important to assess severity because evidence indicates that mild incontinence is more readily cured by conservative measures. Severe stress incontinence is more likely to need surgery. Severe urge incontinence is logically more likely to require anticholinergic drugs.

Many Urogynecology Units now quantitate the severity of leakage by asking three standardized questions, which have a set range of answers, in a format defined by the World Health Organization. For illustration, see Chap. 5, but the questions are as follows:

- How often do you leak urine? (All the time, daily, two to three times weekly, weekly, or less)
- How much urine do you leak? (A little bit, a moderate amount, or a large amount)
- How much does it affect your daily life? (On a scale of 1–10)

We also try to find out what sort of pad the patient is using. A patient who uses two panty liners per week is generally easier to treat than a person who uses six pads per day. If patients use a “pull-up” adult diaper, they need serious help. For example, see Fig. 1.3.



FIGURE 1.3 Adult diapers, medium and small pads, with a panty liner

## History of Voiding Difficulty

Although difficulty in emptying the bladder as the main complaint occurs in only about 4% of females presenting with lower urinary tract symptoms, voiding difficulty does commonly accompany other urogynecological problems such as prolapse, and can be a lifelong problem in women who have previously had continence surgery.

The classic complaints are:

- Needing to strain to void, for example, the urine does not come away without a Valsalva strain to start the flow (this is never normal).
- The flow is intermittent: “stop—start.”
- The flow is prolonged (the patient takes much longer to void than her friends or others in a public bathroom at the movies).
- Post-void dribble: The patient gets up from the toilet thinking she is empty, but urine trickles out as she walks away.
- Need to revoid: The patient gets up from the toilet thinking she has finished but has to go back to the toilet within a few minutes.
- Recurrent episodes of bacterial cystitis.

All such patients need free uroflowmetry with post-void residual and voiding cystometry if these are abnormal (see Chap. 4).

The underlying causes may be:

- Prolapse with urine trapping due to a kinked urethra
- Postsurgical urethral obstruction
- Underactive detrusor (more common in the older woman)
- Urethral diverticulum (usually just complain of post-micturition dribble)

## History of Prolapse

“Something coming down in the vagina” is the classic statement. The patient may have a wide range of severity of symptoms. It is important to define how badly she is affected.

- In mild cases, she may sometimes feel a small lump just at the opening of the introitus when she is washing herself in the shower after standing up all day at work (not every day).
- In moderate cases, she feels an obvious lump the size of a boiled egg there every time she washes and sometimes feels that there is a lump protruding when she sits down. She may find the lump unpleasant during intercourse, or too embarrassing, so that she refuses to have it.
- In severe cases, the lump is there in her underwear all the time, associated with a low backache or nagging discomfort, and trouble sitting comfortably at all.
- In the worst-case scenario, the lump rubs on her underwear and causes staining either brown or red (due to dependent edema with trauma), and she may experience an unpleasant abdominal pain if there is a low-lying enterocele with traction on nerves to the small bowel.

You need to check whether bladder or bowel function is disturbed:

- The patient may have to push her prolapse up to start urination (typical of cystocoele).
- The patient may have to push her fingers on the back wall of the vagina to defecate (typical of rectocoele).

## History Taking for Fecal Incontinence/Obstructive Defecation

Fecal incontinence is really the wrong term to use. We should be asking about anal incontinence, which includes incontinence to flatus *and* feces.

*Flatus incontinence* is defined as regular passage of noisy or foul-smelling gas which the patient is attempting to inhibit, or which seeps out without any warning sensation. Even if this occurs once per month during an important business meeting, it can be disastrous.

*Fecal incontinence* is usually broken down into (1) Whether it only occurs when the stool is liquid (with diarrhea). Note whether patient has inflammatory bowel disease or malabsorption symptoms; treating the underlying disease may cure the problem. (2) Fecal Incontinence when the stool is solid usually indicates a more severe problem and can have a devastating impact on the patient's life. (3) Fecal staining indicates a small brown stain on the underwear, usually just after defecation, and is more likely when patient has a rectocoele.

*Assessing severity:* Does the patient need to wear a pad for the leakage? Does the patient need to take constipating medicine to stop leakage of watery stool? Ask about fecal urgency, defined as unable to defer the call to stool for 15 min.

All these aspects of severity are included in the Wexner score (see Chap. 5).

## Symptoms of Obstructive Defecation

- Constipation is roughly defined as straining to pass hard stool and not being able to defecate daily (passing less than three motions per week).
- The easiest way to ask a patient about whether their stool is hard, like “rabbit pellets,” is to show them a picture of the Bristol stool chart (Fig. 1.4) and ask them to pick out which types of stool they usually pass. Type I stool is not good, as it usually means the patient must strain to evacuate, which weakens the pelvic floor. Urogynecologists have become increasingly aware of this problem.
- Needing to digitate the vagina in order to expel hard stool—the patient often has to put her fingers in the vagina to express the hard stool out manually.

THE BRISTOL STOOL FORM SCALE		
Type 1		Separate hard lumps, like nuts (hard to pass)
Type 2		Sausage-shaped but lumpy
Type 3		Like a sausage but with cracks on its surface
Type 4		Like a sausage or snake, smooth and soft
Type 5		Soft blobs with clear-cut edges (passed easily)
Type 6		Fluffy pieces with ragged edges, a mushy stool
Type 7		Watery, no solid pieces ENTIRELY LIQUID

FIGURE 1.4 The Bristol stool form scale

- Post-defecation soiling with the need to re-evacuate—patient feels defecation is complete, stands up to leave toilet, feels stool coming onto underpants, or else feels more stool present in the anal canal and has to sit down again.

## Assessing Previous Surgical History in Relation to Urinary Incontinence

If patient had previous continence surgery with persistent or recurrent leakage, there is a need to find out exactly what procedure she had (get notes or write to surgeon).

- If it was a previous anterior repair for incontinence, failure is not surprising.
- If it was a previous Pfannenstiel incision, patient may not know whether this was Marshall–Marchetti procedure (failure is common) or a colposuspension (failure is less common; suspect detrusor overactivity).
- If it was a previous “sling,” need to know whether this was a true abdomino-vaginal sling—i.e., autologous fascia was

harvested from the rectus abdominus sheath (failure uncommon).

- Whether the “sling” was a Raz, Peyeyra, or Gittes type (failure very common; see Chap. 9 or a previous mid-urethral sling, retropubic TTVT, failure is unlikely).
- A trans-obturator TVTO, means failure is significantly more likely.

In cases of previous failed continence surgery, check whether the patient had voiding difficulty:

- May have been kept in hospital for catheterization longer than usual.
- May have been sent home with a suprapubic catheter.
- May have had to perform clean intermittent self-catheterization.

If such problems occurred, suspect that patient could have subacute retention with overflow incontinence.

## Important Previous Medical History

The previous medical history is just as important as surgical history in some aspects.

Watch out for Neurological Diseases that may increase the likelihood of detrusor overactivity (DO).

Both Parkinson’s Disease and Multiple Sclerosis are strongly associated with DO *and* voiding dysfunction (incomplete emptying).

Previous stroke (cerebrovascular accident) is strongly associated with DO.

Even transient ischemic attacks (TIA) if substantial or recurrent may promote DO.

Previous brain tumors that have been excised but may have left some brain scarring also link to DO.

Previous major abdominal surgery that may have disrupted the interplay between the sympathetic nerves (that relax the bladder) and the parasympathetic nerves (that are involved in bladder contraction) can cause DO with mild voiding dysfunction.

Also, many GPs are becoming aware of conservative treatment for incontinence, so check whether the patient has been sent to a Pelvic Floor Physiotherapist (but make sure that physio had done a subspecialty training course, or the treatment may not have worked). Also, she may have been given topical vaginal estrogen therapy (cream = oestriol, Ovestin, or vaginal tablet = estradiol, Vagifem). We find the cream much more helpful than the vaginal tablet, which is placed high in the vault, not near the urethra.

## History Taking for Dyspareunia

Any patient with urogynecology problems who also has dyspareunia needs this problem treated. The common features seen in urogynecology are as follows:

- Postoperative scarring from overtight posterior repair.
- Postoperative scarring from overtight episiotomy repair.
- Post-colposuspension changes in the shape of the anterior vaginal wall.
- Atrophic vaginal changes (dryness, pruritus, coital discomfort).

General gynecological causes for superficial and deep dyspareunia should also be considered. For example, deep dyspareunia arising from endometriosis may coexist, and laparoscopic treatment should be carried out (especially if surgery will be needed for the urogynecological complaint).

## History Taking for Recurrent Cystitis

This is covered in Chap. 11, but basics are as follows:

- Has patient had >3 proven episodes of cystitis in the last 12 months?
- Are there postmenopausal atrophic vaginitis symptoms?
- Is cystitis often after intercourse (post-coital)
- Has patient had renal ultrasound to exclude calculi?
- Has patient had ultrasound to measure post-void residual?

- Has patient had cystoscopy to investigate cystitis (need to get findings)?
- Has there been any hematuria, either during cystitis or at other times?
- Has patient had any prophylaxis, e.g., antibiotics, Hipprex, Cranberry, and oestriol cream?

## History Taking for Painful Bladder Syndrome/ Interstitial Cystitis (IC)

This is covered in Chap. 12, but the basics include the following:

- The main complaint is suprapubic pain.
  - Pain may be constant or worse with a full bladder.
  - Pain may be relieved by voiding.
  - Pain may wax and wane over time.
- Relentless frequency of micturition is typical, 10–20 times daily.
- Severe nocturia is common, but not present in all patients, and can be as severe as five to ten nocturia episodes per night.

Bacterial cystitis should be excluded: proven recurrent cystitis generally precludes diagnosis of IC.

## History Taking for Mesh Pain/Complications

Patients who know that they have mesh in their vagina may come to see you because, either they have vaginal pain/discharge/other impairment, or they have seen adverse press about mesh complications and are frightened. In any case, you need to ask the following:

- What sort of pain do they have, worse with exertion/defecation/sitting down for too long?
- Can they feel a mesh extrusion when they wash in the vagina?

- Do they have dyspareunia?
- Can partner feel the mesh (“hispareunia”)?
- Do they have vaginal discharge—foulsmelling, blood-stained, or other colors?
- Any difficulty with incomplete urination/ poor stream?
- Any history of recurrent bacterial cystitis?
- Difficulty with complete defecation, need to push fingers in the vagina to defecate?

Full details of management of mesh complications are given in Chap. 13.

## History of Drug Therapy That May Facilitate Urinary Incontinence

The most common culprit is the alpha-adrenergic antagonist prazosin (Minipress), which relaxes the innervation to the bladder neck and provokes stress incontinence. Always check exactly which antihypertensive the patient is using.

The next most common problem is the use of diuretic therapy to treat hypertension. Although this may be good medical practice, it can be enough to tip the balance in a patient with a weak urethral sphincter or an overactive bladder into incontinence. Ask the patient’s doctor whether another antihypertensive can be used.

A further common problem is the chronic dry cough seen with ACE inhibitors (especially enalapril), which can provoke stress incontinence.

Many psychotropic drugs have anticholinergic effects that can precipitate chronic retention of urine with overflow incontinence. Lithium can be a common culprit: it also is associated with increased thirst so patients accommodate increasingly large bladder volumes; eventually, they cannot cope. Polydipsia can become permanent. The selective serotonin reuptake inhibitors such as paroxetine that also have some alpha-adrenergic blockade effect are also reported to cause chronic retention in some cases, more likely if the patient is also receiving a beta-adrenergic agonist such as imipramine.

## General Assessment of the Patient in Relation to Urogynecology (Fig. 1.5)

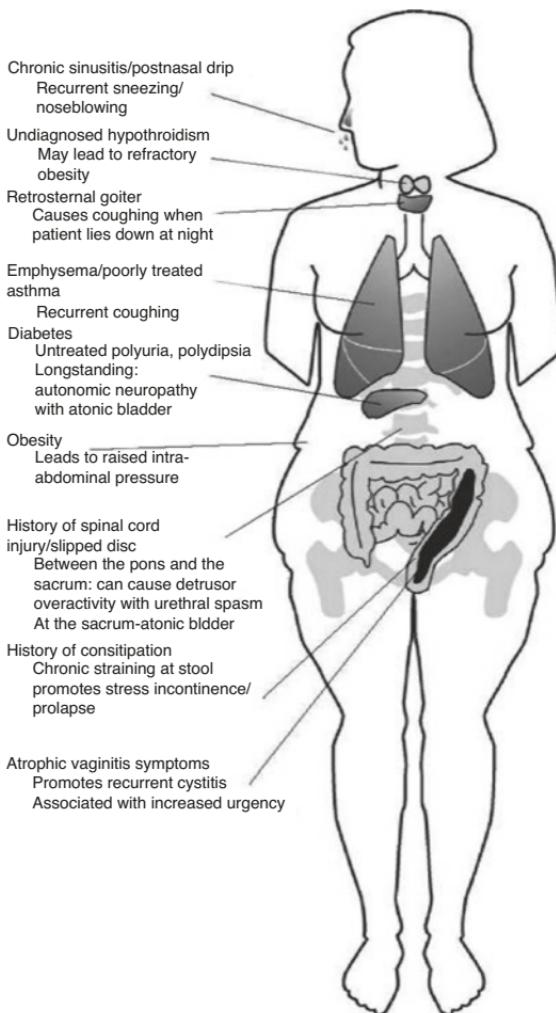


FIGURE 1.5 General factors contributing to the pathogenesis of incontinence or prolapse

# Chapter 2

## Physical Examination



When examining a patient with urinary incontinence or prolapse, more care may need to be taken to avoid embarrassment than with the usual gynecology patient.

For example, a patient with menorrhagia is often fed up with her symptoms and just seeks your help to get rid of a practical problem that has little social stigma. On the other hand, a patient with incontinence often feels that she is “dirty” and “cannot control herself.” A patient with prolapse is often horrified about the lump appearing at her vaginal opening and may have ceased intercourse because of embarrassment.

Therefore, always make sure that the patient’s abdomen and genitalia are covered with a sheet, and only expose that part which you are about to examine. Establish a sympathetic rapport *before* you begin the examination. Explain each part of the exam briefly as you proceed.

### Examine the Abdomen

Before starting the examination, a urine specimen should be taken for culture, and if foul smelling, it should undergo a rapid dipstick test to screen for infection. The patient’s height and weight should be measured, so that BMI can be determined and obesity discussed if present.

Many patients attending the gynecologist for a first visit lie on the couch with their knees drawn up, assuming that only the vagina and pelvis will be examined. This is not appropriate in urogynecology. The abdomen must be examined first, so ask the patient to drop her knees down so that a relaxed abdominal exam can be performed. Check that you know the nature of all her abdominal scars; she may have forgotten some during the history! Check the renal angles for tenderness, for example, renal calculi.

Any mass that raises intra-abdominal pressure may cause incontinence. In our unit, we see one to two patients per annum presenting with incontinence or urgency/frequency who in fact have an ovarian cancer or benign cyst, or an enlarged uterus, that has not been detected previously. Also, patients may present with frequency and urgency but in fact have subacute retention, so it is important to percuss the abdomen to exclude an enlarged bladder. Shifting dullness needs to be elicited if ascites is suspected, which may accompany an ovarian cancer that provokes stress incontinence.

## Inspect the Vulva

First, in the postmenopausal or breastfeeding women, look for evidence of vulvar atrophy. Initially, this appears as thin, shiny, glistening red epithelium that appears fragile, rather than the healthy pink “skin”-like appearance of the premenopausal women. Later changes include patchy whitish areas of cornification with some “cracks” or fissure-like lesions often between the labia majora and minora. Patients may have vaginal atrophy along with lichen sclerosis, in which case the labia minora may be fused at the midline. Urethral caruncle, a red rosebud appearance at the urethral meatus, also indicates estrogen deprivation (see Fig. 2.1).

Do not be lulled into a sense of security because the patient is on systemic HRT. A percentage of these patients do not achieve adequate blood levels in the vagina and vulva and may still get atrophic changes, which also affect the urethra.



FIGURE 2.1 Classic atrophic vagina with urethral caruncle

Next, look at the introitus at rest; a cystocele or rectocele may be evident even without cough. Inspect the perineum for signs of post-obstetric perineal deficiency (to be measured in POPQ).

## Elicit a “Stress Leak”

Part the labia, and ask the patient to cough. In order to save embarrassment, explain to the woman that you will place a piece of tissue/paper towel at the urethra, so that if she leaks, nothing will spill onto the linen. Patients are often terrified that they will leak urine in front of the doctor, yet this is exactly what we are trying to get them to do. You should have a tissue ready in any case, because a strong projectile spurt of urine may reach your clothing and embarrass the women even further (she will know if the spurt has been large enough to do this!).

Typically, a stress leak involves a short spurt of urine that occurs during the height of the cough effort. An urge leak typically occurs an instant after the cough, but a large prolonged urine leak is seen due to the detrusor contraction. In practice, patients with urge incontinence will not get up onto

your examining couch with a full bladder; they will always visit the toilet first.

Assess hypermobility of the anterior vaginal wall. When the patient coughs, there may not be a proper cystocele “bulge,” but the whole anterior wall may move down with the cough.

## Bivalve and Sim's Speculum Examination

Before you pass the speculum, as you part the labia, check if the introitus is normal, or if a skin bridge stands up between the two labia (can cause dyspareunia, may occur after tight obstetric suturing or excessive posterior repair). On the bivalve speculum exam, check that the cervix is healthy, and take a Pap smear/Cervical Screening Test if due. As you withdraw the speculum, ask for a gentle cough to see if the uterus or the top of the vagina descends down., check for normal vaginal epithelium as in any gynecological exam.

When passing a Sim's speculum, traditional advice is to ask the patient to assume the left lateral position for a Sims speculum exam. In fact, if they are obese, this may not be necessary; the bottom of the Sims may not hit the couch if the buttocks are sufficiently plump. If equipment is in short supply, the two leaves of a bivalve speculum can be unscrewed, and the anterior leaf used as a Sims speculum.

Cystocele (prolapse of the bladder into the vagina) and rectocele (prolapse of the rectum into the vagina) are traditionally graded (during Valsalva or cough) as the following:

- *Mild*: The prolapse descends more than halfway down the vagina but not to the introitus.
- *Moderate*: The prolapse descends to the level of the introitus.
- *Severe*: The prolapse descends well beyond the introitus and is outside of the vagina.

Uterine descent follows the same classification, but if the majority of the organ is outside the vagina, the term procidentia is used. See Fig. 2.2.



FIGURE 2.2 Complete procidentia

In highly parous women, the uterus may be well supported, but the cervix may be very bulky and protuberant (worth noting when considering surgical options).

- Enterocoele (prolapse of the small bowel into the vagina) is not a common major finding unless the patient has had a hysterectomy, when it is called a “vault enterocoele” (the top of the post-hysterectomy vagina is called the vault). This prolapse is also graded mild/moderate/severe as above.

This “mild/moderate/severe” terminology, called the Baden Walker classification, was used for many decades until the mid-1990s.

## POPQ Scoring System of Prolapse

In the 1990s we realized that there is considerable subjectivity in defining “mild,” “moderate,” and “severe” under this system. Therefore, urogynecologists devised a new system of measuring the degree of prolapse of the uterus and anterior and posterior walls of the vagina in centimeters, called pelvic organ prolapse quantification or POPQ (see Fig. 2.3a).

First, the reference point of the introitus (the hymenal remnant) is taken as 0 cm. The normal vagina is about 8 to

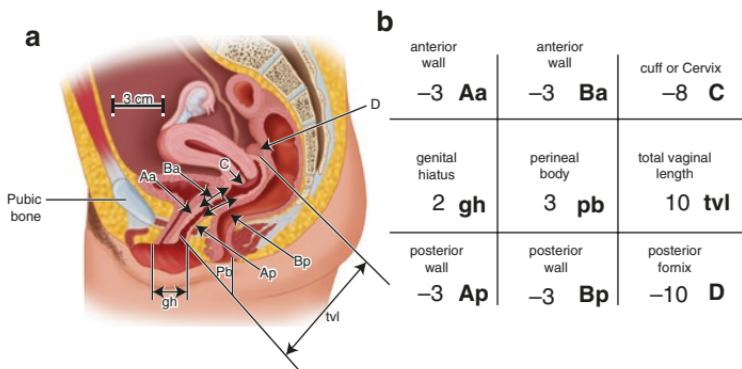


FIGURE 2.3 (a) Six sites (*Aa*, *Ba*, *Ap*, *Bp*, *C*, and *D*) used to quantify POP. (b) POPQ definitions. Reprinted, with permission from Bump et al. [1]; Copyright 1996, Elsevier)

10 cm long. Using the normal vagina, a reference point of 3 cm inside the introitus is called “−3 cm,” for both the anterior and posterior walls. See a schematic diagram of normal anatomy and a normal POPQ in Fig. 2.3a, b.

When a normal woman coughs, the vaginal walls do not move, so the −3 point remains 3 cm inside the introitus. Take a woman with a cystocele: say, for example, that with cough, the anterior wall (at the −3 point) protrudes out to 2 cm beyond the introitus. This is measured and recorded as +2 cm (meaning that the anterior wall at the reference point moves down by 5 cm with strain). The same measurements are applied to rectocele.

Next, the total vaginal length is measured, at the posterior fornix (as shown in Fig. 2.3b) at point D. Then the width of the perineal body is measured as shown in Fig. 2.4, from the fourchette to the mid-anal opening. The length of the genital hiatus, from the lower margin of the urethra to the inner aspect of the fourchette, is also measured. Also in Fig. 2.4, the patient has a rectocele that comes to the level of the introitus (“0”).

Although the POPQ system may seem a little cumbersome to begin with, it is easy to pick up after a few practice



FIGURE 2.4 Rectocele at the introitus with POPQ measuring device, perineum = 2.8 cm

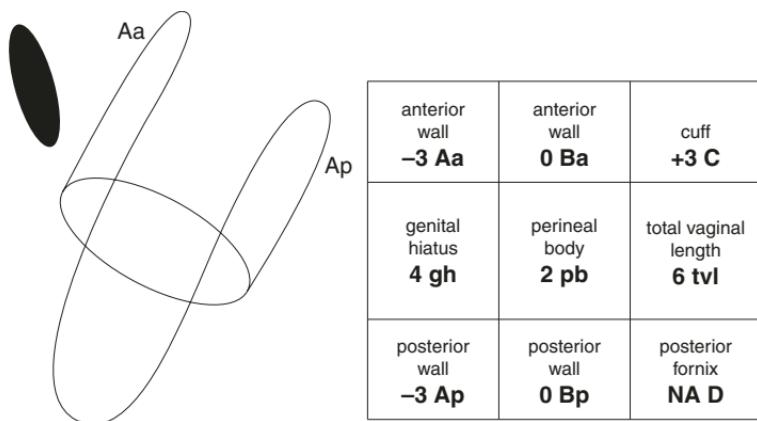


FIGURE 2.5 Complete eversion vagina POPQ Patient has had previous anterior and posterior repair, so that Aa and Ap are still normal (-3)

attempts. Many gynecologists and all urogynecologists have taken it up, because it is objective and allows for scientific research as to the outcome of prolapse surgery that has never been possible before (as shown in Chap. 9). An example of complete descent of the vaginal vault (called complete vault eversion) is shown in Fig. 2.5.

## Perform a Bimanual Examination and Palpate Vaginal Walls/Urethra

Again, examine for pelvic masses that may press on the bladder to cause frequency, urgency, or incontinence. If a patient with incontinence comes to surgery, any other gynecological disorders such as menorrhagia with a large fibroid uterus, ovarian cysts, etc., should be corrected at the same time; hence, the term “urogynecology,” that is, “one-stop shopping,” should be provided!

At the time of bimanual exam, if patient has had colposuspension, put the fingers into the retropubic space to feel for the typical “dimples” of the vagina adherent to the back of the pubic bone. If they are “rock solid” behind the bone, the operation is probably still anatomically intact. If not, the sutures may have come loose.

Run your finger along the lateral walls of the vagina to assess whether the levator ani muscles are too tight, palpable as a band of muscle, which may be quite tender on palpation if the patient has dyspareunia (called levator muscle spasm). For further details, see Chap. 12.

Also, palpate the urethra to feel for a cystic swelling, suggesting a urethral diverticulum. If you feel a urethral swelling, palpate it gently, you may see watery or discolored fluid coming out if there is a urethral diverticulum.

## Assess the Pelvic Floor Muscle Contraction Strength: Oxford Score

Several studies have shown that when asked to contract their pelvic floor muscles during examination, about 50–60% of women will mistakenly contract their gluteal muscles (lifting their buttocks off the couch slightly) or contract their abdominal muscles (which increases the intra-abdominal pressure, the opposite of what is needed).

It is important to place one finger partly in the vagina and exert very gentle downward traction on the pelvic floor muscles about 2 cm inside the introitus, then explain that this is the muscle we want to contract. We find it helpful to ask the patient to pretend that she is in a public place (church or movie theater) and feels wind building up in the rectum and to tighten the muscles around the rectum to stop the wind escaping. Most patients have a rough idea of what you are talking about and give a small contraction. You then encourage them by explaining that this is the correct muscle, with gentle digital traction on the muscle, and explain that now you are going to ask them to contract the muscle as hard as possible and count the number of seconds that they can hold on. The strength of the contraction is re-recorded as the modified Oxford score [2] (Table 2.1), and we find it helpful to also record how many seconds the patient can hold the contraction.

Once you have assessed the strength and duration of the pelvic floor contraction, you can start the patient on a pelvic floor muscle training program (see Chap. 6).

## Rectal Examination/Neurological Examination

Patients with a fairly simple history of stress and/or urge incontinence do not really require a rectal examination, which is uncomfortable and embarrassing. If you suspect neu-

TABLE 2.1 Pelvic floor assessment grading

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0 = nil

1 = muscle on stretch—Flicker

2 = weak squeeze with 2-s hold

3 = fair squeeze and 5-s hold with lift

4 = good squeeze and 7-s hold and lift, repeats ×5

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5 = strong squeeze and 10-s hold with lift, repeats ×10

rological disease (which can affect anal function), or the patient has anal incontinence, a rectal exam to assess the tone and quality of the external anal sphincter is often useful. Fecal impaction is often palpable as hard lumps of feces impinging on the posterior wall of the vagina during the assessment of the pelvic floor muscles vaginally. Inspect the anal margin for large floppy external hemorrhoids, which may be difficult for the patient to clean after defecation; they may give rise to fecal staining and can be readily treated by day-surgery by a colorectal surgeon.

If the patient has symptoms of a rectocele, but she comes to see you with an empty rectum, so you cannot find the rectocele, then explain you would like to do a rectal exam to see it better. Gently place a finger in the rectum and press forward (away from the sacrum), a rectocele may be quite obvious if you do this. If still not visible, ask the patient if she sees the problem better when she is standing up. If so, ask her to stand with one foot up on a footstool and illuminate the vaginal opening and ask for a prolonged Valsalva. (This can also help in cases of a cystocele or uterine descent that is difficult to see).

*A basic neurological exam* is important if a patient has a history of trauma to the lumbosacral region or neurological symptoms that have not been investigated. The lumbosacral region is of most interest.

The power of the lower limbs, the deep tendon reflexes at the heels, and the sensation of the perineal skin (S4), the skin over the inner lower thigh (S3), or the mid-inner thigh (S2) should be checked. Inspect and palpate the lumbosacral spine (sacral dimple may suggest spinal dysraphism; sacral lipoma may be seen). Lightly stroking the skin just beside the anus should provoke a slight contraction of the anus. After explanation, lightly tapping the clitoris should also cause the anus to contract (the bulbocavernosus reflex). After clothing is replaced, observe the patient's gait. If these simple tests are abnormal, a full exam by a neurologist is worthwhile.

Beware patients with a tremor or a "staring" facial expression, as they may have Parkinson's Disease, which is commonly associated with severe detrusor overactivity as well as

incomplete emptying. Other neurological conditions associated with detrusor overactivity are Multiple-System Atrophy (Shy Drager Syndrome), Multiple Sclerosis, Spinal Cord Injury, Transverse Myelitis, and Stroke. For a good overview, see [3].

## Overview of Examination for Mesh Complications/Pain

Further details of the IUGA mesh complications scoring system are given in Chap. 12. However, the basic concept is to perform a careful inspection of all vaginal walls on speculum exam, to look for mesh extrusions, then measure their dimensions and write down which wall they are located on (anterior, posterior, posterior fornix or vault) and how far up into the vagina they are located, in centimeters. Next, carefully palpate all vaginal walls, feeling for any extrusions that were too small to see properly but may still be tender. Palpate for any mesh tenderness or thickening deep in the vaginal walls, and again describe which wall they are on and location in the vagina. Observe spasm of the levator ani muscles when you palpate (as patients may have secondary pain in the muscle). If any purulent discharge, take microbiology swabs from each area.

## References

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# Chapter 3

## How to Manage the Patient After History and Examination

### First, Treat Precipitating Factors

The complete management of incontinence and prolapse is not just a surgical exercise! You need to think about the patient's medical problems as they relate to their pelvic floor problem. Collaboration with physicians and other surgeons may be needed. From a medical point of view, referral to a respiratory physician for chronic cough, endocrinologist (for hypothyroid-related obesity, diabetes), dietician, or neurologist may be required. If the patient has truncal obesity and cannot lose weight, order tests for serum insulin levels at 0, 1, and 2 h after 75 g glucose load; if she has insulin resistance, metformin therapy is likely to help her lose weight. From a surgical point of view, referral to an ENT surgeon, thyroid surgeon, or colorectal surgeon may be needed. The urogynecologist should treat constipation and atrophic vaginal symptoms.

As mentioned, if midstream urine dipstick suggests cystitis, this should be treated, as bacterial endotoxins may weaken urethral sphincter strength or exacerbate detrusor contractions; thus, cystitis may worsen incontinence (see Chap. 11).

## Second, Obtain All Relevant Old Notes

Previous continence surgery needs to be precisely documented, so that you can assess the likelihood of “natural failure” of the procedure or the risk of postoperative voiding difficulty that may not be symptomatic. In the case of Mesh Pain/Complications, you definitely need to get the old notes as patients often have no clear details of what mesh they had inserted (e.g., whether it was a retropubic mesh sling or a trans-obturator mesh tape. In the case of mesh for prolapse, they often do not recall whether it was mesh in the anterior wall, posterior wall, or both walls.

Any previous major abdominal surgery needs to be clarified, especially radical surgery for malignancy, as this may disturb the local innervation or relays between the sympathetic and parasympathetic nerves in the pelvis, leading to complex incontinence. If the patient has any pelvic malignancy, you need to get case notes about the diagnosis and the Stage of disease, as patients may not be able to tell you this accurately. If they have had radiation treatment, get notes from the radiation oncologist as to whether they may have radiation cystitis (chronic frequency with small bladder capacity, may not resolve).

## Third, Begin a Basic Management Program for Urinary Incontinence

If the condition is mild, this may be curative (see Chap. 5 for definition of mild, moderate, severe.). If the condition is severe or complex, urodynamic tests will be required, but there may be a waiting time for this, hence the need to start basic continence therapy.

- If mild stress incontinence and good PFM strength, give home PFM training program, and refer for two to three physiotherapy visits (Chap. 6).
- If mild stress incontinence but weak PFM strength, refer to physiotherapist for electrostimulation; see patients after 12-week therapy; book urodynamics then if no cure.

- If severe primary stress incontinence (wants surgery), book urodynamic testing; discuss the surgical options (see Chap. 9) and give information sheets from [www.iuga.com](http://www.iuga.com).
- If mild urge incontinence (or just OAB dry syndrome, not wet), start bladder training program (Chap. 7), and consider referral to nurse continence advisor for detailed training.
- If severe urge incontinence and if long wait for urodynamics tests give therapeutic trial of anticholinergic drugs, with bladder training (patient to stop drugs 1–3 weeks before test, see Chap. 7). Check whether nocturia is a problem; if so, check the Bladder Diary for nocturnal polyuria and/or a history of snoring, which may indicate sleep apnea; if so, refer for sleep studies. Give some anticholinergics (e.g., Imipramine) at night to start with.

## If Prolapse Is Present

If mild symptoms and mild on examination, consider referral to physiotherapist. Treatment of precipitating factors can make cure more likely. If there is a moderate or severe prolapse, assess suitability for surgery and patient's wishes (see Chap. 10). Discuss vaginal ring pessary and give information sheet (see Chap. 10).

If patient desires surgery, give information sheets from [www.iuga.com](http://www.iuga.com). Ensure postmenopausal women are given topical estrogens prior to ring or surgery, as this medicine improves tissue quality. The ring is tolerated better in our experience with less likelihood of vaginal exudate from the foreign body. Surgically, the tissues handle better when they are estrogenized, although this has been difficult to quantify/substantiate in the literature.

## If Anal Incontinence Is Present

Consider referral to appropriate physiotherapist if mild (Chap. 8). If severe, consider referral to colorectal surgeon for anorectal testing.

If the patient has symptom of post-defecation soiling with a rectocele, the colorectal surgeon is likely to advise that you undertake corrective surgery, especially if there is an entero-coele (because urogynaecologists perform sacrospinous fixation, which is the first line surgery for primary enterocoele, and colorectal surgeons do not perform this case).

Watch out for patients with large external haemorrhoids that are difficult to clean, this can also cause soiling of the underwear, and promote recurrent cystitis. The colorectal surgeon will often perform rubber banding of these hemorrhoids as a minor procedure.

## If Recurrent Cystitis Is the Complaint

Obtain old MSU results where possible to check for proven UTI today. Make sure that the recurrence is not due to inadequate treatment of unrecognized multi-resistant organisms. Consider whether haematuria warrants referral to urologist. Order renal ultrasound and post-void residual measurement. Consider booking uroflowmetry for next visit. Make *sure* postmenopausal lady with recurrent UTI is on Ovestin. Consider non-antibiotic prophylaxis, e.g., Hipprex 1 gm BD with Vit C, Cranberry tablets with Ural, or D Mannose (Chap. 11).

## If Painful Bladder Syndrome Is Suspected

Consider diagnosis of interstitial cystitis (Chap. 12). Make sure the urine is sterile, give three urine jars to be tested at the low-count bacteriuria cut off. Check that the Bladder Chart documents the severity of symptoms, if not clearly severe frequency and nocturia, do another one day chart on a “bad” day. Patient may wish to try a mild bladder relaxing medication (Imipramine) but need to consider booking a cystoscopy with refill examination ± biopsy and diathermy.

If Mesh Pain/ Erosion/ Complications is the Complaint.

If the mesh erosion is quite small, and not painful, less than 2 cm in maximum diameter, then 6–12 weeks of vaginal oestradiol crème may allow the vaginal tissues to close over the erosion. If there is mild tenderness on palpation of the mesh area, then add daily Imipramine 4% cream for 6–12 weeks as it may be very helpful. If the mesh erosion is larger than 2 cm, or painful in daily life, then the patient is likely to warrant removal of the erosion with over-sewing of the vaginal epithelium. If there is mild inflammation or a mucopurulent discharge, then 2 weeks of broad-spectrum antibiotics should also be trialled. Further details of explanation are given in Chap. 13.

## Explaining the Situation to the Patient

As regards *Urinary Incontinence*, most patients have little idea that there are different kinds of leakage. We find it helpful to give out a short booklet explaining this at the end of the first visit,<sup>1</sup> which describes the symptoms, causes, and treatments of stress, urge, and overflow incontinence. It is helpful to explain that, using a step-by-step approach, most incontinence is largely curable, but that it will not happen overnight. You need to be very sympathetic during this explanation, emphasizing how common the problem is (10% of all women under age 65, 25% of women over age 65, and 30% of women who have recently delivered a baby), so that the patient realizes she is not alone in her problem.

As regards *Uterovaginal Prolapse*, many patients have little idea of their anatomy, which walls/organs may be involved in prolapse, and that severity of each one does vary. If a patient has both urinary incontinence and prolapse, you need to explain that these two conditions are quite separate. We find it extremely helpful to draw a diagram for the patient, illustrating her particular prolapse problem and showing her degree of severity. If surgery is indicated/desired, the relevant

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<sup>1</sup> [www.pelvicfloorunit.com.au](http://www.pelvicfloorunit.com.au)

procedures should also be sketched simply on the diagram (see Chap. 10).

As regards *Anal Incontinence*, almost all patients with this problem are deeply embarrassed. Again, it is helpful to explain that there are different causes for this condition; treatment needs to be according to the cause, and thus, investigation is very helpful. Although cure is not as uniformly guaranteed, major improvement is generally likely to occur.

As regards *Recurrent Cystitis and Bladder Pain Syndrome*, many patients come to the clinic with these conditions not clearly delineated. They need to understand that the two conditions are mutually exclusive. That is, proven recurrent cystitis is an exclusion criterion for the diagnosis of painful bladder syndrome. Both of these diagnosis have completely different treatments, and once the initial investigations are complete, it is likely that a careful cystoscopy will be needed. *Summary:* The patient should leave the first visit with a basic understanding of her problem, and feel confident that a “plan of attack” of her condition has been started. She needs to understand that the bladder and the pelvic floor is a delicate system, which needs a “step-by-step” approach to resolve the dysfunction.



# Chapter 4

## How to Conduct Urodynamic Studies: Essentials of a Good Urodynamic Report

### Who Needs Urodynamic Testing?

Urodynamic testing is an invasive procedure. At the minimum, a urethral catheter and a rectal recording line must be inserted. The risk of iatrogenic bacterial cystitis is about 2%. Studies show that urodynamic testing is not cost-effective in *all* patients with urinary leakage, because it does not *always* affect management. For example, women with mild stress incontinence may be rapidly cured by physiotherapy and never need urodynamic testing.

On the other hand, it is fair to say that performing incontinence surgery without having a urodynamic diagnosis of stress incontinence, excluding detrusor overactivity, and checking for voiding difficulty is not good medical practice at all. Several studies have shown that simply having a main complaint of stress incontinence does not equate to the patient having urodynamic stress incontinence (USI).

As is explained further in Chap. 9 (surgery for USI), the fact that a cough can provoke a detrusor contraction was a major stimulus for establishing urogynecology as a subspecialty. Gynecologists realized that simply operating on patients who leak when they cough often failed.

So one needs to take a stance midway between “urodynamics for everyone” (not warranted because of the invasive-

ness of the procedure) and urodynamics only for those who are surgical candidates. In practice, the real problem is that so many patients have mixed symptoms. Urodynamic results do help to dissect out the relative severity of the different components in patients with mixed incontinence and thus guide you as to the main thrust of treatment. This is described in the case history at the end of this chapter.

In general, urodynamics is very worthwhile in the following cases (in descending order):

- Patients with *failed continence surgery* need detailed urodynamic studies.
- Patients with symptoms or a past history of *voiding difficulty* (previous prolonged catheter or self-catheterization post-op or postpartum) need voiding cystometry.
- Patients with *mixed symptoms and cystocele* who are considering surgery should have detailed urodynamics, possibly with ring pessary in situ (see “Occult” Stress Incontinence).
- Patients with *mixed stress and urge leak* need cystometry with ultrasound, to determine the relative severity of the two problems.
- Patients with *pure stress incontinence symptoms who have failed physiotherapy* should have cystometry with ultrasound, to check whether there is undiagnosed detrusor overactivity or incomplete emptying.
- Patients with *pure urge symptoms who have failed bladder training and anticholinergic therapy* should also have cystometry with ultrasound, to look for an undiagnosed stress incontinence component or incomplete emptying (the latter may be worsened by the anticholinergic drugs).

## Different Forms of Urodynamic Studies

The term “urodynamics” is a general phrase, used to describe a group of tests that assess the filling and voiding phase of the micturition reflex, to determine specific abnormalities.

Some of these tests are not “physiological.” For example, inserting catheters into the urethra and a pressure line into the rectum, then expecting the patient to fill and empty as she normally does, may not give a “true” picture of that woman’s bladder function. Nevertheless, the tests have been standardized over the last 40 years by the Standardization Committee of the International Continence Society (ICS), and are performed in a similar fashion across the world. Therefore, abnormalities are interpreted in a standard way and have a common meaning in clinical practice.

The tests that are generally used include the following:

- *Uroflowmetry*: Measuring the patient’s flow rate when voiding in private, onto a commode that is connected to a collecting device that measures the rate of fall of urine upon the device.
- *Simple cystometry*: Inserting a single catheter into the bladder that measures pressure, with no correction for abdominal pressure, during a filling cycle, not widely used in the Western world.
- *Twin channel subtracted cystometry*: Inserting a pressure recording line into the bladder as well as a filling catheter, along with an abdominal pressure recording line (rectal balloon), that records a filling cycle. The abdominal pressure is subtracted from the bladder pressure to give the detrusor pressure (see Fig. 4.1 and later figures).
- *Voiding cystometry*: The same as twin channel cystometry above, but the patient is asked to void into a uroflow commode while the pressure lines are in situ, so that the contractility of the detrusor muscle during the voiding phase is measured.
- *Videourodynamics*: The same as voiding cystometry above, but radiopaque X-ray contrast dye is used to fill the bladder. The test is done in the X-ray department, and the bladder/urethra is filmed during cough and other provocation. In males, filming is continued during the voiding phase, but 60% of women are not able to void in these public conditions. Post-void films are taken to check residual.

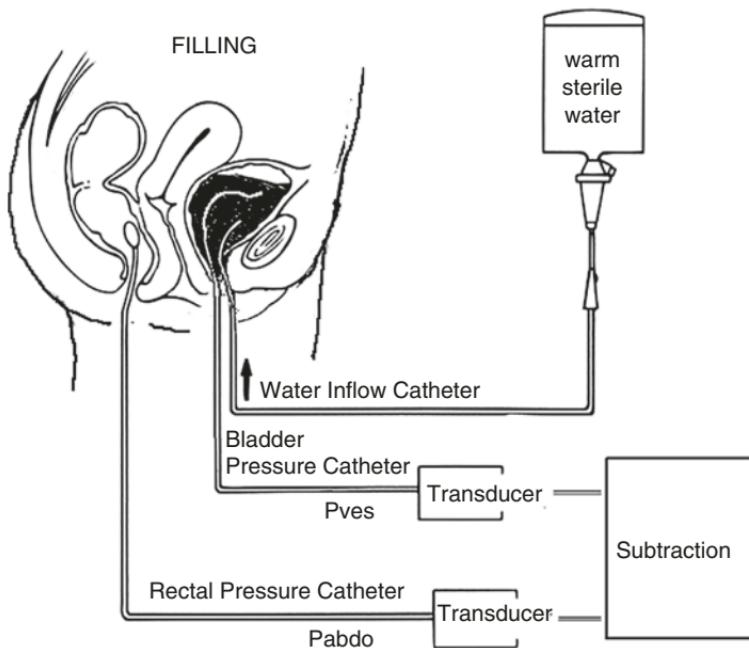


FIGURE 4.1 Schematic diagram of twin channel cystometry

- *Voiding cystometry with ultrasound:* The same as voiding cystometry, but ultrasound imaging is undertaken during cough and other provocation, and post-void ultrasound is done.
- *Urethral pressure profile:* Tests the function of the external urethral sphincter, performed in selected cases. Similar information is available from *leak point pressure* testing.

The Bladder Diary and the pad test are also part of urodynamic assessment, but these are discussed in Chap. 5 (Outcome Measures).

## Practical Advice About How to Perform Urodynamic Studies

This section gives practical advice for a registrar or resident/house officer who is newly attached to an urogynecology department. For information about the medical physics of the

tests [1], a pocket book by Peterson and Fraser (2016) is recommended.

*Calibration of the Equipment* In essence, one must check that the equipment is correctly functioning and measures what it is supposed to measure.

Calibration of the urine flow machine involves pouring a known quantity of fluid into the uroflow equipment at a reasonably slow rate and then checking that the volume poured in equals the volume measured and that the computer calculated the flow rate correctly.

Calibration of the cystometry equipment involves checking that a column of fluid 100 cm high yields a pressure reading of 100 cmH<sub>2</sub>O water pressure, then zeroing the transducers to atmospheric pressure (room air) so that zero pressure gives a zero reading. For detailed discussion, see suggested further reading.

## General Clinical Aspects

When a patient presents for urodynamics studies, you need to “troubleshoot” to make sure that the test can be correctly performed on the day.

If she has symptoms of acute urinary tract infection (dysuria, foul-smelling urine, excessive frequency, strangury, or hematuria), then the test should be postponed, a midstream urine culture taken, and antibiotics prescribed. This is because instrumentation of the lower urinary tract in the presence of infection can cause septicemia and hospitalization.

In many units, there is a substantial delay between the first visit date and the date of the urodynamic test. In these cases, you should review the patient’s status quickly before starting the test. If the patient was given a therapeutic trial of anticholinergic therapy at the first visit, she should be given clear instructions to stop them 1–3 weeks before the test, depending on the half life of the medicine (see Chap. 7). If she is still taking them, then cystometry may not diagnose detrusor overactivity, so the test may need to be postponed so anticholinergic tablets can be stopped.

If the patient had mild symptoms and has been attending a physiotherapist or nurse continence advisor in the meantime, she may be cured of her incontinence and no longer need the test.

As you prepare to do the test, look at her *bladder chart*, to see whether, in her daily life, she mostly has stress incontinence, or urge leak, or both. You need to know what you are looking for.

## Explaining the Test to the Patient

This is often done by the urodynamics nurse, who must form a trusting relationship with the patient. In our unit, that same nurse may have been involved in taking her initial history or will often be involved in following up the patient's response to treatment subsequently.

Urodynamic testing does involve some minor discomfort with passage of urethral and rectal catheters, but if performed in a dignified and sympathetic manner, most patients say that it was just slightly uncomfortable. In a teaching unit, only one medical student should "watch" the procedure. Actually, we ask the student to position the lamp and type in data on the computer, so they do not "watch" the patient but are actively involved. Patients do not like to feel like a goldfish in a bowl, especially when they are being asked to leak.

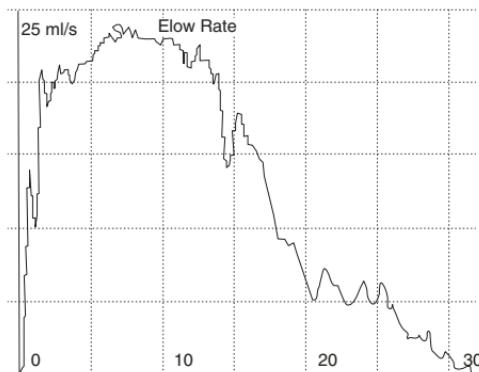
Before starting to fill, the nurse or doctor also explains the concepts of first desire to void, strong desire to void, and maximum cystometric capacity (see below). It is important for patients to know we will stop filling if they have significant discomfort.

## Uroflowmetry

Ideally, the patient should come to the urodynamics test with a comfortably full bladder, then pass urine in a private uroflowmetry cubicle. Because many patients empty their blad-

FIGURE 4.2 Normal uroflow curve.

Maximum flow rate  
25 ml/s (Q Max),  
average flow rate  
14 ml/s (QAve),  
voided volume  
410 ml/s, flow time  
31 s



der just before seeing a doctor, this is not always possible (no matter what letter you send beforehand).

A normal urine flow rate (shown in Fig. 4.2) looks like a bell-shaped tracing. The maximum flow rate should be at least 15 ml/s, but this cannot be judged unless the voided volume is at least 200 ml. This is because flow rate depends on the volume in the bladder. For example, if you drink several pints of beer, you will pass urine rapidly. If you only drink the occasional small cup of tea, your flow rate will trickle out.

Other parameters that are measured include the total duration of flow time to empty the bladder and the average flow rate (i.e., the volume voided divided by the flow time).

Typical abnormalities of flow rate in women include intermittent prolonged flow rate with evidence of abdominal straining, suggestive of outflow obstruction (see Fig. 4.4b). This most commonly occurs after surgery for stress incontinence that has overcorrected the urethral support. It is also seen in women with a cystourethrocele, in which the urethra may be kinked during voiding.

Normal values for flow rate in relation to volume voided have been derived from a study of several hundred normal women (Haylen et al. [2]; see Fig. 4.3). These “nomograms” allow you to determine what centile of the population a patient’s flow rate represents. For research studies, flow rates should be given in centiles. Flow rates below the tenth centile are abnormal.

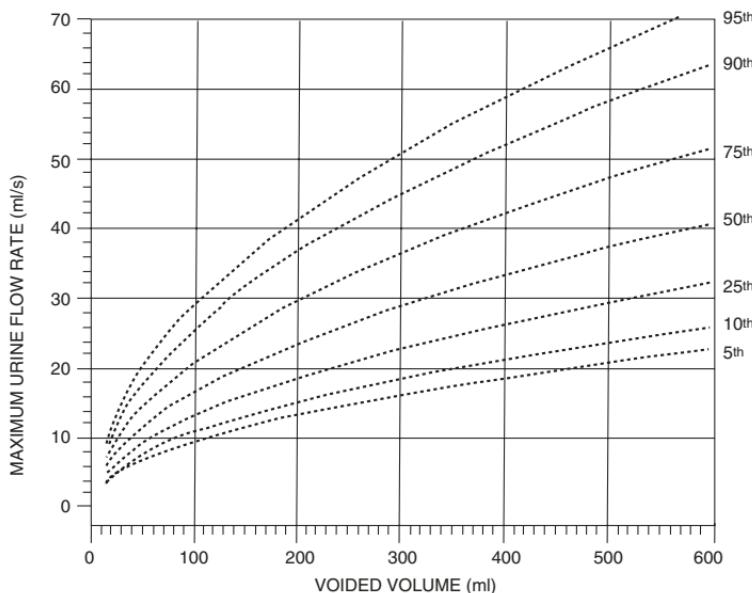


FIGURE 4.3 Liverpool nomogram for maximum urine flow rate in women

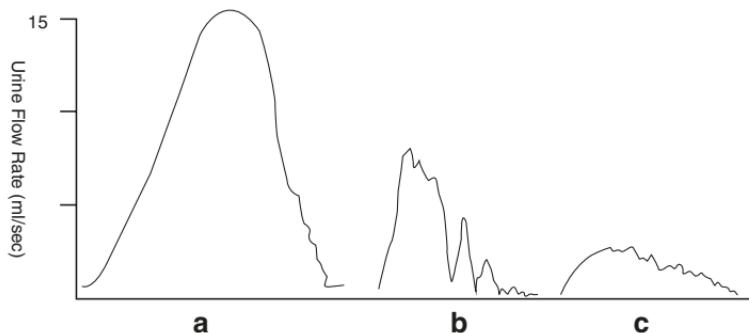


FIGURE 4.4 (a) Normal. (b) Abdominal straining, suggesting an out-flow obstruction, eg tight urethra. (c) Underactive detrusor redrawn

The other common abnormality in elderly women is an underactive detrusor; see Fig. 4.4c. The peak flow rate is poor; the average flow rate is poor, but there is no evidence of

abdominal straining. The detrusor contraction is intrinsically weak, but this needs to be proven by voiding cystometry.

Less common voiding abnormalities are described in the section on voiding cystometry (detrusor hyperactivity with impaired contractility, DHIC, seen in the elderly with mild neurological dysfunction, and detrusor sphincter dyssynergia, seen only in neuropathic disease such as multiple sclerosis).

After uroflowmetry, residual urine volume is measured either by catheterization, if the patient is about to undergo cystometry, or by ultrasound. A simple “bladder scan” (Bard) may be used, which automatically calculates the residual volume. Alternatively, standard transabdominal or transvaginal ultrasound is used to measure the residual volume, and formulae that calculate the volume of a sphere are then used by the clinician to calculate the residual amount (e.g., width × depth × height × 0.7).

## Preparing the Patient for Cystometry

To pass the bladder catheters, the urethra is cleansed with sterile saline; a sterile drape is placed around the urethra; Lignocaine gel is applied to the urethra, then the filling line and the pressure recording line (similar to a central venous pressure manometry line) are inserted into the urethra. Usually, the manometry line is inserted into the distal catheter hole, so the patient only feels one line going into the urethra, then the manometry line is disconnected from the filling line by pulling it backward slightly once it is in the bladder. The vesical pressure line is then attached to the domed transducer unit, which feeds into the software of the urodynamic equipment. See Fig. 4.5.

Some units employ a catheter that has a micro-tip pressure transducer embedded into the distal end, so that an external transducer is not needed and the slight artifactual delay encountered in the fluid-filled system is avoided. Such micro-tip transducer catheters are quite costly (1500–1800 Euros per catheter) and are quite delicate, so they may last roughly



FIGURE 4.5 Bladder filling line, vesical pressure line, and rectal recording line

6 months to 2 years of normal use. The fluid-filled pressure recording lines are single-use items, costing a few Euros per set. Each unit decides which catheter type to use, generally on the basis of cost.

*Passing the Rectal Catheter* The very small rectal transducer catheter is attached to the abdominal pressure recording line (usually prepackaged by the manufacturer). The line is coated in sterile lubricant, then placed into the rectum. One should not push the finger into the patient's rectum; this is unpleasant and unnecessary. Just gently insert the line about 3 cm into the rectal ampulla. As an alternative, a vaginal balloon may also be used to record pressure in the vagina, which is equivalent, but this is usually not successful in parous women as the balloon slips out from the vagina in the erect position.

## Twin Channel Cystometry

After connecting the bladder pressure recording line and the abdominal pressure recording line to the transducer domes, insert fluid into the line to exclude air bubbles, then zero the recording pressure using the software of the urodynamic program. The software program will subtract the abdominal pressure (Pabd) from the vesical pressure (Pves) to yield the true detrusor pressure (Pdet).

The bladder is then filled with warm sterile water. Medium filling rate (75 ml/min) is generally used, except in neuro-pathic patients, where a slower filling rate is needed (25 ml/min). A peristaltic pump is used to prevent backflow into the bladder during a rise in detrusor pressure. The following parameters are important in a full urodynamic report (*italics* underlined):

- Results of free uroflowmetry if available.
- Initial residual urine volume (after the patient has performed free uroflowmetry)—normal residual = less than 50 ml.
- Whether pain or resistance to catheterization is noted (may suggest urethral stenosis).
- The first desire to void, when patient first notes that she would look for a toilet—normal FDV = 150–200 ml.
- Normal desire is often reported, when patient would normally stop work and go to toilet—normal desire usually = 300–350 ml.
- Maximum cystometric capacity, when patient would not tolerate any more fluid. Although the patient should not be pushed to the point of bladder pain, we use the example that if she were driving in the country, she would get out of her car and go behind the bushes to void—normal MCC = 450–550 ml.
- The filling line is then removed (because it has a diameter sufficient to obstruct the outflow of urine during the next steps).

- A supine cough is performed, while the urethra is visually inspected to look for a *stress leak*. Reassure the patient that there is only sterile water in the bladder and that all linen is discarded after each test, so her leaking will not spoil the linen. At this point, a cough-provoked detrusor contraction may be seen.
- Supine tap water provocation is performed, while asking if urgency is increased by the sound of running water (and rise in detrusor pressure is checked for).
- The patient then stands erect.
- The transducer levels are readjusted so that they remain at the level of the symphysis pubis (e.g., raise them for a tall patient).
- Erect tap water stimulus is performed (as for supine).
- Erect cough is performed, with the legs widely apart. Reassure the patient *again* that if any fluid escapes, it is only sterile water; there is no urine in the bladder, and this is an important part of the test.
- The patient then sits down on the uroflow commode; the transducers are lowered so they remain at the symphysis pubis, and voiding cystometry commences. (report Q Max, Q Ave)
- Final residual is recorded by ultrasound (or X-ray in videourodynamics test).

## Urodynamic Diagnoses Available from the Filling Phase

The diagnoses that may be made during the filling phase Abrams et al. [3] are as follows:

*Urodynamic stress incontinence (USI)* is the involuntary leakage of fluid during increased abdominal pressure, in the absence of a detrusor contraction (Fig. 4.6).

*Detrusor overactivity (DO)* is a urodynamic observation characterized by involuntary detrusor contractions during the filling phase, which may be spontaneous or provoked. The

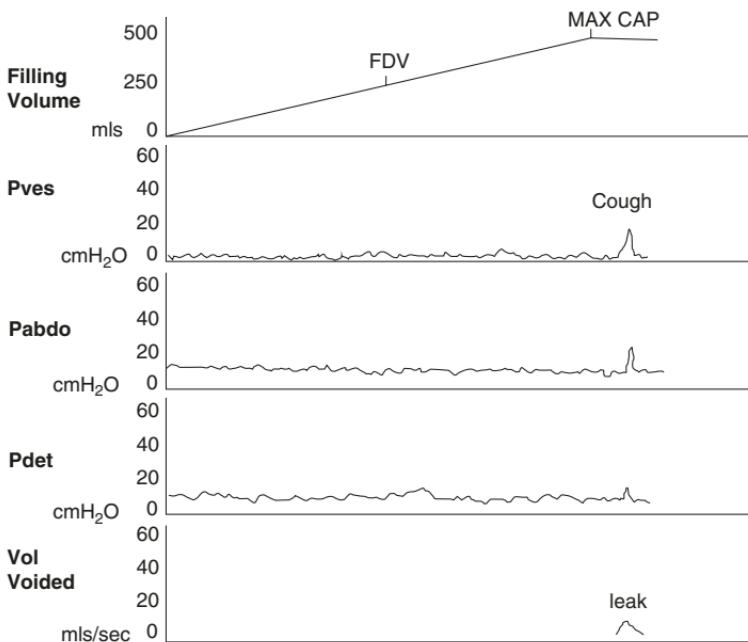


FIGURE 4.6 Urodynamic stress incontinence, with a normal FDV, SDV, and MCC, no detrusor contractions (Pves and Pdet remain flat) but obvious leak of fluid with cough

most common picture is that of systolic detrusor pressure waves, seen during the filling phase (Fig. 4.7). The same picture is seen when the sound of running tap water provokes a detrusor contraction.

A less well-understood phenomenon is detrusor overactivity seen as a gradual linear rise in bladder pressure (Fig. 4.8) that persists after filling stops, in association with urgency. This is often termed "*low compliance DO*."

Finally, two less common but important variants of systolic overactivity are cough-provoked DO and erect-provoked DO. Cough-provoked DO is usually quite clearly seen on the tracing (Fig. 4.9).

But erect-provoked DO often needs careful scrutiny to exclude artifact. A common problem is that the abdominal

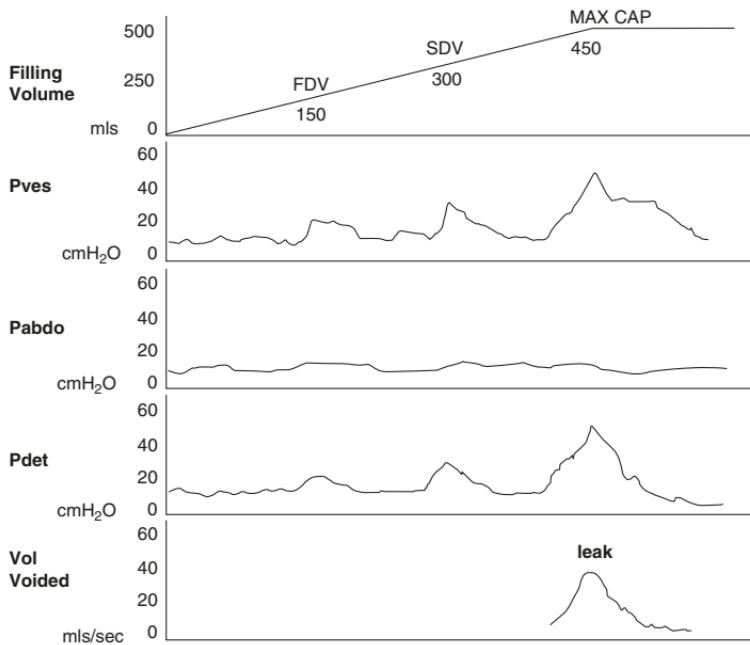


FIGURE 4.7 Detrusor overactivity with systolic waves of detrusor contractions, seen at FDV and at MCC. Stress leak does not occur

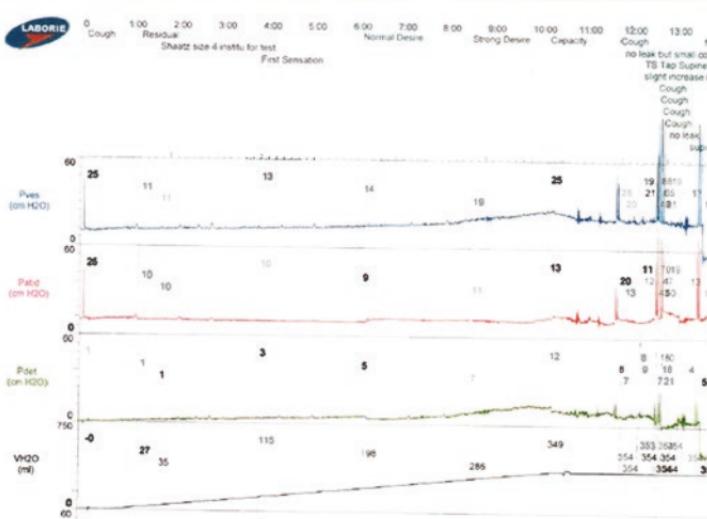


FIGURE 4.8 Low compliance detrusor overactivity

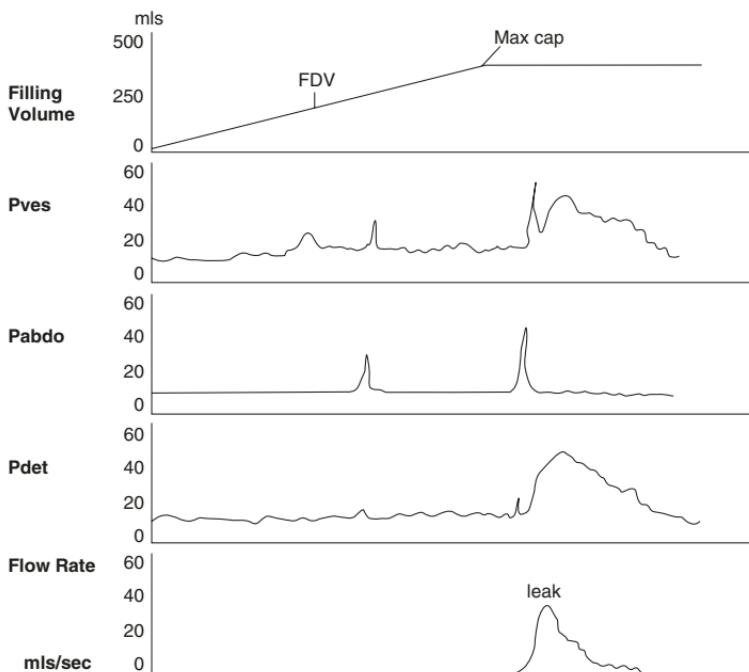


FIGURE 4.9 Cough-provoked detrusor overactivity

pressure transducer is not readjusted when the patient stands up (it is not repositioned to the level of the pubic symphysis). If a short patient stands up from the table, her pubic bone may drop to well below its original site when she was lying on the couch; Pabd then becomes negative. Because Pves minus Pabd equals Pdet, if you subtract a falsely negative Pabd, you will get a falsely positive Pdet when the patient stands (see Fig. 4.18 given as part of the case history at the end of this chapter).

*What Is Sensory Urgency?* For many years, patients who suffered from frequency, urgency, and nocturia, in whom urodynamic testing revealed a stable bladder but a very early first desire to void (less than 100–150 ml) and a small maximum cystometric capacity (less than 400 ml), were diagnosed

as having sensory urgency Jarvis [4]. These patients often found bladder filling unduly uncomfortable. More recently, the International Continence Society has termed such patients as being on the mild end of the spectrum of “bladder pain syndrome.” The severe end of the spectrum is frank interstitial cystitis (see Chap. 12, these patients mainly complain of suprapubic pain). The milder end of the spectrum is now called bladder oversensitivity.

A problem arises in that repeat twin channel cystometry (and ambulatory cystometry, a research tool) will reveal detrusor overactivity in at least one third of cases of “sensory urgency.”

The management of patients with a small capacity stable bladder is therefore usually empirical. One starts out treating as for detrusor overactivity. If the patient does not respond, then cystoscopy to look for features of interstitial cystitis is reasonable. This area is controversial.

*Features of the Atonic Bladder During the Filling Phase*  
Patients with a very late FDV (more than 400–500 ml) and a very large MCC (more than 650–750 ml) have characteristics of an atonic bladder, but this condition should not really be diagnosed until voiding cystometry has been performed, to prove that the detrusor is underactive.

Before going on to describe voiding cystometry, a summary of *videourodynamic testing* and twin channel cystometry with *ultrasound imaging* is given.

## Videourodynamic Testing

This involves installation of a radiopaque dye (e.g., Hypaque) dissolved in warm water, while screening intermittently using a fluoroscopy unit with image intensifier in the radiology department. A fluoroscopy table that rises to the erect position is needed, with a platform on the bottom of the table, so that the erect patient can turn to the side for filming of the lateral view of the bladder neck and urethra (see Fig. 4.10). This study is often termed *videocystourethrography (VCU)*, where a videotape can be made of the screening images that



FIGURE 4.10 Patient in erect position during screening on videocystourethrography

most software packages can superimpose upon the cystometry tracing and store for later review.

Because VCU involves exposure to X-ray and installation of iodine-containing medium which patients may be allergic to, not to mention the costs of using the fluoroscopy unit, it is only needed in selected cases.

VCU was the initial “gold-standard” urodynamics test when systematic urodynamic testing started in London in 1971. It is still important for male patients in whom prostatic outflow obstruction needs to be delineated from simple detrusor overactivity. In men, the voiding phase is always screened. Also, in men with neurogenic incontinence, VCU allows a clearer definition of any contribution from prostatic outflow obstruction. Finally, VCU allows detection of vesico-ureteric reflux, which may threaten the upper urinary tract.

In the female, studies have shown that about 60% of women cannot void in the upright position on a screening table with a collecting funnel between their legs.

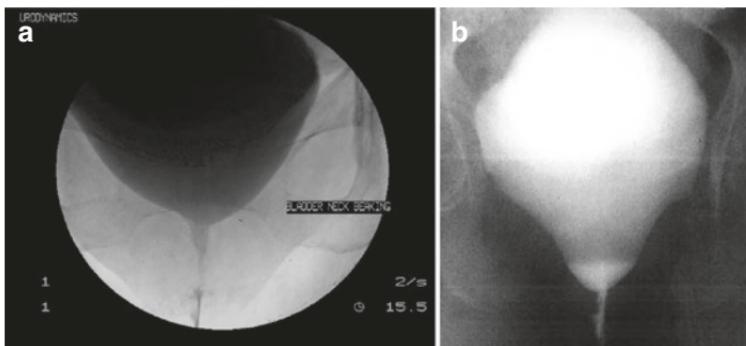


FIGURE 4.11 (a) “Beaking” on VCU, more obvious on patient’s right side (b) Funneling on VCU

Females can still cough of course, and the X-ray contrast dye allows you to see the anatomy of their incontinence. During a cough, the bladder neck may be slightly open, forming the shape of a bird’s beak, with fluid entering the proximal urethra (called “beaking,” see Fig. 4.11). In more severe cases, the urethra may open widely in the shape of a funnel during cough (called “funneling”). In the worst-case scenario, as soon as the patient stands, the bladder funnels open widely, and fluid pours out onto the floor. These findings have been classified using various grading systems which are not used in all departments.

VCU is very helpful in women with failed previous continence surgery. In the anteroposterior view, typical features of previous colposuspension or sling can be seen, with slightly “dog-ear”-shaped indentation just lateral to the bladder neck. Sometimes although these lateral indentations are partly evident, the urethrovesical junction may still be hypermobile on the lateral view, suggesting that the sutures are no longer effective.

The patient in Fig. 4.11 had undergone Macroplastique injections to the midurethra, which explains the slightly asymmetrical picture of the “beak.”

In other cases, the sutures are very evident; the bladder neck does not open appreciably, but fluid still leaks out. This is typically suggestive of *intrinsic sphincteric deficiency*; that is, the urethral musculature is intrinsically weak. Most clinicians would seek to quantify this by performing an abdominal leak point pressure or a urethral pressure profile (see below).

*Value of VCU in Cystocele* In patients symptomatic of cystocele (often worse at the end of the day, not when you examine them in the morning clinic), a cystocele may be very evident in the erect position with a full bladder that was not clearly seen when examined in the supine position in the clinic. At the end of the voiding phase, you may also see urine trapping in the cystocele (when screening in the erect position to check post-void residual; see Fig. 4.12).

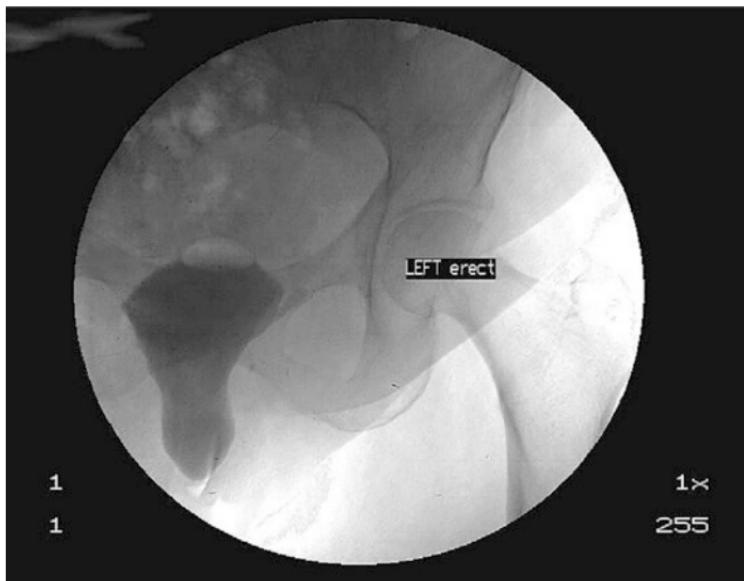


FIGURE 4.12 Urine trapping in a dependant cystocele after voiding

## “Occult” Stress Incontinence

One problem in urogynecology is that a patient with cystocele but no appreciable incontinence may begin leaking only *after* an anterior repair for her cystocoele. This is because the cystocele may involve the upper portion of the urethra, so when the cystocele descends during cough, the urethra is kinked off, masking the incipient incontinence. It is very disturbing when the patient comes to the postoperative visit complaining of stress incontinence for the first time. This is known as “occult” stress incontinence. The likelihood of this occurring ranges from 7 to 28%, depending upon the publication (for review, see Haessler et al. [5]).

Such patients may have to replace their cystocele manually before they can urinate properly. If they do not digitate the cystocele, they can have initial hesitancy, need to strain to start, and have terminal dribble. In such cases, it is worthwhile to conduct VCU (or twin channel cystometry) with a ring pessary in situ, as this is likely to unmask the occult incontinence. This allows one to incorporate a specific procedure for incontinence into the repair operation.

## Ultrasound

Because of the costs and X-ray exposure involved with VCU, ultrasound imaging has become much more popular as part of urodynamic testing. Initially, transvaginal scanning was used, which allowed good definition of the bladder neck but could not be performed during a stress provocation test (because the vaginal probe interfered with urethral leakage). In the last three decades, trans-perineal scanning has allowed good visualization of the bladder neck. See Fig. 4.13. Using this technique, one can assess the following:

- Hypermobility of the bladder neck region
- Fluid in the proximal urethra (Fig. 4.13)
- Beaking and funneling of the urethra

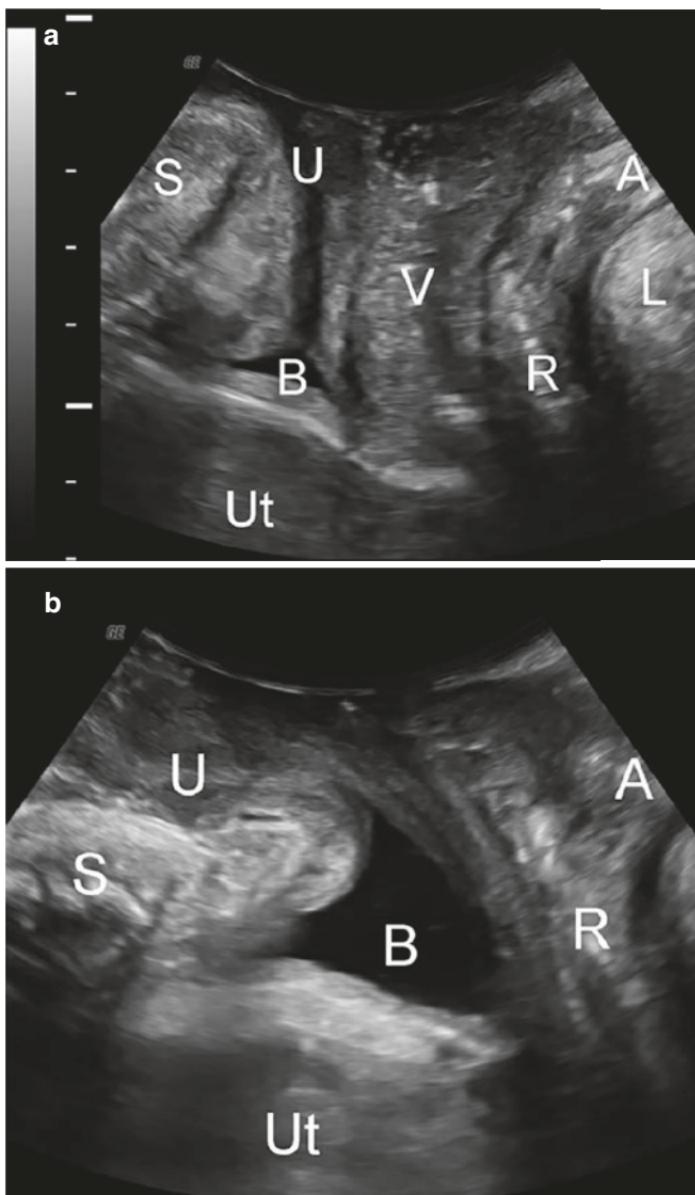


FIGURE 4.13 Determination of bladder neck descent and retrovesical angle: ultrasound images show the midsagittal plane at rest (**a**) and on Valsalva (**b**). *S* symphysis pubis, *U* urethra, *B* bladder, *Ut* uterus, *V* vagina, *A* anal canal, *R* rectal ampulla, *L* levator ani (From: Dietz [6], with permission)

The main difficulties are that:

- Ultrasound scanning is not easy to perform in the erect position.
- Trans-perineal scanning does not easily yield a lateral view that is helpful in previous failed continence surgery.

Therefore, trans-perineal scanning occupies an intermediate position in terms of accurate anatomical assessment of complex incontinence (somewhere between simple “eyeballing” of leakage on twin channel cystometry and full radiological imaging with VCU).

## Voiding Cystometry

During voiding cystometry, the patient sits on the uroflow commode with the pressure transducers in situ. All staff leave the room while she voids in private (Fig. 4.14). The maximum and average flow rates (Q Max and Q Ave) are measured, as in a free uroflow, but the maximum detrusor pressure at the

FIGURE 4.14 Voiding cystometry



point of maximum flow (Pdet at Q Max) is also measured. The findings may be as follows.

In *outflow obstruction*, Q Max and Q Ave are low, but the detrusor pressure is high (the detrusor is trying to overcome the obstruction, so Pdet at Q Max is high, called “high pressure, low flow”).

Also in outflow obstruction, abdominal straining may be seen on Pabdo channel.

In an *underactive detrusor*, the Q Max and Q Ave are low, but the detrusor pressure at Q Max is also low (called “low pressure, low flow”), which is a feature of the atonic bladder.

## Diagnoses Made After Voiding Cystometry

*Outflow Obstruction:* In women, the most common cause of obstruction is previous continence surgery or prolapse kinking the urethra (see Fig. 4.15). The high detrusor pressure with the low flow rate is typical. If sufficient voiding efficiency can

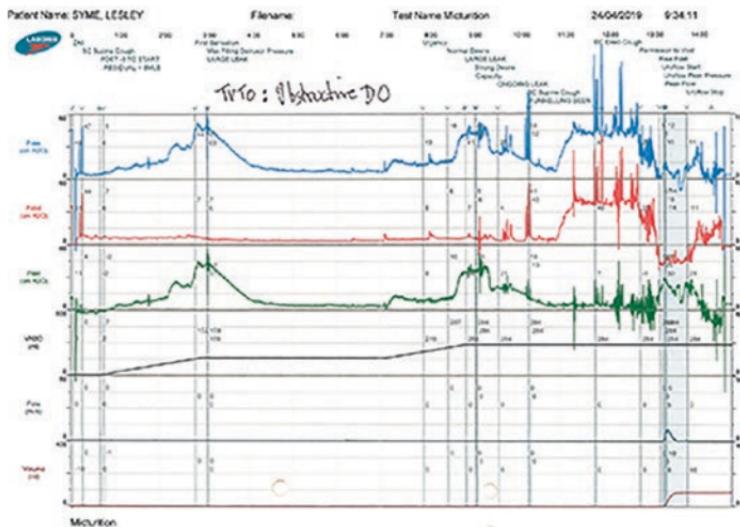


FIGURE 4.15 Obstructed voiding pattern on voiding cystometry. Note PAbdo (red line) is very high; patient eventually expels the P Abdo recording line and is then able to void

be generated (often with abdominal straining, giving an intermittent pattern), then the residual may be minimal.

*Atonic Bladder:* As mentioned, some features of bladder atony (large volume at FDV and MCC) are seen during filling, but during voiding, the most important feature emerges, of low detrusor pressure with low flow rate. Generally, there is a substantial residual. In women, this may be seen with diabetic autonomic neuropathy, or it may be a marker of a neurological lesion at the level of the sacral cord.

*Detrusor Hyperactivity with Impaired Contractility (DHIC):* This is another cause of an underactive detrusor in elderly women. During the filling phase, there may be mild detrusor overactivity (see Fig. 4.16). During voiding, there is

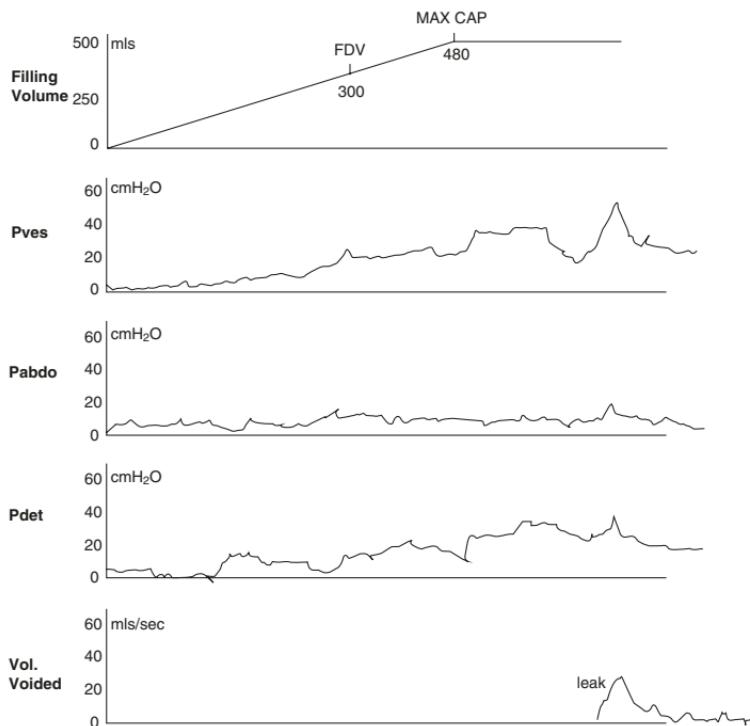


FIGURE 4.16 Detrusor hyperactivity with impaired contractility. Note detrusor overactivity during filling phase, but poorly sustained contractility during voiding. Q Max 8 ml/s, Q Ave 3.5 ml/s, and residual volume was 120 ml

an initial burst of detrusor activity at the start of flow (detrusor hyperactivity), but it is not sustained through the whole flow (impaired contractility). This condition is thought to be due to atherosclerotic changes of the blood vessels supplying the spinal cord, so that there is relative impairment of the coordination of the micturition reflex (see Resnick and Yalla [7]).

*Detrusor Sphincter Dyssynergia (DSD):* In women with multiple sclerosis or spinal cord injury, you may see severe detrusor overactivity during the filling phase, but then during voiding, very high detrusor pressures and an intermittent flow rate *without* abdominal straining occur, due to intermittent spasm of the urethral muscle. It is due to poor coordination of the spinal relays of the impulses that signal the command to void. Normally there should be synchronous relaxation of the urethra with contraction of the detrusor, but in DSD the synchrony is impaired due to spinal cord pathology (for review, see Gonzales et al. [8]).

## Special Urodynamic Tests

### *Urethral Pressure Profilometry*

This test is used to look for a very weak urethra, called *Intrinsic Sphincteric Deficiency*, which may be a factor in failed continence operations. With about 200 ml fluid in the bladder, a double lumen fluid-filled manometry catheter or a flexible micro-tipped pressure recording catheter with one transducer mounted at the end and one 6 cm along is withdrawn from the bladder into the urethra. A mechanical puller device is used so that withdrawal occurs at about 5–10 cm/min. First, a *resting urethral pressure profile (UPP)* is made to record the rise in pressure as the catheter at the 6 cm position passes through the urethral sphincter area. See Fig. 4.17. The urethral closure pressure equals urethral pressure (Pura) minus the bladder pressure (Pves). In a continent woman, Pura exceeds Pves. In most continent women, the urethral closure pressure is greater than 60 cmH<sub>2</sub>O pressure

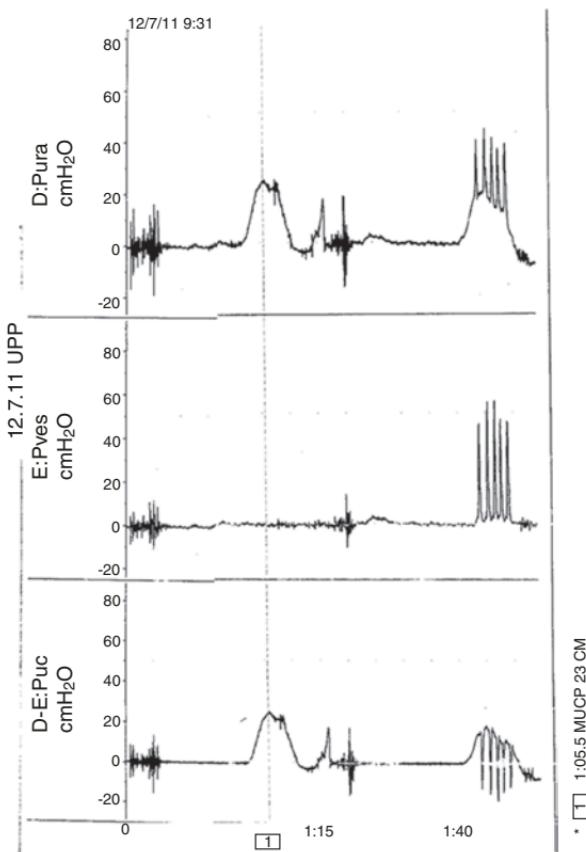


FIGURE 4.17 Urethral pressure profile test in stress incontinence

(although the UPP has been criticized because there is no absolute cutoff between continence and incontinence for this test). A resting closure pressure of less than  $20\text{ cmH}_2\text{O}$  is considered very low and is an indicator of *intrinsic sphincteric deficiency (ISD)*.

Next, the catheter is reinserted into the bladder and withdrawn through the urethra while the patient gives a series of short hard coughs (a *stress UPP*). Even while coughing, Pura should exceed Pves. In the incontinent woman, the Pves repeatedly exceeds the Pura during the cough, yielding a “negative stress profile, as seen on right hand side of tracing.”

### *Abdominal or Valsalva Leak Point Pressure Test*

At a volume of 200–250 ml, with a simple manometry line in the bladder (as for cystometry setup), the patient is asked to give a series of progressively harder coughs or Valsalva maneuvers. The intravesical pressure required to produce leakage from the external meatus (in the absence of a detrusor contraction) is called the abdominal leak point pressure (ALPP). An ALPP of less than 60 cm is thought to indicate *intrinsic sphincteric deficiency*: 60–100 cmH<sub>2</sub>O is equivocal, and a pressure of more than 100 cm is often taken to indicate that the leak is due to urethral hypermobility. The test is controversial because test–retest reliability has been difficult to document and correlation with other measures of incontinence severity is not very good.

### *MRI and 3-Dimensional Ultrasound tests for Urethral Diverticulum*

Until the last 10 years, the triple-lumen catheter test, with radiological screening, was used to diagnose urethral diverticulum. An expensive catheter with two balloons and three lumens was used to force X-ray contrast dye into the urethral diverticulum, thus delineating it on X-ray. In the last 10 years, MRI and three-dimensional ultrasound have become the preferred tests for detection of urethral diverticulum. See Fig. 4.18, for ultrasound image of diverticulum. The condition is rare (about 3% of women with recurrent UTI and post-micturition dribbling, see Kiobashi [9], 2017).

### *Note Regarding Diagnostic Test for Vesicovaginal Fistulae*

Vesicovaginal fistulae are not common in the Western world. Details of management are outside the scope of this basic text. The initial diagnosis is made by a “Three Swab Test;” methylene blue dye is put into the bladder by cathe-

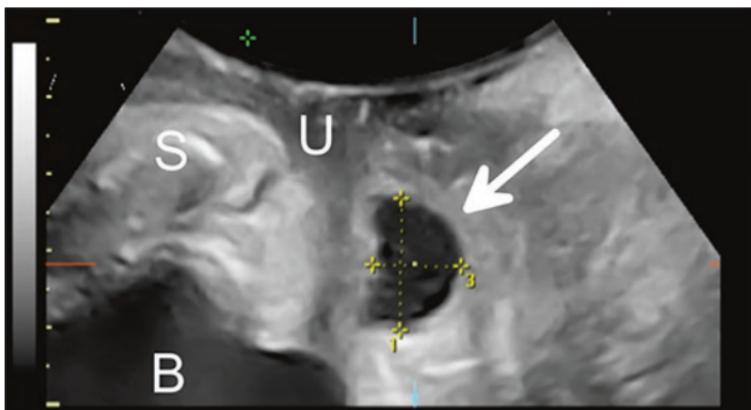


FIGURE 4.18 Urethral diverticulum imaged by 3D translabial ultrasound in the midsagittal plane (arrow). S, symphysis pubis; B, bladder; U, urethra. Courtesy of Professor Hans Peter Dietz, University of Sydney

ter, then three swabs are placed in the vagina: the patient walks around the department for 30 min, then swabs are carefully removed. If there is blue dye on any of the swabs, a vesicovaginal or urethro-vaginal fistula is likely (see Kobashi 2017, [9]).

## Example of Case History and Full Urodynamic Report, with Management

Mrs. Brown is a 57-year-old para 2+0 lady. Twenty years ago, after her second delivery (Kielland's forceps), she noted leakage with standing up from the sitting position, with mixed stress and urge incontinence. She had twin channel cystometry elsewhere; results and other notes are lost. Afterward, she was given 6 weeks of Ditropan 5 mg TDS, which she did not tolerate because of dry mouth. Pelvic floor physiotherapy was not performed. She told the doctor she did not want any more tablets but would like an operation. She underwent a colposuspension and went home with a suprapubic catheter for 10 days.

She was dry for about 2 years but did notice persistent daytime urgency with nocturia. Since then, she has had gradually increasing leakage when arising from a sitting position. She often has to go back to the toilet to revoid completely.

On examination, with bladder partly full, stress leak is not seen. The anterior vaginal wall is not hypermobile. The retro-pubic area is rather fixed to the back of the pubic bone, typical of a colposuspension, more so on the left than the right. She had a weak 2-second pelvic floor contraction.

Summary, provisional diagnosis: This patient may have failed continence surgery with recurrent stress leak, or she may have an overactive bladder, or she may have both. Obstruction is also possible to explain her need to revoid. Clearly, careful urodynamics is essential.

## Urodynamic Result

- Initial Residual: 90 ml. The urethral catheter was not tender to pass.
- First desire to void = 190 ml.
- Strong desire to void = 230 ml. Maximum capacity = 380 ml.
- During filling phase, systolic detrusor contractions were seen, Max P det of 21 cm. Supine tap water = increase in Pdet to 28 cmH<sub>2</sub>O.
- Supine cough = no stress leak.
- Erect provocation = increased detrusor pressure to Pdet 35 cmH<sub>2</sub>O with leak.
- During multiple erect coughs, the patient leaked small drops of fluid.
- On screening, asymmetrical beaking of the bladder neck was seen, with fluid leak.
- In lateral view, the bladder neck did not descend.
- Voiding cystometry—Q Max 25 ml/s; Q Ave 9 ml/s.
- Flow rate was intermittent and prolonged, with abdominal straining.
- Pdet at Q Max was 45 cmH<sub>2</sub>O.
- Final residual was 110 ml. See Fig. 4.19.

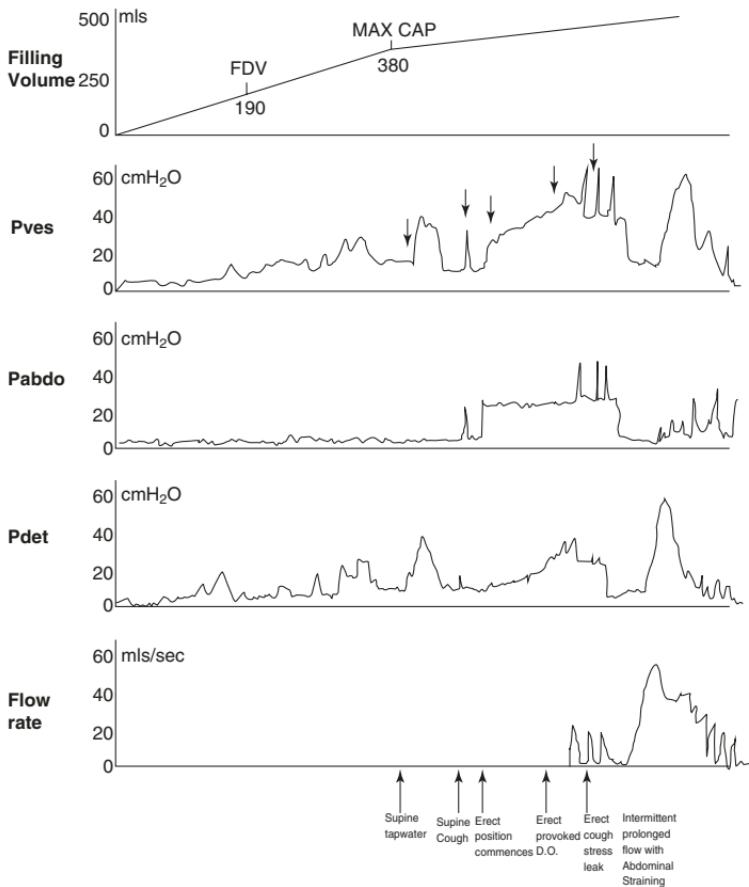


FIGURE 4.19 Urodynamic study of Mrs. Brown

## Comments

Mrs. Brown has a reduced bladder capacity (380 ml), with detrusor contractions provoked by filling, supine tap water, and erect provocation to a maximum of Pdet of 35. She does have some stress incontinence with an asymmetrical appearance of the urethra, in keeping with findings on examining the retropubic vagina (partially failed colposuspension). Her maximum flow rate is fine, but her average flow rate is poor, with abdominal straining suggesting relative outflow

obstruction, in keeping with initial and final residuals of 90 ml/110 ml (typical of colposuspension).

## Diagnosis: Marked Detrusor Overactivity (DO) with Mild Degree of Obstruction; Mild Stress Incontinence: Management

Treat the DO with bladder training, including pelvic floor muscle physiotherapy. Teach double emptying techniques. At 6 weeks, start anticholinergics, for example, Darifenacin (less dry mouth), but recheck post-void residual 6 weeks later. If increased, you may need to consider clean intermittent self-catheterization. After this therapy, if stress incontinence persists, consider collagen/Macoplastique.

*Note:* If this patient had undergone pelvic floor training initially, with alternative anticholinergic therapy that she could tolerate, the current situation may not have arisen.

## Conclusions

Urodynamic testing requires careful attention to detail, both in the selection and counseling of the patient during the test, in performance of the provocation maneuvers, and in analysis of the results, to obtain precise diagnoses of the components of the continence disorder. Unlike an ECG that can be performed by a technician, this test requires a trained clinician in order to yield the maximum information.

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# Chapter 5

## Outcome Measures Used to Assess Response

### Introduction

In the past, doctors recommended a particular treatment because, in their experience, most patients said that they were “better” after receiving it. In the last four decades, we have realized that this is not good enough. We need objective measures by which we can determine what percentage of patients are “cured” (normal) or at least have greater than 50% reduction in symptoms, after any given treatment.

In this century, outcome measures are going to become even more important, because there is not enough money to fund all health care. Doctors (and administrators) must assess whether one treatment is more effective than another, so that money can be spent on that which is most effective. This is loosely termed “health economics.”

In the 1980s, continence clinicians began to realize the importance of outcome measures. It was a time of great creation. Many different outcome measures were created but not necessarily fully “validated.” The process of validation involves the following steps:

- Establish the validity of the test that measures what it is supposed to—includes three subsets: content validity, construct validity, and criterion validity.

- Establish the reliability of the test. For questionnaires, measure internal consistency of different parts of test. For questionnaires and other physical tests, the reproducibility, or test-retest reliability, needs to be proven.
- Establish the responsiveness to change of the test, before and after treatment.

This chapter provides a brief overview of outcome measures that have been validated. Most are used later in this book to describe the effectiveness of different treatments.

The Standardization Committee of the International Continence Society (ICS) is the main body that has governed terminology and outcome measures in the field of urinary incontinence since 1978. The urodynamic measures described in the previous chapter and the pelvic floor assessments (Oxford score and POPQ) described in Chap. 2 are also used as outcome measures. The tests described in this chapter do not require a physical examination or invasive procedures. More recently, the International Urogynecology Society (IUGA) has also created a joint ICS and IUGA standardization of terminology document which also fully covers the terminology for prolapse conditions. The IUGA website is <http://www.iuga.org/>.

The World Health Organization has recently acknowledged the global importance of incontinence, by fostering a regular International Consultation on Incontinence (ICI) every 4 year, which results in a major textbook, called “Incontinence” (see [1] for the most recent text, [www.ics.org](http://www.ics.org)). These publications also consider which treatments are the most effective, as judged by standardized outcome measures. Finally, the Cochrane Collaboration performs meta-analyses of randomized controlled trials in the field of incontinence, which also use the outcome measures described in this text.

The ICS recommends that there should be five main groups, or “domains,” of outcome measures [2].

1. Patient’s observations (symptoms).
2. Quantification of symptoms (e.g., urine loss on diary or pad test).
3. Physician’s observations (anatomical and functional).
4. Quality of life measures.
5. Socioeconomic evaluations.

## Tests That Measure Patient's Symptoms

The *ICIQ-SF* was validated under the auspices of the ICI. It records incontinence symptoms and severity, with a simple quality of life question. The final ICIQ comprises three scored items (Fig. 5.1, maximum score 21) and a self-diagnostic item on the impact of the incontinence upon the patient's "bother." It is probably the most widely used out-

Many people leak urine some of the time. We are trying to find out how many people leak urine, and how much this bothers them. We would be grateful if you could answer the following questions, thinking about how you have been, on average, over the PAST FOUR WEEKS.

**Thank you very much for answering these questions.**

Copyright © "ICIQ Group"

FIGURE 5.1 The ICIQ-SF questionnaire

come test for general urinary incontinence ([www.iciq.net](http://www.iciq.net)). Recently (Karmaker et al., 2017), urogynecologists have used it as a surgical outcome measure have defined its agreement with other measures [3]. They concluded that an ICIQ score < 6 is equivalent to a cure (many surgical studies allow people with urgency incontinence to enroll, and they may still have quite a “bother” score after effective surgery).

The *Overactive Bladder Questionnaire* (OABq) is devoted to assessing the dysfunction suffered by patients with both OAB Wet and OAB Dry—the standard test has 33 questions, but there is also a short form with 19 questions. It is probably the most widely used questionnaire for clinical trials in Detrusor Overactivity [www.pfizerpatientreportedoutcomes.com](http://www.pfizerpatientreportedoutcomes.com).

*The Wexner Score for Fecal Incontinence* was originally a 20-point score concerning three types of incontinence, with one question for impact upon lifestyle (italic bold in Table 5.1). Later, a score for wearing pads, taking constipating medication, or suffering from fecal urgency was added

TABLE 5.1 Modified Wexner fecal incontinence score

	Never	Rarely	Sometimes	Weekly	Daily
<i>Incontinent solid stool</i>	<b>0</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>
<i>Incontinent liquid stool</i>	<b>0</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>
<i>Incontinent to gas</i>	<b>0</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>
<i>Alters lifestyle</i>	<b>0</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>
				No	Yes
Need to wear pad/plug				0	2
Take constipating meds				0	2
Unable to defer 15 min				0	2

(ordinary typeface in Table 5.1). The Wexner score has been fully validated [4] and is used worldwide for fecal/ anal incontinence.

## Tests That Quantify Patients' Symptoms

Rather than giving the patient a questionnaire about her symptoms, the following tests actually measure symptoms such as stress leak, urge leak, frequency, or nocturia.

### Bladder Chart

The bladder chart is a generic term used to indicate several types of records.

- The *micturition chart* only asks patients to record times of voiding and incontinence episodes; only output is considered, roughly.
- The *frequency-volume chart (FVC)* also asks patients to record their fluid intake and the volume they void and when they change pads, usually over 3 days.
- The *Bladder Diary* includes the details of the FVC but also includes symptoms and activities at leakage episodes, including urgency, coughing, lifting, and others.

The micturition chart tells nothing about people who drink too much ( $>3$  l/day) or too little ( $<1.5$  l/day). Many clinicians use the frequency–volume chart. The bladder diary (Fig. 5.2) provides even more detail about the type of leakage in daily life; patients need clear instruction on how to fill this in, but it does give the most insight into the patients' problem.

The Bladder Diary is a useful outcome measure. It tells you:

- The number of leakage episodes per 24 h (in mild cases, convert to leaks per week by taking an average of the 3 days).
- The number of voids per day (“frequency”).
- The episodes of nocturia.
- Whether patients are fluid restricting for fear of urge leak.

- Whether patients are drinking more than 2 l/day (overdrinking).
- What factors make them leak (see diary typical of Stress Incontinence in Fig. 1.2).

### BLADDER CHART – 1 day (24 Hours)

TIME	AMOUNT & TYPE OF FLUID IN	TIME	AMOUNT OF URINE PASSED	COMMENTS
7:30am	—	7:30 am	290 ml	Eg leakage, urge, pain, burning etc.
7:40	150ml black coffee			Leaked on way to toilet ++ urge
		8:45	75 ml	urge
9:15	250ml coke			
		9:30	160 ml	Leaked on way to toilet urge ++
		10:05	75 ml	urge
		10:40	90 ml	urge
11:00	Cappuccino 200ml			
		11:20	110 ml	urge
12:30pm	300ml soup			
		1:15pm	220 ml	Leak with laughing
		3:30pm	60 ml	Leak at photocopier
3:40	75ml espresso			
		4:45pm	50 ml	urge
		6:30pm	85 ml	
7:00	90ml sherry			
		8:05pm	100	Leak with washing dishes
		11:30pm	120	woken from sleep.
		02:30	65	

FIGURE 5.2 A Bladder Diary from a patient with urge incontinence. Patient drinks little (1.065 l/day), has marked frequency (11 voids per day), nocturia  $\times 2$ , and a small bladder capacity (average of 12 voids = 108 ml). Note that diary gives the extra details that she leaks with urge, laughing, running water. Note the caffeine intake

The ideal duration of the Bladder Diary is controversial. The 7-day diary is the most sensitive and accurate, but patients dislike this burden, so compliance is poor. Because the first 3 days and the last 4 days of a 7-day test correlate well ( $r = 0.9$ ), most clinicians use a 3-day Diary, at least at the first visit. The ICI Committee for Research Methodology found that in most cases, a single 24-h diary is sufficient. In our unit, we use a 3-day Diary for the first visit and a 24-h Diary for follow-up visits (see discussion of bladder training in Chap. 7).

## The Pad Test

*The One-Hour Pad Test* was initially the “industry standard” after its introduction in 1983 and ICS recommendation in 1988. This test involves:

- Patients attend with a comfortably full bladder.
- Are given a pre-weighed continence pad.
- Then drink 500 ml of water over 15 min.
- Then perform a standard series of activities to provoke leakage.
- The voided volume is then measured, and the wet pad is reweighed.

Unfortunately, the 1-h pad test fails to correlate with other measures of severity (poor criterion validity) and has poor sensitivity (up to 40% false-negative rate). For many years, the 1-h pad test was the only objective method that could be used to define mild (1–10 g leakage per 1 h), moderate (11–50 g/h), and severe ( $>50$  g/h) incontinence; thus, it is used in many publications quoted in this text.

*The 24-Hour Pad Test* was developed in the late 1980s because of the problems with the 1-h test. It was designed to be conducted at home, in “real-life” conditions. The 24 h pad test involves the following:

- Women are given a set of (usually 5) pre-weighed pads in sealed bags.
- The pads are worn at home for 24 h, as many as they need.

- Ordinary provocative activities are carried out, this is most important.
- They return pads in a sealed plastic bag, personally or by post, to be re-weighed.

There is no loss of accuracy by evaporation from the sealed plastic bag for durations of 72 h to 2 weeks (see Fig. 5.3). Thus, wet pads can be returned via post. The 24-h pad test is more sensitive than the 1-h test (10% false-negative rate).

Normal ranges for the 24-h pad test have been controversial. Studies from 1989 to 1996 in small samples of women ( $n = 23\text{--}78$ ), using simple kitchen scales, gave a normal value of 8 g [2]. This seems a lot of fluid on the underwear to be tolerated by an asymptomatic woman. However, this definition of “continent” (up to 8 g) is used throughout most studies in this book.



FIGURE 5.3 Five pre-weighed pads in zip-lock bags, with instructions for 24 h home pad test

Recently [5], the normal values were redefined ( $n = 120$ ) using scales accurate to 0.1 g. A median value of 0.3 g (95th centile 1.3 g) was obtained. The test correlates with the ICIQ [6]. However, most researchers have not converted to this stringent cut-off level.

The definition of mild, moderate, and severe is important. Because conservative therapy is more likely to cure patients with mild incontinence and surgery is often offered to patients with severe leakage, a pad test should be able to define severity. Mild, moderate, and severe incontinence were characterized as 1.3–20, 21–74, and >75 g on the 24-h test [7].

## The “Cough Stress Test”

Because both the one-hour and the 24 h pad tests do require considerable effort on the part of the patient (to do the test), the doctor (to explain the rationale for the test) and the nurse (to give the patient instructions, then collect all the pads and weigh them), some urogynecologists perform and “on the spot” cough stress test. This test is *not* actually properly validated as an outcome measure. Bladder filling is recommended to be either 300 ml, or maximum cystometric capacity if that is less than 300 ml, by two authors [8, 9], so this assumes that the patient has already had cystometry testing! That makes the test difficult to use an outcome measure for conservative therapy (as many such patients do not need cystometry). A further study [10] tested various filling volumes (“comfortably full,” versus 200 ml of retrograde fill, or retrograde fill to half the functional capacity from the bladder chart). None of these studies provided any data about the amount of urine collected on a pad during the leakage.

## Tests That Measure Anatomical and Functional Observations by Doctors

- The Oxford score for measuring pelvic floor muscle strength and the POPQ scoring system for measuring prolapse were shown in Chap. 2.
- The standard urodynamic test measurements were shown in Chap. 4.

## Quality of Life for Incontinence

A large array of quality of life (QOL) tests are available in urogynecology.

- Generic tests that just measure overall QOL are often used to provide a comparison with other medical therapies (e.g., cardiac surgery). The SF36 is the most common.
- For incontinence, the two most common are the Urogenital Distress Inventory (UDI) and the Incontinence Impact Questionnaire (IIQ), from the United States. Both come in a short form and have been fully validated. The King's health questionnaire is also often used (from the United Kingdom, available in many languages. For full review, see Castro Diaz et al. [11]).
- In order to perform a health economic analysis [12], a QOL test that scales from 1 to 100 needs to be used, such as the York questionnaire or the AQOL (for review, see Wagner et al. 2016).

## Quality of Life Tests for Prolapse and Sexual Function: Why Do We Need Them?

You might ask, why do we need QOL tests for Prolapse? Up until the 15–20 years, gynecologists judged the “success” of their surgery for prolapse on the anatomical findings after the operation. As will be seen in Chap. 10 on Prolapse

Management, it now appears that we may have focused too heavily on getting a perfect “vaginal reconstruction,” without asking the patient whether she is still bothered by any prolapse *symptoms*. This focus on an ‘ideal anatomy’ led to widespread use of vaginal mesh, which turned out to be a mistake (see Chap. 13, Mesh Complications).

Therefore, we needed to have outcome measures that could reliably define the severity of “prolapse bother symptoms.” These outcome measures are still undergoing refinement, but the most useful ones are the Pelvic Floor Distress Inventory, and the Pelvic Floor Impact Questionnaire.

These questionnaires mainly focus upon “bother” of urinary, bowel, vaginal prolapse, and sexual symptoms [13] but do not measure the frequency or severity of the symptoms. They were based on the UDI and the IIQ (that are long-standing validated measures of *QOL* impairment due to leakage, see earlier this chapter).

In 2006, the International Consultation on Incontinence (ICI) expanded the ICIQ into a series of modules that could be added onto the ICIQ, to encompass prolapse symptoms [14]. A copy of ICIQ–Vaginal Symptoms is available on their website: [www.iciq.net](http://www.iciq.net).

The need for QOL tests regarding Sexual Function is rather more obvious. For many years, women over the age of 60–70 (the peak ages for prolapse) were not thought to desire sexual activity any more. Now that the median lifespan for women is 83 years in most Western countries, gynecologists have learned that many women (and/or their partners) *do* wish to continue normal sexual activity well into later life. Thus, we have become aware that simply restoring normal vaginal anatomy is not sufficient. If the surgery required to do this causes scarring and fibrosis with dyspareunia, then the woman, if asked, may not consider this operation a functional success.

As a result, QOL tests that measure sexual function have been developed:

- The “PISQ”—prolapse and sexual function questionnaire—was published in 2001 [15].

- The GRISS test of sexual function was published in 1986 [16] and includes 28 questions about overall sexual function without any items that focus on prolapse symptoms, but it has been used as an outcome measure for prolapse surgery, in terms of improved sexual function.

## Is There a Test That Combines Incontinence, Prolapse, Bowel, and Sexual Function?

With so many questionnaires available about all the multiple aspects involved in pelvic floor dysfunction, would not it be useful if there was one questionnaire that measured all of these factors? Also, it would be useful if the test was validated for self-administration by the patient. Fortunately, such a questionnaire has been developed (by a German urogynecologist working in Australia [17]) and validated, which comprises 15 bladder questions, 12 bowel questions, 10 sexual function items, and 5 prolapse questions (Baessler et al., 2009). It was then validated for self-administration by patients ([18] contains copy of the test). Recently, the “minimal important difference,” which helps researchers to use it as an optimal research tool, has been established [19].

## Socioeconomic Evaluation

- A standard test for measuring the personal and treatment costs of incontinence is the Dowell Bryant incontinence cost index (DBICI), which is validated [20]. Another common test is the willingness to pay questionnaire, usually tailor made for the particular condition. In order to perform a health economic analysis, a QOL test that scales from 1 to 100 needs to be used, such as the SF36, the York questionnaire or the AQOL (for review, see Moore et al. [21]).

## Conclusions

The last 20 years have brought considerable advances in the standardization of the outcome measures that we use in Urogynecology, which have improved our research capabilities. This is allowing us to tell women which treatments are proven to work. In later chapters in this text, studies that employ validated outcome measures are emphasized, but in the absence of objective data, some studies presenting mainly subjective data are mentioned, because they have stood the test of time.

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# Chapter 6

## Conservative Therapy of Stress Incontinence



### Managing Chronic Cough and Obesity

When starting a patient on a conservative treatment program for stress incontinence, you must check whether there are uncorrected precipitating factors.

It is demoralizing for the patient to work hard on a pelvic floor muscle training program if she has uncorrected chronic cough. We often see patients with chronic sinusitis, nasal polyps, postnasal drip, or asthma/chronic bronchitis, who have never seen an ENT surgeon or had optimal asthma therapy. Reflux esophagitis may also provoke chronic cough, which may not be adequately recognized unless you take a careful history.

Many general practitioners have had no training in managing incontinence during their undergraduate years. They may not realize that in the last 20 years, major advances have been made in conservative continence therapy, but we cannot achieve a cure in the presence of an unrelenting cough. Hence, the urogynecologist may need to refer such patients to the appropriate ENT surgeon, respiratory physician, or gastroenterologist. Certainly, a woman with stress incontinence and untreated cough should NOT undergo continence surgery, as the procedure may not last if the cough resumes postoperatively.

Similarly, marked obesity should be reduced whenever possible. A large randomized controlled trial showed that obese women who lost 10% of their body weight were significantly more likely to achieve at least a 70% reduction in the frequency of incontinence compared to controls [1]. Increases in body mass index relate directly to increased risk of incontinence [2].

In women with a “truncal” distribution of fat, which will press down upon the bladder, serum insulin levels at 0, 1, and 2 h after a 75-g glucose load may reveal *insulin resistance (IR)*. We routinely test for I.R. in truncal obesity. If the test is positive (fasting insulin levels >14, 2 h insulin levels >80), then treatment with Metformin 750 mg–1.5 g per day is of proven benefit. We explain to patient that the condition of IR is the opposite of diabetes; in IR, too much insulin is produced too late after a carbohydrate meal, which is associated with postprandial hypoglycemia that induces inappropriate hunger. Metformin also decreases intestinal glucose absorption, and inhibits gluconeogenesis, so there is less glucose to store in fat [3]. Other mechanisms of action are described by [4]. Many gynecologists are familiar with IR, because it is common in polycystic ovarian syndrome; metformin is often used to achieve weight loss and fertility in this condition [5]. Because metformin does not have FDA approval in the USA for obesity treatment, its efficacy is often overlooked [3].

In the morbidly obese woman with stress incontinence (i.e., BMI > 40), who does not have insulin resistance, then discussion of bariatric surgery is worth considering. A recent meta-analysis of 33 cohort studies [6] found that bariatric surgery for women with  $\text{BMI} > 35 \text{ kg/m}^2$  resulted in complete resolution of any urinary incontinence in 48% of 2910 patients (39% of those with stress incontinence, 55% of those with urge incontinence), based upon patient questionnaires such as the ICIQ (described in Chap. 5).

By striving for reasonable weight loss, you may convert a patient from someone who needs surgery, with the attendant thromboembolic risks in the obese, into a woman who can achieve cure from a conservative program. In our unit, we do

not routinely offer continence surgery to an obese woman without a serious trial of weight loss, because the weight loss may obviate the need for surgery and anesthesia (and the well-known surgical complication of detrusor overactivity or voiding difficulty; see Chap. 9).

Having said this, some obese women are trapped in a vicious circle. They need to exercise in order to lose weight, but whenever they exercise, they leak much more urine than in daily life. In this scenario, we usually strike a deal with the patient. If they can start the process and lose even 5%, then we will offer surgery if supervised pelvic floor training does not achieve a major benefit.

## Treatment of Constipation

Uncorrected constipation (with chronic straining to defecate) is an acknowledged risk factor for stress incontinence. Patients need to learn how to manage this problem before they can expect a conservative program to work.

Further information is provided in Chap. 8 on obstructed defecation, but in essence management is as follows:

- Colorectal surgeons recommend the use of bulking agents such as Metamucil, psyllium husks (from which Metamucil is manufactured), or Movicol. Normacol granules are better tolerated by some patients. A dessert spoon of psyllium husks or Metamucil should be dissolved in 400 ml of water in order to achieve a moist stool that is easily passed. Putting these substances onto the cornflakes in the morning is of no benefit, they must be dissolved in a plentiful amount of water!
- A lubricating substance, such as Agarol or Lactulose, can be added, to lubricate the bolus of stool as it moves down the gut.
- In cases where the call to stool is felt, but the bolus of feces cannot be evacuated, then rectal glycerin suppositories are inserted to encourage defecation in this circumstance.

- Simply getting the patient to eat a large juicy orange first thing in the morning, with dilute hot tea, then sitting and relaxing on the toilet can be remarkably helpful. Patients must not “rush” the act of defecation, sometimes they need to sit and wait for 3–4 min.
- Regular use of Senokot is now considered unwise, although intermittent doses help if all else fails. Studies by colorectal surgeons indicate that this agent stimulates the nerves of the gut to increase peristalsis and may induce a state of dependence. Eventually, the colonic nerves may become refractory to Senekot.

## Treatment of Postmenopausal Urogenital Atrophy: Benefit for Stress Incontinence

We all know that incontinence is more common as age advances, with a peak at menopause. Because estrogen receptors are known to occur in the urethra, estrogen therapy should give benefit, by thickening the urethral epithelium, improving mucosal coaptation, and enhancing vascular tone in the periurethral vessels.

The Cochrane meta-analysis on the use of estrogens for incontinence in 2002 concluded that topical estrogen has about a 50% benefit for incontinence compared to a 25% benefit for placebo [7]. Systemic estrogen therapy (HRT) is no longer recommended, as two large trials have shown that stress incontinence was worsened in those on HRT compared with those on placebo [8, 9]. The most recent Cochrane review [7] concluded that vaginal estrogen was associated with a significant increase in the strength of the urethral closure pressure (RR 4.35, 95% CI 2.5–6.20). This Cochrane review is difficult to interpret because so much of their data still discusses systemic HRT, which is so well known to worsen incontinence.

A recent prospective observational study [10] of 68 patients with stress incontinence in three countries who received oestriol crème 3 times daily for 6 weeks showed significant benefit ( $p = 0.01$ ) on the stress domain of the

UDI-6 test. Cough-stress pad test results were highly variable and thus did not show benefit. A 12-week study is underway by the same group.

*Practical Advice for Patients regarding Oestrogen Cream:* Many elderly women dislike the vaginal applicator that accompanies oestriol cream (Ovestin). It is cumbersome for those with arthritis, and many do not like inserting the applicator all the way into their vagina and then having to wash it. Some patients stop using it for these reasons (and the first two complaints also apply to estradiol, Vagifem tablets). We encourage patients to put a small amount of oestriol creme on their finger and apply it around and just inside the vagina, last thing at night before sleep. Most women find this much more acceptable than using a messy applicator.

Many women ask whether the use of vaginal estrogens will increase the risk of breast cancer. In general, the blood levels of oestriol are well below the menopausal levels (90 picomol/l) in women on Ovestin cream. However, a small study of women on Vagifem tablets [11] indicated that vaginal topical estrogen should not be given to women who are on aromatase inhibitors for suppression of breast cancer recurrence risk.

## Starting a Home-Based Pelvic Floor Muscle Training Program

The first step in starting a pelvic floor muscle (PFM) training program should be done during the physical examination (see Fig. 6.1). That is, palpate the PFM digitally; make sure the patient can contract the correct muscle. On palpation, you may find that the PFM is partially or completely absent (called Levator Avulsion Defect) which may make it difficult for her to contract the muscle [12]. If the muscle is intact, then explain that she should not:

- Contracting the gluteal muscles (lifting buttocks off the bed).
- Contracting the adductor muscles (tightening thighs together).

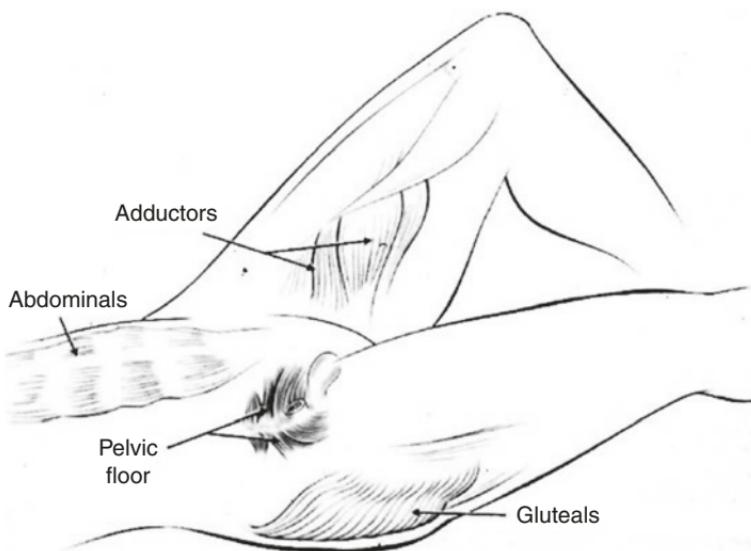


FIGURE 6.1 Assessing the pelvic floor muscles

- Contracting the abdominal muscles (bearing down on the pelvic floor).
- Contracting these muscles will not help and may make leakage worse.

Once the patient can contract the PFM correctly, ask her to squeeze as hard as she can, then count up to a maximum of 10 s. Observe when the muscle starts to fatigue, and stop the count there, for example, 6 s.

After the patient has gotten dressed, explain to her that the PFM is a muscle running from the pubic bone to the tail bone, with three openings in it (urethra, vagina, anus). We find it helpful to show a diagram such as that shown in Fig. 6.2, inasmuch as many patients do not understand this basic anatomy. Explain that the PFM is a postural muscle, like the erector spinae of the back. Think of the weight lifter who goes to the gymnasium. He usually has a very erect posture because of the strong resting tone of his large back muscles, but he can also lift heavyweights. The woman needs to train her PFM gradually, over 12–24 weeks, to increase the resting



FIGURE 6.2 The pelvic floor muscle

tone of the muscle, and it will also hypertrophy. Then the patient can train to squeeze the muscle against the “load” of coughing or sneezing.

## The Role of the Nurse Continence Advisor

The assessment and basic explanation of the PFM (as above) are a task that any registrar or clinician should be able to carry out, as it only takes 1 min during the physical exam and 3 or 4 min of explanation time.

The following description of how to start a PFM training program may be too time consuming within the confines of a busy outpatient clinic. In this case, the patient should be referred to a nurse continence advisor (NCA) for the detailed training given below. If her PFM is quite weak, then physiotherapy referral is more appropriate as she may need electro-stimulation therapy (see below). Sometimes, which type of therapist you refer to may depend on availability and cost.

- First, the woman must contract the muscle as hard as possible for as long as she can, up to her maximum when fatigue is noted (e.g., 3 s).

- Then rest the muscle for 5 s to let oxygen back into the muscle.
- Explain that just squeezing the muscle over and over without this oxygen break will cause it to tire out, not strengthen.
- To make it easy to remember, we usually set a program that builds up numerically from her 3-s maximum, for example, 3-s squeeze, 4 squeezes per “set” or group, and 5 sets per day.
- In this example, she would perform 20 contractions per day.
- The five sets per day should be spread out over the day, not done all at once in the morning (because this causes fatigue also).
- To help remember this, we would give five red adhesive dots to be placed around the house in places that are visited at different times of the day (near the toothbrush, kettle, telephone, television remote control, etc.). See Fig. 6.3.

After the patient has strengthened her PFM for 3–4 weeks, she should then learn how to contract the muscle just before



FIGURE 6.3 Written PFM training program for a patient with an initial pelvic floor contraction of only 3-s duration, who is to do four contractions per set and five sets per day (five *red dots* given)

a cough or sneeze. This technique, called “the knack,” has been shown on pad testing to reduce leakage by up to 60%/day [13].

In subsequent visits, the nurse continence advisor reiterates the initial explanation and upgrades the program (makes it harder). If a patient is sent to physiotherapy, the first visit always includes this type of explanation, with upgrading at follow-up. Even if the main complaint is urge incontinence, the PFM is used to defer micturition, so patients need to know how to contract it.

## Who Should Be Referred for Physiotherapy?

If a woman cannot contract her PFM at the initial examination (or can only manage a weak flicker) despite your best efforts to help her locate the muscle, then she definitely needs referral to a pelvic floor physiotherapist (a physiotherapist who has undergone subspecialty training). She will assess the patient vaginally, use additional methods to help her identify the muscle, then move on to biofeedback or electrostimulation or both (see below for details).

The question then becomes the following: do women who can contract their muscles need a supervised training program, or can they practice at home with equally good results? In the last 30 years, many publications have considered this question. One problem is that the outcome measures used by the different authors varied greatly. Table 6.1 summarizes the results. Although several of these studies are quite old, many still are frequently quoted. The term “hospital PFMT” indicates that patients attended a pelvic floor physiotherapist weekly or monthly and had regular supervision of their training program. “Home” PFMT indicates that they were given instructions to practice at home. “Control” equals no active treatment.

The duration of follow-up in these trials also varied a great deal. Nevertheless, it can be seen that supervised PFM training yields generally higher success rates (average about 50% cure, range 25–75%), compared to a home-based program (20% cure).

Another problem with this table of results is that the severity of leakage at baseline was seldom taken into account.

TABLE 6.1 Objective results after pelvic floor muscle training for stress incontinence

<b>Authors</b>	<b>N</b>	<b>Treatment</b>	<b>Results</b>
Wilson et al. [14]	15	Home PFMT	Pads/24 h 11% benefit
	45	Hospital PFMT	Pads/24 h 54% benefit
Jolley [15]	65	Home PFMT	48% subjectively dry
	56	Control	0% subjectively dry
Henalla et al. [16]	25	Hospital PFMT	65% cure/markd benefit pad test
	24	Control	0% cure/markd benefit pad test
Burns et al. [17]	38	Hospital PFMT	54% reduced leaks/ week FVC
	40	Control	9% worse leaks/week FVC
Bo et al. [18]	26	Home PFMT	Pad test change NS
	26	Hospital PFMT	Pad test 27 g fell to 7.1 g/h
Bo and Talseth [19]	23	Hospital PFMT	75% dry cough test
Mouritsen et al. [20]	100	Hospital PFMT	47% dry pad test
Cammu et al. [21]	52	Hospital PFMT	25% dry on FVC
O'Brien et al. [22]	292	Home PFMT	29% not using pads
	132	Control	No benefit
Lagro-Janssen et al. [23]	53	Home PFMT	Leaks/week 19.6, fell to 7.2/week
	57	Control	Leaks/week 21, worse, to 23/week
Hahn et al. [24]	170	Hospital PFMT	35% dry on stress test
	30	Control	0% change
Seim et al. [25]	96	Hospital PFMT	Pad test 28 g fell to 10 g
Bo et al. [26]	25	Hospital PFMT	44% dry pad test
	30	Control	6% dry pad test

Stratified randomization was rare (so that mild and severe patients could be distributed equally into both treatment arms). A study in which only patients with mild to moderate incontinence (on 1-h pad test) were recruited (with stratified randomization) showed that 65% of those with mild incontinence were cured, compared to a 35% cure rate for moderate incontinence [27]. In this pragmatic trial, only patients with a weak pelvic floor were referred for subspecialty physiotherapy. In those with a good contraction strength at baseline, a nurse continence advisor supervised their training.

The Cochrane review [28] mentioned poor standardization of outcome measures and follow-up duration but concluded that women with stress incontinence who underwent supervised PFM training were eight times more likely to report cure (56% vs. 6%, RR 8.38) than those who had sham or no treatment.

## What Does the Physiotherapist Do That Increases Efficacy?

Basically, the pelvic floor physiotherapist has three techniques:

- To act as a personal trainer, just as for an athlete:
  - To reexamine the PFM at regular intervals to check strength and increase the difficulty of the training program.
  - To evaluate the Bladder Chart with the patient regularly and see whether leakage is really declining.
  - To remind the patient to perform “the knack” as they often forget.
  - To increase motivation by positive verbal feedback (as results improve).
- To use some form of “biofeedback” technique such as:
  - Verbal biofeedback during digital examination, asking the patient to contract harder or for a longer duration.

- A graduated perineometer, to show contraction strength (Fig. 6.4) The physiotherapist inserts this into the vagina, then asks patient for a maximal contraction of the pelvic floor muscle, which is measured on the scale on the front of the device (works by measuring air displacement from cylinder in the vagina).
- Vaginal weighted cones that the patient wears in the vagina for 20 min twice daily while walking around. As



FIGURE 6.4 Perineometer used to define the strength of the PFM contraction and measure improvement between treatments, Vaginal Cone Weights used to encourage proprioception/enhanced contraction

the cone weight falls lower in the vagina the patient has to tighten her muscles to stop it from falling out on the floor. She is given gradually increasing cone weights over time.

- Mechanical or auditory biofeedback, such as a vaginal pressure transducer that conveys increased pressure by an increased auditory or visual signal.
- To employ electrostimulation therapy when the patient has a weak or absent PFM contraction, which usually comprises trans-vaginal electrostimulation (Fig. 6.5)/ Older studies used supra-pubic electrostimulation (called interferential therapy, now rare).



FIGURE 6.5 Intravaginal electrostimulation device

## The Efficacy of Physiotherapy Techniques

For a detailed analysis, the reader should consult a dedicated text, such as “Incontinence” (Adewuyi, 2017 [29]). Nevertheless, some conclusions can be made. The first item of physiotherapy training above (acting as a personal trainer to enhance performance and gradually increase the difficulty of the training) is clearly efficacious, as shown in Table 6.1 regarding home training versus supervised training.

Biofeedback is quite controversial. The following statements are evidence based. In a compact book such as this, it is not practical to cite all evidence.

Use of the *perineometer* aids the patient by measuring the degree of improvement in pelvic floor muscle strength. This does not always translate into improved continence, unless the patient uses her PFM during cough or other episodes of raised intra-abdominal pressure (the knack).

Use of *vaginal weighted cones* provides a variable degree of enhanced efficacy. In some studies, they give major benefits; in other studies, the benefit over PFM training is not statistically significant. The Cochrane meta-analysis found that cone therapy is better than no treatment and similar to PFMT alone, with no clearly significant benefit gained from adding cones to a PFMT program. We find that a patient’s attitude towards a self-inserted vaginal device is very important. Some women find them useful; others cannot accept the idea of inserting a cone into their vaginas. Use of *auditory or visual biofeedback* techniques to enhance the woman’s appreciation of her PFM strength is now known to enhance PFMT. Women who were given biofeedback had a significantly greater likelihood of noting cured or improved continence (risk ratio 0.75, CI 0.66–0.86 [28]).

Use of electrostimulation is physiologically attractive. The skeletal muscle of the PFM is given a regular electrical stimulus by stimulating the pudendal nerve, which causes a tetanic (maximal strength) contraction. In our experience, electro-

stimulation (often called “E-Stim”) is very useful for a woman who really cannot contract her PFM at all. Once she can feel it contracting with E-Stim, she should be given a detailed PFM training program to use between the E-Stim visits. Unfortunately, most studies of this technique do not specifically select women who are unable to contract the PFM and do not give a PFM training program for use between electrostimulation visits. Many of the studies are very small ( $n = 20\text{--}30$  in either arm), so that they are “under-powered” to achieve a significant result. Definition of “cure” is variable. For example, a quite large RCT ( $n = 155$ ) of PFMT versus PFMT with E-Stim, versus a brochure [30], found bladder diary reductions of 78% vs. 80% vs. 75%, respectively (but they did NOT select women who were unable to contract their PFM!).

The International Consultation on Incontinence (ICI) found that comparing E-Stim versus control, the cure rates (22% vs. 5%, OR 2.43) were not significantly better, but the improvement rates (53% vs. 30%, OR 3.64) were significantly greater for E-Stim [29].

## Extracorporeal Electromagnetic Chair Stimulation Therapy

This is an alternative form of electrostimulation therapy that avoids the need for a vaginal probe. Patients sit fully clothed on a chair that contains a magnetic coil under the seat (Fig. 6.6). We invite all our students to sit on the electromagnetic chair, as they feel an immediate contraction in the base of the pelvis which is unmistakable. A randomized controlled trial using a sham chair showed that, in women who were unable to contract their pelvic floor muscle at the first visit, the active chair therapy produced a significant reduction in leakage on pad test ( $p < 0.05$ ) compared with sham chair [31].



FIGURE 6.6 Electromagnetic Chair; Patient sits fully clothed in the middle of the chair and receives a perceptible stimulation of the pelvic floor muscle

## What to Do if Conservative Therapy Fails but Patient Does Not Want Surgery?

Prior to the 1990s, such patients had little choice but to use continence pads. In the last three decades, several bioengineering companies have taken up the challenge to develop mechanical devices that can correct incontinence.

The first of these was the bladder neck support prosthesis (Introl, Fig. 6.7), which was shaped like a prolapse ring pessary but has two prongs that sit in the retropubic space and cradle the urethra. Clinical trials indicated that 62% of those who could be fitted become continent (Moore [32]). The device was most useful for those who mainly leak during sporting activities (who could also have coexistent prolapse). Because it came in 26 different sizes, the fitting kit was expensive and general gynecologists found it cumbersome to use, so it is no longer manufactured.

The same inventor went on to develop a simpler device, Contiform, that is shaped like a hollow tampon (Fig. 6.7). Initially, this device was only available in three sizes and gave

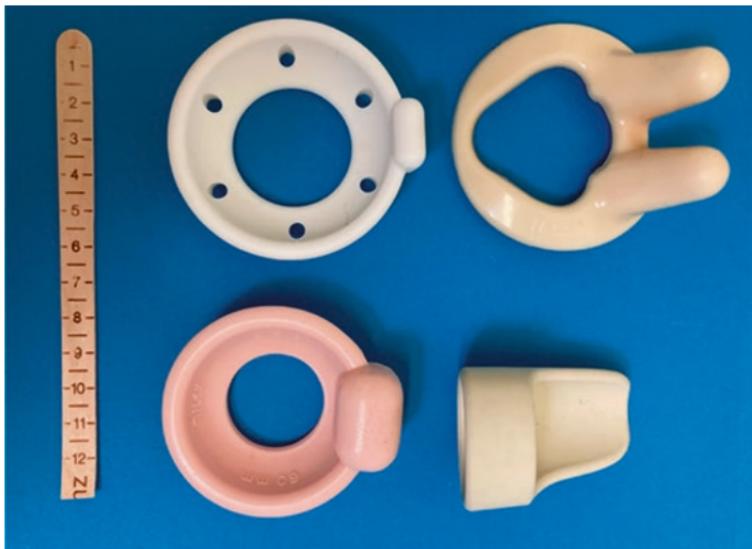


FIGURE 6.7 White Continence Dish (*top left*), Introl device (*top right*), Pink Continence Dish (*bottom left*), Contiform (*bottom right*)

a significant reduction in incontinence, but the “cure” rate on pad testing was only 22% [33]. Subsequently, a fourth size was manufactured which yielded improved efficacy, 51% dry on pad testing [34]. This device does not treat prolapse but is useful in patients who mainly leak with sporting activities. The Continence Dish, from the USA, looks more like a prolapse ring, but has a small “knob” in the midline which sits underneath the urethra to support it. Although a very small study was first published in 2002, recent data [35] indicate that 87% of patients with stress incontinence are dry on a 24-h pad test, but 54% were cured on the ICIQ outcome (which includes a “bother” score that was not always zero in women who used the vaginal ring).

Unfortunately there is no “successful” drug therapy for stress incontinence. Duloxetine is a serotonin reuptake inhibitor that also affects Onuf’s nucleus in the pelvic nerve plexus. It was designed for the medical treatment of stress incontinence because it enhances the strength of the internal urethral sphincter. Unfortunately because 14% of patients

suffered quite bad nausea, it was not a great success. Because it also enhances bladder capacity, it has also been used in detrusor overactivity [36]. It is licensed in Denmark for use in incontinence.

In the last 5 years, there has been considerable interest in using Laser Therapy to treat stress incontinence, especially in postmenopausal women. The treatment is thought to work by increasing collagen formation in the lamina propria of the peri-urethral area. As yet there is no long-term objective outcome data for this treatment. For example, an RCT of 72 women (who were all postmenopausal, but were NOT all incontinent, some only had urgency) from Brazil was evaluated after three visits at 14 weeks [37]. After randomization to carbon dioxide laser versus promestriene versus vaginal lubricant, ANOVA (analysis of variance for repeated measures) revealed no difference in ICIQ scores between groups. A cautionary note was sounded by Song et al. 2018 [38]. A study of erbium laser ( $n = 205$ ) from Italy [39] was able to follow 66 women out to 24 months, when the ICIQ score showed no significant difference from baseline (despite there being significant benefit at 6 and 12 months). Treatments can cost US\$1400 per visit, minimum of three visits.

## Conclusions

PFM training needs to be tailored to the individual woman. Stress incontinence is not life threatening, and patients know this. Do not recommend a therapy that the patient feels uncomfortable with, as her compliance will be poor. In order to provide the best results, discuss the options with the patient, and let her select the one which she thinks she can manage.

The caveat to this advice is that patients should also understand the risks of surgery, if they do not respond to conservative therapy. If a woman understands that current continence surgery has a 5–6% risk of developing overactive bladder and a 1–2% risk of voiding difficulty, then their interest in and compliance with conservative therapy may be enhanced. Urogynecologists must always remember that our first duty is “to do no harm,” and PFM training has no complications.

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# Chapter 7

## Step-by-Step Guide to Treatment of Overactive Bladder (OAB)/Detrusor Overactivity

If a patient has the main complaint of frequency/urgency/nocturia/urge incontinence (OAB syndrome) on history, with a typical bladder chart, or if urodynamic testing has revealed detrusor overactivity, then bladder training is an essential part of treatment. Most continence clinicians would not prescribe anticholinergic drugs without teaching bladder training first. This is because anticholinergic medicines act to relax the detrusor muscle, which should allow a bigger bladder capacity (and thus less frequency, and leakage less often). However, if the patient does not do the three steps of bladder training, the benefit of the medicine may be diminished.

### Explain the Condition

This is the first step. Many patients with OAB think that they are “neurotic”; often they are an embarrassment to their families as they frequently need to rush to the toilet on social occasions. In fact, during the 1970s and 1980s, several studies suggested that this condition was largely psychosomatic, but conclusive evidence of this was not found.

Since the introduction of Quality of Life testing in the 1990s, we have learned that patients with detrusor overactivity have a much poorer quality of life than those with stress incontinence and are more anxious and depressed, because of the unpredictable nature of their incontinence. A woman with stress incontinence can just stop playing tennis or quit jogging, but a woman with OAB has no way to change her lifestyle to avoid leaking—except that they often stop going out socially to avoid embarrassment.

*Etiology:* In the last 30 years, studies of the bladder and brain in patients with DO have found that:

- The afferent limb of the micturition reflex is abnormal: The subepithelial nerves in the lamina propria are overabundant in this condition (increased by about 35% compared to controls [1]; see Fig. 7.1), and neuropeptides involved in conveying “nociceptive” or painful symptoms are increased by 80–90% [2]. The urothelial cells lining the bladder are now known to release various signaling molecules such ATP and cytokines, that can activate the afferent nerves in the lamina propria. Stretch of the bladder

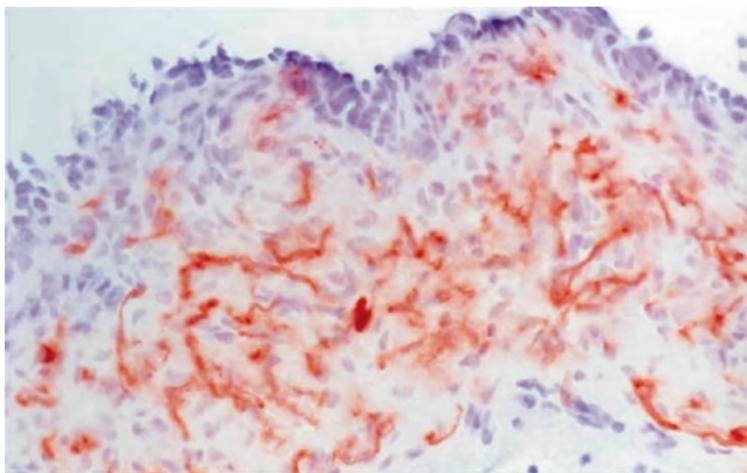


FIGURE 7.1 Increased subepithelial nerves in detrusor overactivity patient

causes a more rapid release of ATP in patients with OAB compared to controls [3].

- The central (brain) control of micturition is altered: The ability of the cerebral cortex to inhibit the desire to void is reduced in this condition, but can be strengthened by training. Functional MRI studies performed during urodynamics show changes in cerebral blood flow in OAB [4]. Specific areas of the brain, the dorsal anterior cingulate gyrus, the prefrontal cortex, and the midbrain periaqueductal gray matter, have shown abnormalities compared to controls [5] and these abnormalities change after biofeedback-assisted pelvic floor muscle training (e.g., Step 2 of our Bladder Training program).
- The detrusor muscle is overly contractile, giving rise to “muscle cramps” in the bladder. Pharmacological studies show that, in the organ bath, the muscle strips from these patients do not relax entirely when atropine is administered (whereas detrusor strips from control patients do relax after atropine is applied) (For review, see [6]). Recent work suggests that this may be partly associated with atherosclerosis of bladder blood supply, leading to ischemia, hypoxia, and damage to the mitochondria of the detrusor (for review, see [7]).

Therefore, the patient must understand that she is not neurotic but has an abnormality of the afferent (subepithelial nerves), and efferent (detrusor contractility) limbs of the micturition reflex, with subtle changes in precise cerebral areas of micturition control. Patients are often pleased to learn that they have a defined abnormality, which is not “all in their head.”

The next step in bladder training is to look at the frequency-volume chart with the patient. Because the severity of frequency varies in this condition, the therapist needs to find a realistic target “voiding interval” toward which the patient can aim. For example, if the chart shows that the patient usually toilets every hour but sometimes can hold for 2 h, then the target voiding interval should be 2 h (Fig. 7.2).

## BLADDER CHART – DAY 1 Date: 8/07/2021

TIME	AMOUNT & TYPE OF FLUID IN	TIME	AMOUNT OF URINE PASSED	COMMENTS
530 am	juice 250	530 am	500 ml	–
		730	200 ml	leak & urge
		800	100 ml	– (80)
815	coffee 350	915	175 ml	leak at front door after walk
		1030	190	–
		1145	230	–
1230	coke 375	1pm	250	leak on way to toilet Large
		3pm	175	–
4pm	coffee 250	415	150	leak & running water drops
		630	180	–
7pm	cranberry 150	730	120	–
830	wine 125	9pm	–	leak in shower
		2am	150	leak on way to toilet

FIGURE 7.2 A typical example of a patient with OAB, with the voiding intervals of less than 2 h in red, and the voiding intervals of two or more hours in blue

Once the target (e.g., 2 h) is chosen, the instructions *to the patient* are as follows.

## Step-by-Step Guide to Bladder Training

When you get a desire to go to the toilet, look at your watch.

If it is more than 2 h since you last went to the toilet, just go ahead and pass urine.

If it is less than 2 h since you last went, then you need to do three things:

**A. Sit down.**

The reason for this is that the bladder has gravity nerves inside the wall that give you a stronger desire to toilet when you are standing than when you are sitting.

**B. Contract your pelvic floor muscle (PFM).**

The reason is that you must stop any drops of urine escaping from your bladder into your urethra. Once the fluid gets into your urethra, there is an automatic reflex that will make you start leaking urine onto your pad/underwear, so you need to “nip this in the bud.”

**C. Send a strong message from your brain, down your spinal cord to the level of the tailbone, then out to your bladder, saying, “No, I am *not* going to the toilet for 2 min.”** There is a direct pathway from the front of your brain, down the spine, to the bladder, but in your condition, the message signals on this pathway seem to have become “rusty” or weak. These messages can be strengthened by focused concentration.

Sit quietly for 2 min, contracting your PFM. At the end of 2 min, stand up (contracting your PFM as you stand), and walk slowly to the toilet (do not run or you are more likely to leak).

However, if you have waited 2 min, it is likely that you will no longer want to go.

This is because the bladder spasms that cause your leakage are like a muscle cramp; they normally only last 1–2 min, and then the muscle cannot hold the spasm anymore; it relaxes.

Therefore, you may be able to hold on for another half an hour or so, until another spasm occurs. If this happens after you have successfully stopped the previous spasm, then you should go ahead and walk to the toilet for this one.

Before the patient can successfully undertake step B, she must be examined to make sure that she can contract her PFM, and if not, undergo a program of pelvic floor muscle training, as described in Chap. 6. Do not disappoint the patient by expecting her to succeed with bladder training until she has learned how to contract the pelvic floor muscle.

However, do not confuse the fact that Bladder Training is an essential “package” of treatment for her bladder spasms, of which PFM training is only one-third of the components.

If drugs are prescribed for this condition, they will help to relax the bladder spasms, giving a larger bladder capacity. But the patient must try to inhibit the premature desire to void, and stop urine getting into the urethra, if she wants to get maximum benefit from the medicine!

**Nocturia:** If a patient suffers from nocturia, bladder training works to increase her bladder capacity during the day. Gradually, her bladder capacity should also increase at night. She must attempt to inhibit the desire to void at night if she is awakened by a snoring husband or night flushes (which may respond to HRT if appropriate). She must avoid nocturnal trips to toilet out of habit.

However, as discussed in History Taking (Chap. 1), patients who produce more than one-third of their total 24 h urine output during the night (Fig. 7.3) have a condition called

BLADDER CHART – 1 day (24 Hours) DATE: 9/8/21

TIME	AMOUNT & TYPE OF FLUID IN	TIME	AMOUNT OF URINE PASSED	COMMENTS Eg leakage, urge, pain, burning etc.
		7.25am	Urine 200ml	URGE
7.30am	Coffee 200ml			
8.30am	Coffee 200ml			
		10am	Urine 150ml	URGE
		10.45am	Urine 10ml	URGE, trickle
12.15pm	Coffee 200ml			
		12.25pm	Urine 50ml	URGE, trickle
		2.30pm	Blow's mouthwash 50ml urine	Soft but hard to empty
		2.50pm	URINE 5ml	URGE, trickle
4pm	2 glasses of water 80ml			
		5.30pm	URINE 150ml	URGE always feels not empty
7pm	Coffee 200ml			water
		10-10pm	URINE 200ml [REDO]	Urge - good flow
		12.30pm	URINE 250ml	URGE - strong flow
		3am	URINE 200ml	URGE
		5.40am	URINE 200ml	URGE
5.45am	Water 100ml		Voids x 8	
			+ 3 NOCTE	12 URGE
		1.30pm		NO LEAKS
		4 Coffees		

FIGURE 7.3 Bladder chart of nocturnal polyuria

Nocturnal Polyuria [8], which is strongly associated with Sleep Apnea. If they also suffer from snoring, and/or obesity, referral to a respiratory physician who specializes in diagnosing sleep apnea, for an overnight sleep study, is important. If they are found to have sleep apnea, the obstruction to the glottis caused by the apnea is associated with production of a chemical from the heart atria, Atrial Natriuretic Peptide, which causes increased production of urine by the kidneys at night. Treatment of sleep apnea will usually resolve their nocturia [9], but bladder training may not always succeed.

*Is bladder training proven to be effective?* Bladder training (BT) was introduced before the era of objective outcome measures. An often-quoted paper from 1980 set the stage. In it, 25 women had inpatient bladder drill (they were kept in a hospital bed, with nurses not allowing them to urinate before the prescribed time even if they wet the sheets) and 25 women had drug therapy (with imipramine and an outdated drug flavoxate). Of the bladder drill group, 76% “were rendered symptom free,” versus 48% of those given drugs [10]. In the same year, outpatient bladder drill was reported to achieve subjective cure in 87% and objective cure in 53% of 90 women [11].

Since then, there has never been an adequately powered trial comparing BT versus no therapy, using objective outcomes. A small ( $n = 105$ ) but well-designed RCT [12] of 4 detailed BT visits, versus oxybutynin alone, versus placebo, showed 82% reduction of urge incontinence in the BT group, versus 78% reduction in the Ditropan group (51% reduction occurred in controls, who performed 8 weeks of bladder diaries). Despite the high placebo response, the between-group differences were significant ( $p = 0.002$ ). The most recent [13] prospective open study ( $n = 85$ ) of two detailed BT visits with a specialized nurse, including a video about the physiology of micturition, found that bladder capacity and nocturnal polyuria were significantly reduced on bladder diary ( $p = 0.04$  and  $p = 0.024$  respectively). For the full review, which describes the significant benefit of BT versus, or combined, with oxybutynin or tolterodine, see [14].

Most clinicians find that bladder training is important. We explain to patients (based on our 30 years of experience in

our department) that, if they can be successful with bladder training, then they are more likely to *not need* long-term medications.

## How Do Anticholinergic Drugs Work?

Anticholinergic drugs work through the parasympathetic nervous system; they are antagonists that work at the muscarinic receptor to inhibit (and in some cases abolish) detrusor muscle contractions. For the patient, this can be likened to a muscle relaxant acting on the bladder. Anticholinergic medicines must *NOT* be given to patients with Narrow-Angle Glaucoma as it can suddenly worsen the intraocular pressure (but is safe in those with Wide-Angle glaucoma). Patients with incomplete emptying may show impaired voiding function and a modest increase in residual urine volume (because the detrusor is also relaxed during voiding). There are several types of anticholinergic drugs, with varying pharmacological properties.

*Oxybutynin (Ditropan):* Maximum dose 5 mg TDS, has been used since the 1970s. It is an antimuscarinic drug but also has local anesthetic properties (thus, it can be given intravesically) and also a smooth muscle relaxation effect. It is very effective in reducing detrusor contractions (60% dry rate), but about 60% of patients will get annoying dry mouth/dryness of the esophagus/difficulty swallowing and stop taking it. It is very cheap. The onset of action is quick (1–2 h) with 6–8 h duration of effect. When giving oxybutynin, titrate the dose against the symptoms. For severe nocturia but less daytime leak, give 2.5 mg mane and 5 mg nocte. Some patients are worse in the morning but have no nocturia; give 5 mg mane and 2.5 mg after lunch. The drug works within 1 h and lasts 6–8 h. A long-acting “slow-release” form of oxybutynin has been developed but is not marketed in all countries; this gives less dry mouth (about 25%).

*Oxytrol Patch:* A transdermal patch 3.9 mg per patch extended release, change patch every 2–3 days. Gives much

less dry mouth by avoiding production of a liver metabolite: 66% reduction in urge leaks. Pruritus at the patch site occurs in 14% [15].

*Imipramine (Tofranil)*: 25–50 mg nocte, is also a very old drug. In much larger doses (75–100 mg daily), it is an antidepressant. It has a beta-mimetic action to relax the dome of the bladder but also has anticholinergic effects. Blood levels stabilize in 3 weeks (i.e., slow acting). Because a common side effect is drowsiness, it can be useful for nocturia.

*Tolterodine (Detrusitol)*: 2 mg BD, was developed in the 1990s. It attaches to the bladder muscarinic receptors to a much greater extent than to those in the salivary glands, so it gives less dry mouth than oxybutynin but is just as effective. It has a longer duration of effect than oxybutynin hence the BD dosage. In some patients, 4 mg BD can be given without dry mouth. A slow-release form has been made which is somewhat more effective with even less dry mouth, but is not available in all countries.

*Propiverine (Detrunorm)*: 15 mg TDS, is an antimuscarinic agent that is also a calcium channel blocker. It is rapidly absorbed within 2 h, half-life 11 h. Mild dry mouth occurs in about 20% of patients but is not usually distressing. It is not available in many countries.

*Trospium (Regurin)*: 20 mg BD, is a nonselective quaternary amine that gives little dry mouth (4%). Its structure also limits blood–brain barrier penetration, thus reducing CNS effects in the elderly (confusion). Half-life is 20 h. It is widely used in the United Kingdom.

*Darifenacin (Enablex)*: 7.5–15 mg daily, selectively acts at the M3 receptor, specific for mediating detrusor contractions, available in most countries. Is said to be a least likely agent to cross the blood–brain barrier thus less likely to cause confusion (which is a real concern in the elderly, for review see [16]). Can cause quite substantial constipation in about 4–8% of patients. Widely available internationally.

*Solifenacin (Vesicare)*: 5–10 mg daily, is also selective for the M3 receptor and also does not attach well to the salivary gland receptors. It was developed in the early 2000s and

achieved continence in 51% of one trial, with 11% suffering from dry mouth, available in most countries.

*Fesoteridine* (Toviaz): 4–8 mg daily, is the most recently developed anticholinergic, which was derived from tolterodine, to produce less dry mouth. It is available in the United Kingdom and Europe.

The last three agents (Darifenacin, Solifenacin, Fesoterodine) all have prolonged duration of action and steady-state blood levels require 3 weeks to equilibrate. The older medicines are often subsidized by a national health service, but the newer agents are often a “private script.”

*Mirabegron (Betmiga): A new approach!* In addition to the cholinergic receptors in the detrusor, we now know that Beta<sub>3</sub> adrenoreceptors exist in the detrusor and urothelium and cause relaxation of the detrusor muscle. Ten years ago, this led to initial studies of a Beta<sub>3</sub> agonist called Mirabegron, which is rapidly absorbed, metabolized in the liver, with a half-life of 23 h. Although Beta receptors exist in the heart and the vasculature, they do not exist in the salivary glands or the gut, so dry mouth and constipation do not occur with this medicine. Even better, they can be given to patients with narrow angle glaucoma. An initial review of five large RCTs [17] discussed dosages of 25, 50, and 100 mg, but generally, the dose of 50 mg is now used. Initial concerns about tachycardia/arrhythmia or myocardial dysfunction did not materialize (OR 2.18,  $p = 0.06$ ). However, there is a slight increase in risk of hypertension (OR 1.11,  $p = 0.08$ ); patients with untreated hypertension should not receive the drug until hypertension is controlled. (see Sebastianelli et al. 2018 for full review [18]). The voiding phase of micturition is unaffected.

## Are Anticholinergic/Beta Mimetic Drugs Effective?

This is controversial. Most pharmacotherapy trials only consider efficacy at 12 weeks or thereabouts. An initial Cochrane meta-analysis [19] found that, in a review of 6713 patients in

51 studies, the placebo effect was much higher than expected (about 45% with respect to control) but that the drugs gave an additional 15% over placebo. Overall, anticholinergic drugs achieved one less leak per 48 h and one less void per 48 h, versus placebo. This may seem like a small effect, but most of these trials did not include formal bladder training programs, so they do not reflect ordinary clinical practice. The most recent Cochrane review [20] has not been updated since 2009; in 61 trials (11,956 adults), anticholinergic drugs gave a statistically significant improvement in overactive bladder symptoms. In clinical practice, these medicines give a substantial benefit. For Cochrane review comparing different agents, see Madhuvrata et al., 2012 [21].

*Mirabegron effectiveness:* Meta-analysis of data from four large RCTs showed a “dry rate” of 44% for the 50 mg dose; 32% of patients had less than 8 voids/24 h [17]. Incomplete emptying seldom occurs. In practice, we find that response to Mirabegron is quite individual. In Australia, this medicine is a “private script” (cost 55\$AUD per month) so we do not use it as first-line therapy unless the patient has Narrow Angle glaucoma or incomplete emptying.

When considering the “effectiveness” of medicines for Detrusor Overactivity, one must consider whether DO is actually a chronic disease, because if you believe it is chronic, then medicine will not “cure” it, only improve the symptoms. Achieving a “dry” state in 100% of patients may therefore be difficult.

The long-term history of detrusor overactivity has received little attention. A review of 76 patients with proven DO at a median of 6 years [22] found that symptoms had largely resolved in about 16% of cases. Symptoms fluctuated up and down in about one-third, and were unchanged (no better, no worse) in another 25%. Sadly, symptoms got worse over time in 25% (Fig. 7.4). Thus, some form of long-term therapy may be needed in about half of patients.

Having said that, patients may not have to take the full dose to achieve good symptom control. Many patients have “good days” and “bad days.” In a randomized controlled trial,

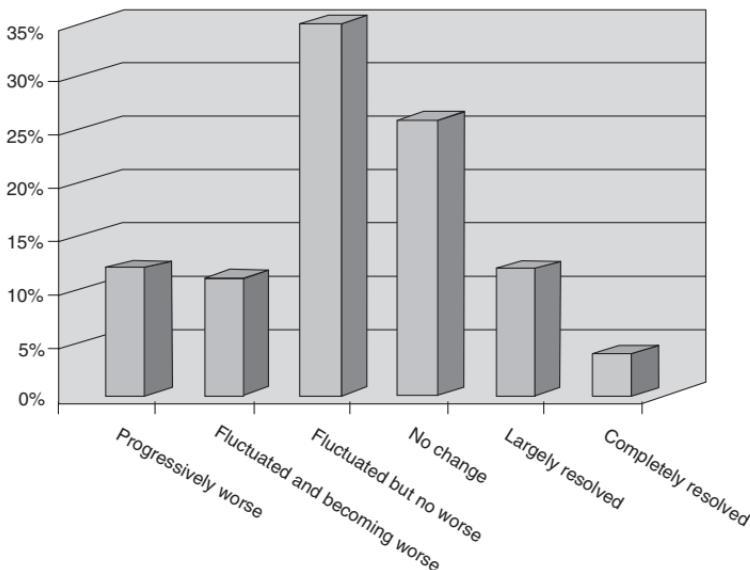


FIGURE 7.4 Histogram showing the course of disease in 76 patients with detrusor overactivity at a median follow-up of 6 years (Data from Morris et al. [22])

Burton [23] showed that patients who took short-acting tablets only on their “bad days” (the “PRN regime”) obtained equally good effects as those who took the daily dose.

#### *What about Nocturia in patients with OAB/ DO?*

In the last 10 years, we have come to realize that nocturia is a major health problem. Because people are living to such a greater age, nocturia has emerged as a serious disruptor of sleep, with major effect upon nighttime falls and fractures (then a twofold increase in mortality) not to mention day time somnolence/ impaired function. The urogynecologist is often the first “port of call” for such patients, but our understanding of this condition and optimal therapy is still emerging (for review see Bower et al., 2017 [24]).

The first-line therapy for women with OAB and nocturia still remains bladder training, but such patients really need to rearrange their fluid intake as well. We explain that in the morning, their body wakes up thirsty, they need to drink a

large glass (e.g., 400 ml) of non-caffeine fluid, e.g., orange juice, green tea, and water then drink normally through the day, but after 6 pm they should only sip small amounts of fluid, as in a dainty teacup or a sherry glass. In older patients with peripheral edema, cardiac evaluation is often very helpful.

*Desmopressin (Minirin):* Consider this treatment if nocturia cannot be helped by other agents. This synthetic vasopressin analogue markedly reduces the renal production of urine for about 6 h. It was given as 1–2 nasal sprays to each nostril before bedtime; now oral tablets and sub-lingual melts are available. It is useful for patients with debilitating nocturia who are practicing bladder training during the day but have not yet improved their bladder capacity, so they have not yet seen any reduction in nocturia. It is now recommended for patients with nocturnal polyuria [8]. It is not a good long-term strategy in the elderly, because it is associated with hyponatremia that can be life threatening. In children with bedwetting, long-term usage has been shown to be safe.

## Role of Topical Estrogens

Theoretically, the effect of vaginal estrogen upon the bladder base/trigone should promote tissue elasticity and enhance bladder capacity. Also, the effects of estrogen seen in patients with stress incontinence (thickening the urethral mucosa to prevent leakage of urine) should also help to reduce leakage in women with OAB.

Unfortunately, few studies have investigated this. Small studies from the early 1980s showed significant improvement in urge incontinence symptoms. The 2012 Cochrane review showed that maximum capacity was significantly improved (RR 50, 95% CI 36–64). An RCT of topical estrogen versus placebo ( $n = 110$ ) showed reduced urinary urgency [25]. Recent pharmacokinetic data about the safety of topical estrogen show that the serum levels of estriol (Ovestin) are generally below the menopausal cut-off of 90 pmol/L [26].

## Alternative Therapies for Detrusor Overactivity

### *Electrostimulation*

As discussed in Chap. 6, electrostimulation (E-Stim) is a recognized technique for strengthening the pelvic floor muscle in women with stress incontinence, by inducing repetitive tetanic muscle contractions. It can also be used for patients with detrusor overactivity (DO). E-Stim of the nerves of the perineum or anus is known to cause reflex inhibition of detrusor contractions. In the 1970s, E-Stim was usually delivered via an anal electrode, not popular among middle-aged women. In the largest sham-controlled RCT, Brubaker et al. [27] showed that *intra-vaginal* electrostimulation resulted in a urodynamically stable bladder in 49% of patients with DO (no significant change in the sham group). The latest Cochrane review found that E-Stim was better than sham therapy (RR 2.126, 95% CI 1.85–2.8). Benefit for urge leak was seen, but with wide 95% CI (RR 5.03, CI 0.28–89.8) [28].

### Transcutaneous Electro Stimulation

Transcutaneous Electro Stimulation (TENS) has been used for many years in the labor ward, to inhibit the sensation of pain during uterine contractions. TENS (Fig. 7.5) has been used for patients who feel the urge to void as an unpleasant spasm. It works by modifying sensory input, by interrupting the relay of afferent impulses to the cerebral cortex. The electrodes are applied over the pubic bone or over the sacrum, and the patient self-regulates the electrical impulses coming from the stimulator (worn attached to her belt) until she feels a strong buzzing sensation over the application site. Small clinical trials showed promising results [29, 30]. The device costs about 50 euros and can be used by patients at home. It has been largely superseded by PTNS (see Fig. 7.5).



FIGURE 7.5 TENS machine for the treatment of detrusor overactivity

## Acupuncture

Acupuncture has also been helpful for detrusor overactivity. Acupuncture increases the levels of endogenous opioids (beta-endorphin and met-enkephalin) in the patient's cerebrospinal fluid. Pharmacological experiments show that enkephalins inhibit detrusor contractions. Animal studies show that the acupuncture effect on suppression of bladder contractions by sacral acupuncture was inhibited by giving a GABA (gamma-aminobutyric acid) receptor antagonist beforehand.

The traditional bladder points are documented in the literature (for full review, see Forde et al., 2016 [31]). In the first Sham study ( $n = 26$  patients on acupuncture, 24 sham therapy), symptom improvement occurred in 85%, with 75% becoming urodynamically stable and bladder capacity was significantly increased [32]. A large study of acupuncture versus Tolterodine showed significant benefit from both treatments in urge incontinence and nocturia, but the two groups were equivalent [33].

## Electro-Acupuncture and Posterior Tibial Nerve Stimulation

The SANS (*Stoller Afferent Nerve Stimulator*) is a device that mimics acupuncture, but adds an electrical stimulus to the needle, which is inserted into a bladder point over the medial

malleolus of the ankle (near the posterior tibial nerve). This device can be employed by trained nurse continence advisors, because the relevant bladder point is easily identified from surface anatomy (Fig. 7.6).

Acute administration of SANS during cystometry significantly increased the maximum cystometric capacity [34]. After 12 weeks of SANS in 53 patients, a 25% reduction in frequency, 21% reduction in nocturia, and a 35% benefit for urge incontinence were noted [35]. Maintenance therapy with repeated treatments may be necessary however [36].

Further commercial refinement of this device led to Posterior Tibial Nerve Stimulation. The acupuncture needles come prepackaged with the stimulator lead attached, so the leads are single use (but the equipment is more expensive. A well-known RCT (the SUMiT trial) randomized 220 women to PTNS versus sham. Urge leaks were reduced from 3/day to 0.3 per day ( $p = 0.001$  vs. sham reduction of 0.8 per day) Voids per day were reduced from 12.3 to 9.8 (sham voids worsened,  $p, 0.001$ ) [37]. Other smaller sham-controlled studies, and #

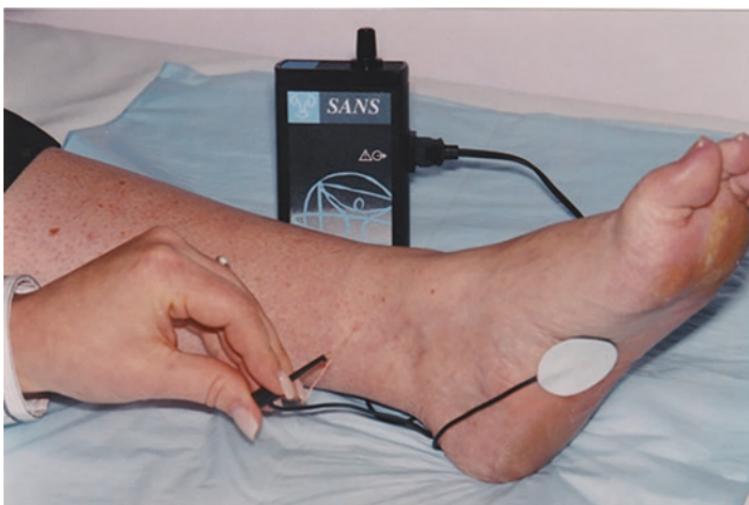


FIGURE 7.6 SANS device, applied to the bladder acupuncture point at the medial malleolus

RCTs of PTNS versus oxybutynin or tolterodine have all shown major benefit (and PTNS can also be combined with such medicines to give added benefit. Treatment is usually weekly for 12 weeks, then studies suggest monthly booster doses for 6–12 months.

More recently, transcutaneous adhesive pads have been used, instead of the acupuncture needle, which is called TTNS. This device has similar effectiveness but lower cost (Fig. 7.7), and is suitable for patient use at home (reminiscent of TENS, but with better outcome data).

## Hypnotherapy

Hypnotherapy has also been helpful [38]. After 1 month of 12 sessions, 58% of 63 patients became symptom free; 14% were unchanged. Cystometry showed that 50% had become stable, with 36% improved. Of 30 patients reviewed at 2 years, 33% remained symptom free. Patients required an audiocassette

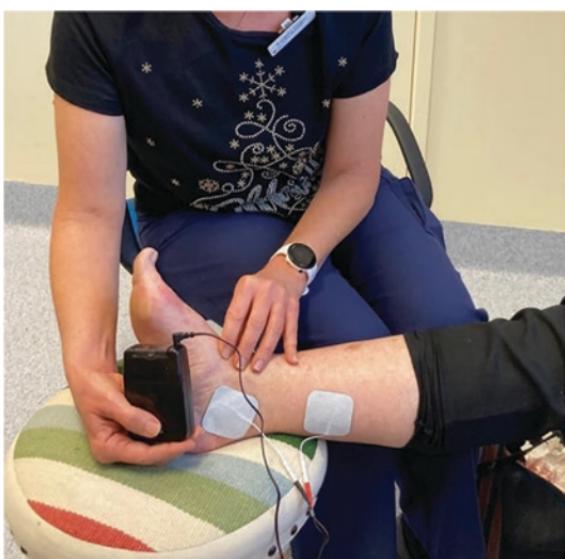


FIGURE 7.7 Transcutaneous posterior tibial nerve stimulation, TTNS

tape to be used in their own homes at regular intervals in order to maintain symptomatic benefit, so this therapy requires a motivated user.

## Extracorporeal Electromagnetic Stimulation Therapy

As mentioned in Chap. 6, this is a form of electrostimulation therapy that avoids the need for a vaginal probe. “On-chair” cystometry studies show that the magnetic stimulus abolishes detrusor overactivity in the majority of cases, but a sham-controlled study (using a sham chair that delivered no current) showed no benefit for active treatment of detrusor overactivity over sham [39].

## Cystodistention

Originally, Helmstein’s cystodistention was undertaken for 5–7 h (under epidural anesthesia) in order to produce necrosis of superficial bladder tumors. Later studies showed that this degree of distension produced tissue anoxia, which was thought to reduce detrusor contractility. Studies in the 1970s showed subjective response for DO in 70%, with 65–80% of bladders becoming urodynamically stable [40]. However, later studies showed a symptomatic response in 32%, with a stable bladder in 19% [41]. Epidural anesthesia and day-only admission are no longer justified.

However, in patients aged above 50 years with refractory DO, it is reasonable to offer cystoscopy to exclude carcinoma *in situ* (which may cause chronic irritative symptoms, e.g., frequency, urgency, and nocturia) and at the same time perform a simple cystodistention. This involves distending the bladder to capacity under general anesthetic, then allowing the total fluid volume to remain in the bladder for 3–5 min (with the infusion bag at a height of 1 m above the bladder).

A refill examination can then be performed in patients who also complain of suprapubic pain (see Chap. 12) to exclude interstitial cystitis.

## What Is “Refractory” Detrusor Overactivity?

In the last 20 years, the concept of “Refractory” DO has become well established (defined as failure to respond to two anticholinergic drugs with bladder training for more than 12 months, proven by bladder diary showing disabling urge incontinence [1]). Other authors use less stringent definitions [42]. However, the concept is important to note, because the treatments given below are traditionally used for patients who are “Refractory.” Before recommending the surgical treatments described below, we need to be mindful of recent evidence (from our department, 2 units in London, and a center in Chicago), that Refractory DO patients have a 25–45% likelihood of having recurrent low-grade bacteriuria, or classical cystitis respectively [43]. For further details of these terms see Chap. 11. However, Refractory patients should have at least three MSU samples taken, with careful labial toilet, as part of their workup before invasive surgery. If recurrent bacteriuria is found, cystoscopy to exclude follicular cystitis (which may respond to diathermy [44]) should be considered (see Chap. 11).

Before moving on to the two main current surgical therapies for refractory DO, we need to mention treatments that are now of historical interest only:

- *Intravesical Resiniferatoxin (RTX) Installation* is useful for neuropathic DO. RTX acts to desensitize the vanilloid receptors in the bladder lining, which normally convey a sense of urgency. Small trials undertaken idiopathic DO showed early promise, but later studies including RCT showed no benefit.
- *Clam Cystoplasty* was popular in the 1980s. In severely refractory disease, the bladder was opened transversely (in

the manner of opening a clam), and a segment of flattened bowel was inserted into the bladder opening, then the bladder was closed with its interposed bowel segment in continuity. The idea was to increase the bladder capacity and interpose an autologous tissue that would impair detrusor muscle contractility. This procedure has a 1% mortality rate. the initial 90% subjective response was not sustained over time. The bladder becomes stable in about 60% of cases. At a mean of 6 years [45], 53% of 51 patients were continent, but 40% needed to self-catheterize and suffered recurrent UTI. Mucous plugs from the bowel segment caused urinary retention in 20%. A less invasive procedure, *Partial Detrusor Myomectomy was later developed* [46]. It yields better results with less morbidity but is still a major surgical undertaking and is now seldom employed.

## Botox Therapy (Botulinum Toxin A Injections)

Since 2004, Botox injections to the detrusor muscle have been widely used in neuropathic DO (especially multiple sclerosis). The neurotoxin binds to cholinergic terminals locally to inhibit acetylcholine release, and to some extent ATP release, resulting in reduced detrusor contractions at the injected muscle site. It also blocks the release of some afferent neuropeptides involved in transmission of noxious stimuli. For idiopathic DO, about 30 injections of 100–150 units are usually given, via cystoscopy. One ampoule of 100 U costs about US\$800. Symptom benefit lasts 6–9 months. Several RCTs of Botox versus saline injection for idiopathic DO have shown significant reductions in urge incontinence and other OAB symptoms.

The first large RCT showed that 72% of patients had a 75% or greater reduction in leakage at 1 month [47]. Up to 45% of patients needed to self-catheterize (Cochrane review [48]). A large RCT [49] revealed a median reduction of urge leaks from 5 per day to 2.95 per day (vs. –1.03 leaks for saline

injection). Unfortunately, none of the publications give a “dry rate.” A long-term (3.5 years) follow-up study [50] of up to 6 repeat injections showed that risk of CISC was only 4%, but threshold for CISC was defined as >300 ml residual. The main adverse event was briefly mentioned as UTI, but the supplementary table containing the data is no longer available online without payment.

## Implantation of S3 Sacral Nerve Root Stimulator

Initially, a two-stage procedure was used for refractory DO. The first stage involves peripheral nerve evaluation (PNE). With the patient lying prone under anesthesia, the S3 foramen is located; a spinal needle is used to test that the nerve root has been located by electrical stimulation, and then a temporary stimulation wire is inserted and taped securely, see Fig. 7.8.



FIGURE 7.8 Insertion of sacral nerve stimulation lead at S3

This is attached to a temporary pulse generator device that the patient wears externally. The patient goes home for 2 weeks and records the benefit in a detailed diary. If the symptomatic benefit after PNE is greater than 50–70%, a permanent electrode is implanted into the S3 foramen. The pulse generator is then implanted below the posterior superior iliac crest. Overall cost is about US\$16,000. To improve success, a permanent tined lead may be inserted at the first procedure, with implantation of the permanent electrode if the 2-week diary showed >50% benefit. At 12 months, urge incontinence in 41 patients was reduced from 8.8 leaks to 2.3 leaks per day, and pad usage declined from 4.7/day to 0.82/day ( $p < 0.0001$ ) [51]. At 5 years, a study of 150 less-severe patients showed that leaks per day reduced from 3.1 to 1.1/day ( $p < 0.0001$ ) with complete continence in 45% of subjects [52] (see also Cochrane [53] review).

Because S3 sacral stimulation has no appreciable mortality, it has essentially replaced clam cystoplasty and detrusor myomectomy in patients with severe refractory detrusor overactivity. However, a safety review at 4.4 years [54] found that 33% (21/64) of patients required re-operation: one-third for removal of the stimulator, one-third to reposition the implant for pain, the other third require a revision of the lead or a replacement battery. Mean lifespan of the battery was 62 months (range 49–75 m). Readjustment of the stimulation parameters was needed on five occasions in 66% of patients. So patients with a sacral nerve stimulator do need considerable long-term monitoring in a center that is focused upon this technique. Also, patients with this implant cannot undergo MRI, and need a certificate to present to airport security as to their status.

## Conclusions

Idiopathic detrusor overactivity is often very distressing for patients, because they cannot predict when they will leak. It is also rather frustrating for the clinician, because we do not yet understand the cause of the condition and we have no

“cure.” Patients need to be treated as sympathetically as possible, with careful bladder training and attempts to find the best therapy for each woman. Although there is now a good range of anticholinergic/Beta mimetic agents available, several non-drug therapies are very attractive. In Refractory DO, Botox injections are effective but must often be repeated: sacral nerve stimulation has superseded clam cystoplasty for severe cases. The patient should be told that a great deal of research is ongoing, to discover the cause and find better treatments for this problem.

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# Chapter 8

## Anal Incontinence and Disorders of Obstructive Defecation

Before moving on to surgical treatment of stress incontinence, or prolapse, we must consider the disorders of defecation. This is because many patients with urinary incontinence or prolapse have anal incontinence, recurrent straining with constipation, or other aspects of obstructive defecation. Because surgery may be considered for the defecation disorder, and these surgeries can be performed simultaneously by the colorectal surgeon along with bladder/prolapse procedures in a multidisciplinary Unit, such conditions are dealt with here.

### Basic Physiology of Anal Continence and Defecation for the Gynecologist

Because the anal continence mechanism and the physiology of defecation are not part of normal registrar training in gynecology, the doctor who works in an urogynecology unit needs a basic outline, to understand the treatment of defecation disorders.

Anal continence depends upon the following:

1. Stool consistency (watery diarrhea *alone*, e.g., gastroenteritis can cause faecal incontinence).

2. The ability of the rectum to distend up to normal volumes.
3. The sensory input from the anal canal and rectum.
4. The strength and innervation of the internal and external anal sphincters.
5. Normal colonic motility.

The first problem is unique to the bowel (although infected urine can cause bladder incontinence). The second and third problems are rather like those seen in an overactive bladder, where the bladder wall may be noncompliant and the subepithelial nerves are dysfunctional. The fourth problem is rather like that of stress incontinence (weak sphincters), except that the anal sphincters are more complex. The fifth factor is unique to the gut; abnormal motility may result in fecal urgency (due to uncontrolled movement of feces from sigmoid to rectum).

Several theories exist as to the mechanism of anal continence. In the 1970s, the main theory was that the normal puborectalis muscle caused an acute anorectal angle, so that during rises in intra-abdominal pressure, the rectum was forced down upon the anal canal, with a “kink” at the puborectalis muscle, so that feces were denied access to the anal canal. Arising from this concept, the operation of *post-anal repair* was developed, to restore the anorectal angle and improve continence. It is seldom performed today, as success rates are very variable (see below).

Later studies showed that continence was really dependent upon the sphincters and the puborectalis muscle acting together. When the pressure in the rectum rises, the contractility of the anal sphincters increases, by neurological mechanisms. Thus, operations to repair the anal sphincter, which do not increase the anorectal angle, also improve continence.

Even later, it was realized that continence also depends on awareness of rectal filling. This gives one the ability to distinguish whether the rectal contents are gas (which could be passed in private, not necessarily in a toilet) or feces, in which case the external sphincter can be contracted voluntarily while looking for a toilet. The anal canal is highly able to discriminate light touch, pain, and temperature. In contrast,

the rectum is not very sensitive to these impulses. Instead, rectal sensation is conveyed by stretch receptors within the pelvic floor muscles that respond to the bulk phenomenon of rectal distension.

Distension of the rectum (by feces or flatus) causes relaxation of the internal anal sphincter, along with contraction of the external anal sphincter. This allows the contents of the rectum to enter the sensitive anal canal (but prevents escape of the contents from the anus). Once the contents enter the anal canal, the nerves sense whether gas or feces are present. This is called the “anal sampling reflex.”

The sensitivity of the anal mucosa declines with age and menopause, partly explaining the increasing prevalence of anal incontinence in older women.

Filling of the rectum is normally first sensed at volumes of 10–70 ml. Maximum capacity is about 300 ml. Rectal distension initiates contractions of smooth muscle in the rectal wall, which causes the desire to defecate at “fullness.” This normal compliance of the rectal wall is reduced after pelvic irradiation, with inflammatory bowel disease, and sometimes after denervation following radical pelvic surgery.

Finally, strength and innervation of the sphincters are a vital component of continence. The internal anal sphincter (IAS) is continuous with the circular muscle in the wall of the rectum (see Fig. 8.1). It is in a constant state of tonic contraction, to promote continence. This provides the so-called high-pressure zone in the resting state, about 2 cm from the anal verge.

The high-pressure zone also receives a 15% contribution from the three “anal cushions” that have a rich arterial supply and behave like erectile tissue. They are engorged with blood when the IAS is relaxed and forms a seal. Their pressure is higher in those with hemorrhoids and can be damaged by vigorous hemorrhoidectomy. Inadvertent division, or marked thinning, of the IAS (i.e., after some vaginal deliveries) is associated with fecal soiling in up to 40% of cases.

The external anal sphincter (EAS) is continuous with the puborectalis muscle (see Fig. 8.2). Although the EAS is a stri-

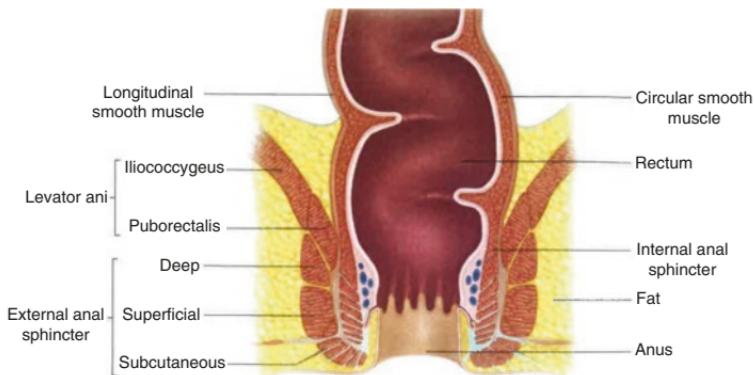


FIGURE 8.1 Anterior–posterior view of anorectal musculature

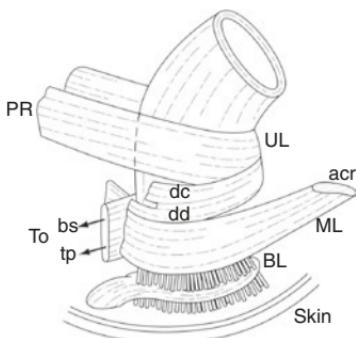


FIGURE 8.2 Lateral view of anorectal muscles. *PR* puborectalis, *UL* upper loop, *DC* decussating fibers of puborectalis that blend with the longitudinal muscle of the rectum, *DD* decussating fibers that join the perineal body, *ML* middle loop, *ACR* anococcygeal raphe, *BS* bulbospongiosus, *TP* deep transverse perinei, *BL* basal loop, perforated by fibers of the conjoint longitudinal layer (Reprinted with permission from Bogduk [1], Blackwell Publishing)

ated muscle and is under voluntary control, it is also in a constant state of contraction to promote continence. During cough, the EAS tightens reflexively. Ultrasound studies of the EAS have shown that about 35% of women who delivered by forceps have a partial or complete laceration of the EAS, which generally does not recover and also contributes to anal incontinence.

The motor innervation to the EAS is via the pudendal nerve. Fecal continence also relies on intact pelvic nerve plexuses that innervate the distal colon. Prolonged bearing down in the second stage of labor is associated with a traction neurapraxia of the pudendal nerve, which may not recover. Also, damage to the pelvic nerves may occur during prolonged bearing down or instrumental delivery. Hence prolonged labor may be associated with anal incontinence even with intact anal sphincter muscles.

If rectal sensation is poor, and rectal compliance is reduced, and if the sphincters are also weak, then patients can experience anal incontinence before they even get the desire to defecate.

## The Act of Defecation

The defecation mechanism is still not completely understood, despite extensive research:

- Stool comes down from the sigmoid colon to the rectum, by peristalsis, and is slowed by a “colonic break” [2] to allow regulated passage of stool into the rectum.
- Stretch receptors in the pelvic floor detect the stool in the rectum, giving the urge to defecate.
- The anal sampling reflex (internal sphincter relaxes, external sphincter stays closed) occurs; the anal mucosa senses whether stool or gas is present and conveys this to the brain.
- If defecation is not socially convenient, the pelvic floor muscles and the puborectalis contract. This propels feces back up into the sigmoid colon, and the internal sphincter contracts again.
- Once the toilet is reached, the pelvic floor muscles are relaxed while sitting on the toilet, allowing the perineum to descend.
- Both sphincters are relaxed. Puborectalis opens.

- The patient gives a Valsalva maneuver to raise intra-abdominal pressure.
- The bolus of feces is expelled. Upon completion, a closing reflex tightens the external sphincter.

## Overview of Anal Incontinence

Anal incontinence is really “the last taboo.” Patients are deeply ashamed if they soil themselves and usually consider it far worse than urinary incontinence. Questions must be phrased very tactfully; for example, do you ever lose bowel material on your underwear?

Anal incontinence is actually not uncommon. Large prevalence studies indicate that about 13% of the adult population have anal incontinence (including leakage of gas/wind) [3], with a much larger percentage of those in nursing homes. The most recent study indicates that 4.3% of noninstitutionalized adults suffer from accidental loss of solid or liquid stool [4]. As can be seen from the discussion of the physiology of defecation, the pathophysiology of anal incontinence is often multifactorial. The history assessment has been described in Chap. 1. The Wexner score (now modified to the St Mark’s Continence score [5], or the Cleveland Clinic FI Scale) should be used to measure the severity of anal incontinence (shown in Chap. 5). Considerable detail about previous colorectal surgery, previous radiation, inflammatory bowel disease, etc., is needed. Physical examination requires attention to anal sphincter tone, perineal descent, pelvic innervation, etc.

We encourage any patient with regular fecal incontinence to be fully assessed by a dedicated colorectal surgeon. Such a surgeon is part of our unit so that case notes and nursing staff are shared. On the other hand, patients with minor incontinence to flatus or rare incontinence to liquid stool may benefit from pelvic floor muscle training with a subspecialist Continence Physiotherapist.

The common tests of anorectal function for patients with anal incontinence comprise the following:

*Anorectal manometry* tests the magnitude of the resting anal pressure at the high-pressure zone (85% comes from IAS rhythmic slow wave contractions, 15% from tonic contraction of EAS). The most common method is a water-perfused catheter containing four recording channels, to detect pressure at various points along the rectum/anal canal, with a balloon at the end. After testing baseline resting pressures, the patient is asked to cough (pressures should rise briefly, to prevent incontinence) and then to squeeze the EAS, which gives the voluntary “squeeze pressure.” The rectal balloon is then distended with fluid to elicit a brief drop in anal pressure, showing competency of the “sampling reflex.”

*Pudendal nerve terminal motor latency (PNTML)* measures the time taken to conduct a stimulus (the conduction latency). A stimulating electrode, mounted on a gloved finger, is inserted into the rectum; the fingertip is placed on the ischial spine (near the pudendal nerve), with a recording electrode at the external anal sphincter. If the anal sphincter is weak, a prolonged PNTML may indicate neurogenic dysfunction, while a weak internal sphincter and a normal PNTML may indicate sphincter dysfunction [6]. The test does not give much prognostic information about treatment response and its usefulness has been questioned.

*Anal mucosal sensitivity testing* measures the adequacy of anal sensation (that is needed for the anorectal sampling reflex). A ring electrode mounted on a Foley catheter is placed in the anal canal. A tiny current (up to 0.1 mA) is delivered: the patient states when she can feel a tingling sensation. Standard normal values have been derived.

*Endo-anal ultrasound* is now the best way to measure whether the sphincters are intact, using a rotating probe (Fig. 8.3). Defects of the EAS are detected very accurately. This technique was used by Sultan et al. in a classic paper [7] to show that about 35% of parous women have defects of the EAS. This does not necessarily mean that they will respond to surgery.

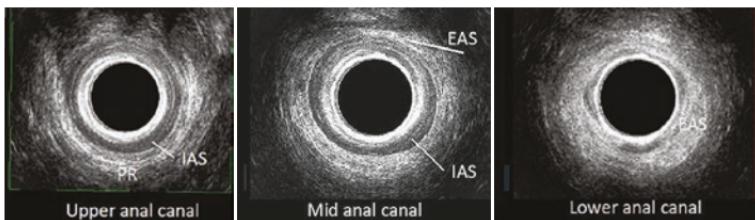


FIGURE 8.3 Three-dimensional ultrasound of internal and external anal sphincters, and puborectalis muscle, courtesy of Dr. V Patton, from the St George Hospital Pelvic Floor Unit, Anorectal Physiology Laboratory

Three-dimensional ultrasound has now been developed to accurately quantify residual sphincter injury after repair. The Starck score [8] uses 3-D ultrasound to measure the effectiveness of sphincter repairs in postpartum women or after colorectal sphincter repair.

## Treatment of Anal Incontinence

Management involves a large range of conservative and surgical treatments. A short summary is provided; for details, see [9].

*Pelvic floor muscle training* is done to teach the patient to contract the external anal sphincter, similar to that in urinary incontinence [10]. Biofeedback is often used, by a rectal EMG sensing device, to enhance patients' awareness of their ability to contract [11]. Electrical stimulation of the muscle has also been used (as for stress incontinence) with varying success.

*Regulation of diet to avoid watery stool* is often successful for patients who only leak when they have liquid feces. Also, 2–3 dessert spoons of Metamucil or psyllium husks are dissolved in a small amount of water (100–150 ml) to thicken the stool.

*The drug Imodium (loperamide)* is also used to thicken the stool; it also increases the resting tone of the anal sphincters to promote continence.

*Lomotil (Diphenoxylate hydrochloride + atropine sulfate)* should be avoided due to its addictive properties.

*Anal sphincter repair (sphincteroplasty)* involves dissecting the damaged ends of the external sphincter, freeing them up enough to be laid across each other and sutured, in an “overlap repair,” although recent evidence indicates that the overlapping repair is not significantly better than the end-to-end repair [12]. When performed for obstetric lacerations of the sphincter, continence is achieved in about 80%. Success is best when the pudendal nerve to the sphincter is intact and the internal sphincter is not damaged.

*Postanal repair* involves plication of the puborectalis muscle posterior to the anorectal junction. The posterior aspect of the external sphincter is usually reinforced also. The operation is designed to increase the anorectal angle (originally thought to be very important to the continence mechanism). Audit in the mid-1990s showed that less than 50% of patients have improved continence at 2 years, so the procedure is seldom used.

*The dynamic graciloplasty* was a complex surgical procedure involving transposition of a segment of gracilis muscle from the inner aspect of the thigh and then tunneled under the pubic bone to wrap it around the anal sphincter. Initial results were promising. However, the 2-year data showed only 15% were 100% continent; in a large series of 121 patients, there were 211 adverse events, half of which required rehospitalization or repeat surgery [13]. The device has been withdrawn in the USA (another lesson in medical history).

*Sacral nerve stimulation* has now become more commonly used for fecal incontinence (FI) than either the anal sphincter repair or the postanal repair in the last decade. It is particularly useful for urge FI; it is thought to act by modulating the pelvic nerves that supply the sigmoid colon, thereby reinstating the “colonic break” [14].

The procedure is the same as described for patients with detrusor overactivity in Chap. 7, except that after inserting the temporary stimulator (see Fig. 8.4), patients should keep a diary for at least 2–4 weeks because FI is often erratic; thus,



FIGURE 8.4 Sacral nerve stimulation

more time is needed to judge whether >50% benefit is occurring. Implantation of the permanent device is identical [15]. In patients with a good response to the temporary stimulator who have the permanent implant, the Wexner score improves markedly, down from baseline 15 to a median of 2 [15] in the short term. A long term study by [16] showed that 78% of patients had greater than 50% reduction in incontinence episodes ( $n = 228$ , at median of 7 years), with Wexner scores falling from median 16 (IQR 13–18) down to 7 (IQR 4–12). Complications of seroma at the battery wound site, lead migration, and lead fracture are similar to that of SNS for detrusor overactivity, but patients with FI also report a 9% risk of tingling in the perineum [17].

*Posterior Tibial Nerve Stimulation (PTNS)*, which is also used for detrusor overactivity (Figs. 7.6 and 7.7), has become a valid treatment for FI in the last 5–6 years. It is particularly beneficial for the urge component of this disorder, allowing patients more time to get to the toilet when they get the call

to defecate [18]. In a randomized trial of PTNS versus sacral nerve stimulation implants, the Cleveland Clinic score after PTNS fell from 15.2 down to 12.1, versus a reduction from 16.2 down to 10.4 for sacral nerve stimulation [19]. In Europe, PTNS devices cost approximately 630 Euros versus approximately 10,000 Euros for SNS.

## Overview of the Disorders of Obstructive Defecation

In the urogynecology patient, the main problems comprise constipation, incomplete evacuation with a need to digitate the vagina, and post-defecation soiling. These symptoms often coexist with rectocele, but such patients are often referred to the colorectal surgeon rather than the urogynecologist. Debate exists about who should manage rectocele. In our unit, such patients are often assessed jointly by the urogynecology and colorectal teams. If the patient has a substantial enterocoele, then sacrospinous fixation with a urogynecologist is often done, but if the patient has idiopathic slow transit constipation or rectal intussusception, then colorectal input is vital. The colorectal approach is given here, derived from experience in our combined unit.

## Constipation

When patients complain of constipation, only about a third of them are actually concerned about infrequent defecation; the rest are worried about straining at stool or passing hard stools. Patients should be shown the Bristol Stool Chart to define what type of stool she passes (see Chap. 1, Fig. 1.4).

The definition of constipation has been standardized, now called the “Rome definition,” as a patient who has two or more of the following, for at least 12 months, when not taking laxatives [20]:

- Straining during >25% of bowel movements (BM)
- Sensation of incomplete evacuation in >25% of BM
- Hard or pellet stools on >25% of BM
- Less than three stools passed per week

Other symptoms such as the need to digitate to defecate, abdominal cramps, bloating, and so on do not feature in the Rome definition but help one to assess the severity of constipation. Depending upon the definition used, constipation affects about 4% of the population but about 17% of those aged 30–64 years and 40% of those above 65 years. It is common in urogynecological patients.

## Assessing the Causes of Constipation

Before one treats constipation, one must seek nonbowel (secondary) causes. Some can be reversed. Others indicate that management may be difficult. These include:

- Endocrine causes: Hypothyroidism, hypercalcemia, diabetic autonomic neuropathy
- Neurological disorders: Parkinson's disease, multiple sclerosis, autonomic neuropathy
- Psychiatric causes: Depression, anorexia, sexual abuse
- Narcotic analgesic drugs
- Cardiac drugs (nifedipine, verapamil, disopyramide, amiodarone, flecainide)
- Antidepressants (clomipramine, fluoxetine, venlafaxine, sertraline, paroxetine)
- Tranquilizers (alprazolam, olanzapine, risperidone)
- Lipid-lowering drugs (lovastatin, pravachol, cholestyramine)
- Miscellaneous drugs: Bromocriptine, valproic acid, ondansetron

Once secondary causes are excluded, other bowel disorders that can manifest as constipation should be considered,

such as diverticulosis, polyps, stricture, ischemia/bowel obstruction, and malignancy. One is left with four main types of constipation:

*Simple constipation* describes patients who have a mild-to-moderate degree of difficult or infrequent passage of stool, which responds quickly to increased fluid/fiber intake.

*Constipation-predominant irritable bowel syndrome* includes such patients mainly complaining of abdominal pain, who are commonly young women, and is not considered further here.

*Idiopathic slow-transit constipation* is a rare disorder, generally affecting young to middle-aged women who seldom feel the urge to defecate and have a very poor response to laxatives or bulking agents.

*Outlet obstruction/evacuation disorders* comprise the following:

- *Rectal mucosal prolapse* is a surgical problem and is not considered further here.
- *Intussusception* is a prolapse of the anorectal mucosa down into the anal canal.
- *Anismus* is a condition in which patients have trouble emptying the rectum because they experience involuntary spasm of the striated pelvic floor muscles or of the puborectalis muscle (see below, under biofeedback therapy).
- *Rectocele* is a prolapse of the anterior wall of the rectum into the vagina.

The basic investigations that are used to distinguish these four types of primary constipation are as follows:

*Anorectal manometry studies* (as per fecal incontinence) but with the addition of a balloon expulsion test to elicit spasm of the striated muscles seen in anismus.

*A colonic transit study* involves the ingestion of radiopaque markers over 3 days; then, an abdominal X-ray is taken on day 4 (or later if markers are still present). In nor-

mal patients, the gut transit time is 36 h, so all markers should be expelled by day 4; a prolonged test suggests idiopathic slow-transit constipation.

A *defecating proctogram* (Fig. 8.5) is an X-ray test of the act of defecating a radiopaque porridge-like mixture. It identifies the site and size of rectocele (as well as other defects). If contrast material is trapped in the rectocele after defecation, this can also lead to post-defecation soiling (as the feces slowly seep out from the pocket). It also demonstrates rectal intussusception, which can contribute to fecal incontinence as well as obstructed defecation.

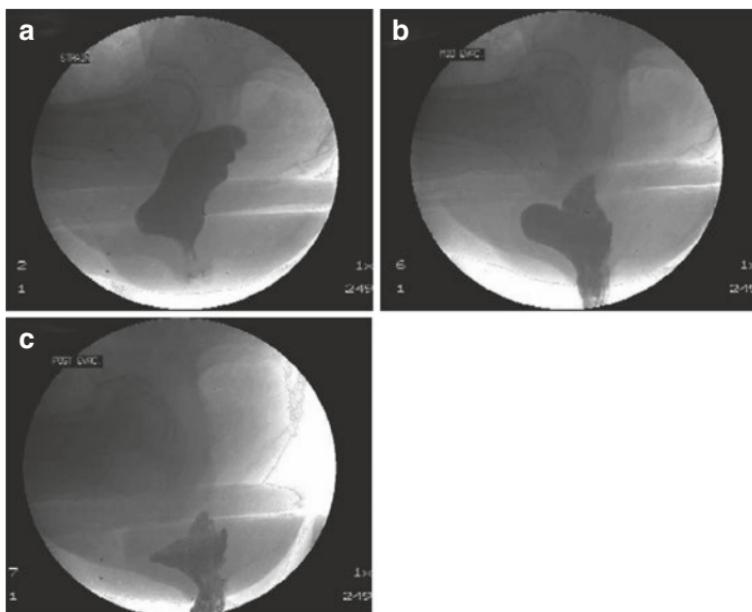


FIGURE 8.5 Defecating proctogram. (a) The bulging of the rectocele anteriorly into the vagina. (b) Defecation, with “holdup” in the rectocele. (c) Post-defecation film, with contrast trapped in the anterior rectocele

## Overview of Treatment of Disorders of Defecation

*Simple constipation* is treated as discussed in Chap. 2. A dedicated nurse continence advisor or continence physiotherapist can also help such patients to learn the correct position for defecation (feet elevated to accentuate relaxation of the anorectal angle) and modify their lifestyle so they have enough time to relax and defecate properly, as soon as they get the call to stool. Postponement of the defecation impulse because of a busy schedule is a major factor in constipated individuals.

*Constipation-predominant Irritable Bowel Syndrome* is difficult to treat (not within the remit of this chapter).

*Idiopathic slow-transit constipation*, once suspected on the basic tests, requires a colonic transit study, as well as serious effort with laxative therapy. If this fails, surgical removal of the colon with ileorectal anastomosis may be indicated, although diarrhea may result.

Sacral nerve stimulation initially showed promising results for slow transit constipation in two RCTs, but a recent RCT showed with long-term follow-up showed no benefit at 2 years (see [14] for full review). A continent stoma (Chait tube) can be created on the anterior abdominal wall, so patients can irrigate their bowel and defecate rectally every morning [15].

*Anismus* is treated by biofeedback. Similar intrarectal EMG devices are used to help patients to relax their anal sphincters and puborectalis during the act of defecation.

*Constipation with rectal intussusception* (+/- fecal incontinence) can be treated by laparoscopic ventral rectopexy [21]. Either polypropylene mesh or biological mesh is sutured to the ventral aspect of the distal rectum. Some colorectal surgeons also attach it to the upper surface of the vaginal vault, to prevent enterocoele. Then the mesh is attached to the front of the sacral promontory (in the same manner as urogyn-

cologists perform an abdominosacro-colpopexy (ASC). At a median of 41 months, 7% of patients who had initial response developed a recurrence (see full details of procedure in [22]).

Urogynecologists contemplating an ASC in patients with complete vault descent who have previously had ventral rectopexy should be careful, as the ASC mesh may need to be tacked over the previous rectopexy mesh at the sacral promontory. Mesh may have also been sutured to the vaginal vault.

*Rectocele* was previously often treated by transanal repair, because any associated anal sphincter defect could be repaired at the same time by the colorectal surgeon. However, a recent Cochrane review [23] evaluated randomized trials of transanal repair versus vaginal posterior repair by gynecologists; the symptom of rectocoele was more likely to persist after transanal repair (RR 2.78, 95% CI 1.0–7.70) Repeat rectocoele on examination was more likely to recur after transanal repair (RR 4.12, 95% CI 1.56–10.88). Hence gynecological repair is now preferred.

## Conclusions

Anal incontinence and disorders of defecation are more common than is generally appreciated. Such problems need to be elicited carefully in urogynecology patients. If minor and rare, conservative therapy may help, but if the problem gives rise to major symptoms, full investigation is needed. As you can see from the range of treatments that have been tried but not always succeeded, major fecal incontinence is not easy to cure.

## A Note Regarding Obstetric Trauma as a Cause of Anal Incontinence

In the last 25 years, colorectal surgeons and obstetricians have become increasingly aware that the management of the second stage of labor has a tremendous impact on the likelihood of anal incontinence developing during a woman's life.

This subject is vast and controversial. It cannot be adequately dealt with in a short practical text. This does not mean it is not important. Registrars are strongly advised to read the classic text on this subject: Sultan AH, Thakar R, Fenner DE, editors. Perineal and anal sphincter trauma. London: Springer; 2009.

*The following is a list of some landmark papers/reviews giving an overview of the subject:*

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# Chapter 9

## Surgery for Urodynamic Stress Incontinence



### Introduction

Prior to the late 1960s, patients who leaked when they coughed often underwent an anterior colporrhaphy with a Bladder Neck Buttress. Urodynamic testing was not common until the late 1970s.

Once urodynamic studies were introduced, it was realized that coughing can provoke a detrusor contraction. Thus, many women who underwent anterior repair with Bladder Neck Buttress did not obtain cure (because they also had some detrusor overactivity). This poor success rate was one of the reasons that gynecologists became interested in performing urodynamic tests (to improve their surgical cure rates) and was one stimulus to the establishment of urogynecology as a subspecialty.

Once a diagnosis of urodynamic stress incontinence (USI) has been made, without substantial voiding difficulty, and after any detrusor overactivity has been thoroughly treated; then this chapter describes the surgical options available.

## Bladder Neck Buttress

This procedure is *no longer* a primary procedure for USI, but is still used in highly selected cases of mild USI. For example, if a woman mainly complains of prolapse due to cystocele, but is found to have a minor element of stress incontinence on cystometry, then it is reasonable to discuss this option. This is particularly true if an elderly woman with prolapse and stress incontinence is found to have an underactive detrusor at urodynamics; one may counsel her that a simple repair with buttress for her USI is not likely to cause voiding difficulty. The evidence for this comes from retrospective case series, rather than randomized controlled trial [1].

The bladder neck buttress involves the following (see Fig. 9.1).

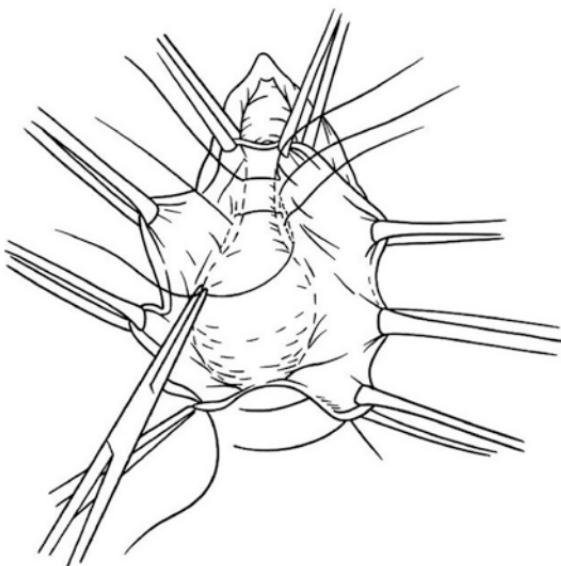


FIGURE 9.1 Bladder neck buttress procedure. The sutures pass deeply through the periurethral endopelvic fascia on the posterior aspect of the symphysis pubis

- Insert urethral catheter with 5 ml balloon (to delineate urethrovesical junction), then insert local anesthetic with adrenaline widely underneath the urethra.
- Dissect vaginal epithelium off the bladder and proximal urethra.
- Use a small needle with 1 Vicryl or nonabsorbable suture.
- Place three mattress sutures at the bladder neck and proximal urethra to plicate (or buttress) the periurethral endopelvic fascia behind the posterior aspect of the symphysis pubis.
- Tie the sutures gently in the midline underneath the urethra.

The goal is to assist closure of an open bladder neck, but if done correctly, it will also elevate the urethrovesical junction in the retropubic space. This procedure was first described by Kelly in 1913, who reported an initial subjective success rate of 90%, but this decreased to 60% subjectively continent over 5 years.

For further details of associated anterior repair for cystocele, see Chap. 10 (prolapse). For postoperative management of voiding function, see “Colposuspension” below.

## The Open Burch Colposuspension

From about 1970 until the late 1990s, the most common procedure for USI was the colposuspension. It was designed by a gynecologist (Burch) to treat failed Bladder Neck Buttress cases [2]. This remains a very effective procedure if the patient requires an abdominal operation for any other reason.

The procedure is mainly indicated for USI in the presence of urethral hypermobility on physical exam, or obvious bladder neck descent/funneling on ultrasound. If previous surgery has created a fixed, nonmobile urethra, then consideration should be given to performing a pubovaginal sling, or inject-

ing collagen/bulking agents (but see discussion of TVT). The colposuspension is also highly effective in correcting cystocele.

*Preoperative Consent Discussion;* Before consenting a patient for colposuspension, ensure that she understands fully the 5–15% risk of developing de novo detrusor overactivity. Patients can be *very* distressed if they have an operation because they leak when they play tennis, but afterward have to void frequently and leak with unpredictable urge, not to mention nocturia. Such angry patients are commonly referred to a tertiary urogynecology unit!

Also, ensure that the patient understands the 2–5% risk of longer term voiding dysfunction (with a 0.5% risk of clean intermittent self-catheterization, CISC). Some urogynecologists ask patients to meet with a nurse continence advisor to teach CISC before the operation.

Patients want to know the *success rate*. Objective success rates depend on the outcome measure used. The original series by Burch [2] revealed a cure rate of 93% ( $n = 143$ ) at approximately 2 years, as judged by a stress test at 250 ml and a lateral X-ray with a metal bead chain in the urethra (to look for stress leak or an open bladder neck). The cure rate in 109 women at a mean of 14 years follow-up (range 10–20 years) was 80% on 1-h pad testing [3]. The 2016 Cochrane review [4] gives an overall cure rate of 90% at 1 year, 80% at 5 years.

Very recently [5], a large ( $n = 336$ ) case note review and telephone follow-up using the ICIQ (cure defined as score  $\leq 6$ ) at a mean duration of 13 year was reported. At the last clinic review (time not stated), 83% had no stress incontinence symptoms or signs. On the telephone ICIQ at 13 years, 76% of 208 women had cure, defined as ICIQ score  $\leq 6$  [5].

*Postoperative Convalescence;* This is similar to abdominal hysterectomy, for example, the first week at home should be spent in quiet leisure (reading books, watching TV, etc.). The next 5 weeks are “light duties” (including walking gently, *not* jogging, driving locally to get the newspaper, gentle swimming in salt water *not* chlorine, with regular rest periods).

After the 6 weeks visit/vaginal examination, normal activity can resume (including intercourse, light shopping/laundry, light gym exercise) but with no heavy lifting for a further 6 weeks.

## The Technique of Colposuspension

This involves the following (see Fig. 9.2):

- Place a 16-gauge catheter (easy to feel vaginally) in the urethra.
- Inflate 10 ml balloon (30-ml balloon is too big, will get in the way).
- Make a Pfannenstiel incision.
- Access the retropubic space (the Cave of Retzius).
- By careful dissection (to avoid large veins in this region), expose the back of the pubic bone and the lateral aspects of the para-urethral vaginal tissue (urogenital diaphragm).
- The right-handed operator double gloves and places the left hand in the vagina.
- With fingers on either side of the catheter in the vagina, define the urethrovesical junction (at the balloon), and dissect gently down laterally along the edges of the para-urethral tissues, to reach the upper portion of the vagina (urogenital diaphragm).
- Place three Ethibond J-shaped sutures on either side of the urethrovesical junction.
- Attach each suture to the iliopectineal ligament at the back of the pubic bone.
- With the surgeon's left hand lifting up the vagina, the assistant ties the sutures onto the iliopectineal ligament.
- The surgeon dictates the degree of tension so as not to overcorrect (tissue should *not* be taut, just comfortably elevated).
- Insert a drain to the retropubic space.
- Insert suprapubic catheter and empty the bladder (no vaginal pack).

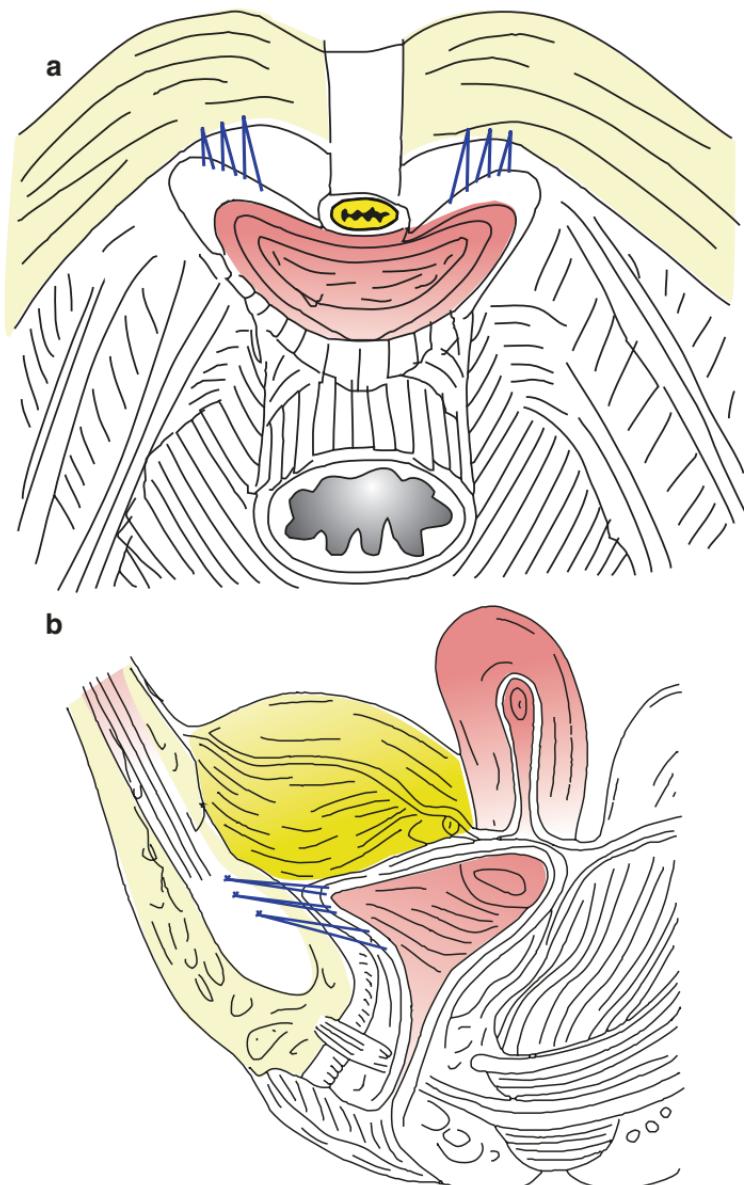


FIGURE 9.2 Three permanent sutures are (a) placed through the endopelvic fascia on each side of the urethra and (b) passed through the iliopectineal ligament of Cooper

## Complications of Colposuspension

### *Immediate:*

- Hemorrhage into the retropubic space, with a transfusion risk of about 0.5%.
- Trauma to the bladder (inadvertent cystotomy) requiring repair and subsequent urethral catheter for 7–10 days, approximately 2%.

### *Long Term*

- Detrusor overactivity (5–15%).
- Voiding difficulty (2–5%).
- Enterocele or rectocele (7–17%).
- Recurrent bacterial cystitis (1–2%) (but 5% at 14 years [3]).

## Postoperative Management for Colposuspension

- Free drainage of SPC for 36–48 h; patient unlikely to void due to pain of incision during this time frame.
- Commence trial of void at approximately 36 h, if patient is ambulant.
- Once residual volumes obtained from the catheter are less than 100 ml on three consecutive occasions, usually by day 5 postop, remove suprapubic catheter.
- If residuals are gradually getting lower but still not <100 ml at day 4–5, teach patient to perform *Double Emptying*:

- Void initially in the normal position, wait till stream stops.
- Stand up and rotate the pelvis a few times to stimulate the afferent nerves.
- Sit down and lean forward with elbows on knees.
- “Drop” or purposefully relax the pelvic floor muscles.

- Turn on tap water, this sound is known to stimulate bladder.
- Remain so for 2–3 m, perhaps read a magazine, and await further flow.
- Patient will usually void another 50–100 ml, may be sufficient to give residual <100.

*Why do we use a suprapubic catheter (SPC)?* Some urogynecologists use an indwelling urethral catheter (IDC) after substantial continence operations, but once the IDC is removed, the patient must void completely, or else have the IDC re-inserted. Then she may possibly go home with a catheter bag, or else learn to perform clean intermittent self-catheterization (CISC). Because the risk of voiding difficulty is 2–5%, we find it much more convenient and pleasant for the patient to have an SPC. It is quite common for incomplete emptying to take 3–5 days to resolve. With an SPC, the residual urine volumes are obtained from the SPC tube after the patient to voids in the toilet urethrally. The SPC with a Flip Flow valve (Fig. 9.3) is easily managed at home, compared to “a bag.”

## How to Manage Short-Term Voiding Difficulty

Note that the literature often does not define what is meant by “voiding difficulty.”

In this textbook, “short-term voiding difficulty” means the management of a temporary suprapubic catheter (SPC), or self-catheterization, for up to 4 weeks. “Long-term voiding dysfunction” means that the temporary SPC required removal because the sutures were becoming inflamed, and thus CISC was instigated, from 4 weeks postop to permanently.

If patient is not voiding to completion by fifth postoperative day and not suffering from persistent wound pain (hematoma/ infection), is able to defecate fully (no impacted feces or perineal pain from other repair), the urine is not infected,



FIGURE 9.3 "Witch's hat" urine collection device and Flip Flow valve

double-emptying technique is being used, but otherwise well and ready to plan discharge from hospital:

- Discard the drainage bag.
- Attach a Staubli valve or Flip Flow valve (Fig. 9.3) to the SPC.
- Teach patient to record own voided volumes and residual volumes on chart.
- After training for 12–24 h, using a "witch's hat" graduated collecting device placed in the toilet (Fig. 9.3).

- Send her home for 3 or 4 days to continue trial of void in home toilet.
- Review back in clinic in 3 or 4 days with her residual volume chart.

The majority of patients will void well with this method.

## How to Manage Long-Term Voiding Dysfunction

- If unable to void after 2–3 weeks of home trial of void, the SPC site will become inflamed and painful.
- If patient is almost voiding normally, flucloxacillin 500 mg TDS may stop inflammation of the SPC for a few more days.
- After this, patient should be trained in clean intermittent self-catheterization (CISC), by a specialist nurse continence advisor because the SPC site will become inflamed.
- Follow-up with a voided volume and residual chart, kept for 24 h prior to each visit, should be every 2 weeks thereafter. If the bladder is kept well emptied by CISC, spontaneous resolution of the voiding dysfunction often occurs over 3 months.
- Bad prognostic features are:
  - Patients with previous pelvic radiotherapy.
  - Patients taking psychotropic drugs with anticholinergic properties.
  - Patients who have undergone radical bowel resection with denervation of pelvic nerves.

*Laparoscopic Colposuspension* is discussed later in this chapter (historical chronology).

## The Pubovaginal Sling

Also known as the abdominovaginal sling, this procedure is the time-honored operation for patients with previous failed continence surgery. It was designed by urologists [6], partly

because they are more accustomed to an abdominal approach to surgery. In the urological literature, it can be described as a primary procedure. Most urogynecologists would disagree: it is most useful in the case of previous failed incontinence surgery, when the urethra is fixed in the retropubic space (on vaginal exam and VCU) *and* the urethral closure pressure is low (below 20 cm) or the Valsalva leak point pressure is low (below 60 cm).

Note that if the urethra is fixed in the retropubic space, but the urethral closure pressure or Valsalva leak point pressure is *normal*, then collagen/Macoplastique/other bulking agents para-urethral injections may be worthwhile; see later section this chapter.

*Preoperative Consent for Pubovaginal Sling (P-V Sling):* This discussion is similar to that for the colposuspension, except that risk of voiding difficulty/dysfunction is probably higher, mean of 12.5% (range 3–32%);

The risk of de novo detrusor overactivity is slightly higher (mean risk 10%, range 4–18%).

*Success Rate:* The outcome of the P-V Sling was measured by a postal UDI questionnaire and chart review at 4.3 years (range 2–5.6 years) [7]. A series of 247 women had undergone the autologous sling over 4 years, of whom 114 had a low abdominal leak point pressure (<60 cm H<sub>2</sub>O pressure). The cure rate on UDI questionnaire was 91% in those with a normal abdominal leak point pressure and hypermobile urethra, versus 84% in those with a low ALPP (88% success overall). A recent ICI review [8] revealed an objective cure rate of 73–95%.

*Convalescence:* The patient should have 7 days of prophylactic antibiotics to protect the graft. After a procedure involving a Pfannenstiel incision and a vaginal incision, the first “quiet” week of the convalescence period should probably increase to 2 weeks, but light duties should still be appropriate up to 4 weeks (total restriction still 6 weeks).

## The Technique of Pubovaginal Sling

As described by the first authors [7] the steps are: (see Fig. 9.4):

- Insert 16-G Foley catheter into bladder with 5 ml balloon.
- Make a wide Pfannenstiel incision.
- Harvest a strip of (autologous) rectus abdominus fascia  $13 \times 2$  cm;
- Lay the graft flat in a dish and wrap in moist gauze.
- Dissect down to the retropubic space as for a colposuspension.
- From below, incise the anterior vaginal wall as for an anterior repair but should only need to dissect about 3 cm below the urethrovesical junction.

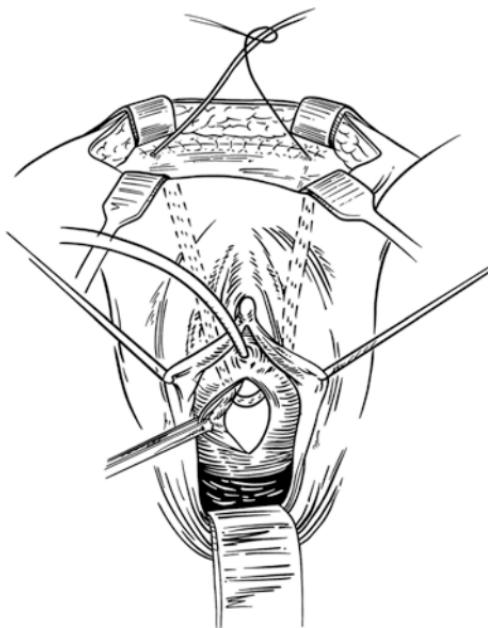


FIGURE 9.4 Harvesting a strip of rectus abdominus fascia  $13 \times 2.5$  cm, then placement of autologous sling under urethra and attachment to rectus abdominus under minimal tension

- Working on a flat sterile surface; insert nylon 1.0 sutures to the four corners of the rectus sheath graft.
- Insert a long narrow Bosman's packing forcep downward from the retropubic space into the vagina, piercing the urogenital diaphragm, emerging at the urethrovesical junction (guided by the balloon of the catheter).
- Bring the nylon sutures attached to the strip of sheath up into the abdominal wound (first on the left, then on the right).
- Place the fascia strip snugly under the urethrovesical junction.
- Apply 2.0 Vicryl tacking sutures to the fascia at the edges of the vaginal wound to maintain the position of the strip at the urethrovesical junction.
- Lift the nylon sutures into the abdominal wound so as to place the fascial strip just under the urethra, with absolutely no tension.
- Tie the nylon sutures at the four corners of the strip to the rectus abdominus fascia.
- Close the abdominal and vaginal wounds in the traditional fashion.
- Insert SPC. Insert drain to the retropubic space. Pack is not mandatory.
- Postoperative management is as for a colposuspension.

## Historical Note: Stamey Needle Suspension and Raz/Pereyra/Gittes Procedures

In 1973, Stamey described a minimally invasive procedure for stress incontinence. This involved two passages of a long needle behind the pubic bone; after the first pass, a polypropylene suture was threaded through the needle. An arterial graft plegget was threaded onto the vaginal end of this suture (Fig. 9.5). A second pass of the needle brought the suture back up behind the pubic bone, capturing a thick bridge of periurethral tissue; the suture was tied over the rectus sheath (then repeated on other side). The Raz, Pereyra, and Gittes modifications did not use the plegget.

Initially, these procedures showed great promise, with 2-year objective cure rates of 70–86% in the early 1990s [1]. However, these cure rates were not sustained. For example, at 5.5 years, 130 patients had a cure rate of 50%, but 11.5% had never become continent [8]. Of 30 patients who had 1-h pad test at 10 years, only 30% remained dry [9]. The pledges/sutures seemed to pull through the periurethral tissue. In some cases, the pledge later eroded through the periurethral tissue and migrated into the vagina (Fig. 9.5). These proce-

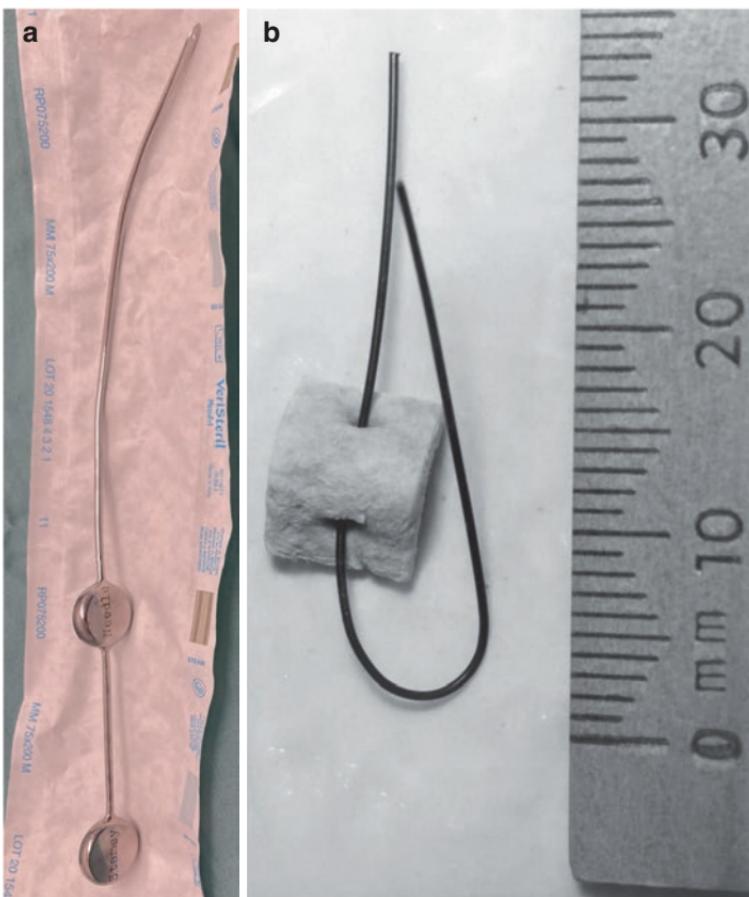


FIGURE 9.5 (a) Stamey Needle (b) Stamey bladder neck suspension pecten removed from the vagina of a patient 3 years after the procedure

dures are not considered further, but illustrate the importance of long-term scrutiny of the efficacy of any new surgical procedure. Beware rapid introductions of new operations!

## Modified PuboVaginal Sling, The “Sling on a String”

In 2000, urologists from Wales [10] suggested that the length of the autologous sling need not be the full 13 cm. Instead, a shorter strip of tissue could be brought up from the periurethral vagina into the retropubic space, by using the Stamey needle (see Fig. 9.5b) to carry the nylon sutures upward. A randomized trial of this “sling on a string” versus the traditional P-V Sling, was published in 2007 [11].

Of the 165 women with pure USI, there were 30% in each arm with previous failed surgery. The 1 h pad test showed no difference between groups. On UDI and IIQ, 81% of “sling on a string” were cured versus 78% of the P-V Sling, at median of 3.5 years (range 1–6 years). A 10 year follow-up [12] from a different RCT also using “sling on a string” showed a 75% dry rate on a urological questionnaire (BFLUTS) and EQ-5D.

Because some patients are concerned about the small risk of mesh erosion of the newer retropubic mesh tapes (see TVT below), the “sling on a string” is now worth discussing as a primary surgical option. The abdominal incision and the vaginal incision are both much smaller than the original pubo-vaginal sling; the postoperative time in hospital in our department is usually only 2–3 days, determined by the time to achieve normal voiding function.

## Paravaginal Repair

The paravaginal repair is regarded as an alternative method for repair of cystocele, but has also been used to treat USI—see Chap. 10, prolapse. As regards USI, a single report showed a 97% subjective cure of stress incontinence at 3–4 years follow-up, with no objective tests done [13].

## Laparoscopic Colposuspension

The laparoscopic colposuspension was first described in 1991. Ten randomized controlled trials (RCTs) have now compared the laparoscopic procedure with the open colposuspension. Overall, the objective cure rate (cough stress test or pad test) at 18 months was significantly lower for the “lap colpo” (RR 0.91, 95% CI, 0.86–0.96), also shown in studies that judged success on urodynamics [14]. At 18 months – 5 years, the latest Cochrane review [15] showed that the RR for cure of the “lap colpo” was even lower, 0.82 (95% CI 0.28–2.80) versus the open colposuspension, although wide confidence intervals were noted. It is disappointing that there is little long-term data from these 10 RCTs; hopefully this is not because the authors are reluctant to report longer term failure.

Because the ICI recommends that lap colpo should only be performed by high-volume surgeons, the technical details of the case are not described here. As regards adverse events, the “lap colpo” had a higher risk of bladder perforation, about 3% (RR 1.72, 95% CI 0.90–3.29) but it had a lower risk of voiding dysfunction (RR 0.81, 95% CI 0.50–1.31) [15].

After the introduction of the TTV in 1999, use of the “lap colpo” when no other laparoscopic procedures are needed, was not recommended by the ICI in 2009 [14], although the most recent ICI review [8] did not make this summary remark. However, since then, the 1–3% risk of mesh complications for the TTV have received bad press publicity (see below). Therefore, we find that the “lap colpo” is of considerable interest to patients, as it is “keyhole surgery,” and should be included in the discussion of surgical options.

## Overview of Mid-Urethral Polypropylene “Tape” Slings: TTV and TVTO

The Tension-free Vaginal Tape (TTV) was developed in the late 1990s; the first publication by Ulmsten of a 93% cure rate on pad testing at 3 years appeared in 1999 [16]. The

theoretical basis of the TVT was novel, in that the polypropylene Tape was placed at the mid urethra, rather than at the bladder neck (which was typical of the colposuspension and the autologous pubovaginal sling). Without going into detail, the procedure caused less urethral obstruction (and less urgency).

The TVT operation changed the management of USI internationally. It was originally designed to be performed under local anesthesia, often as a day case procedure, because the risk of voiding dysfunction was much lower (as a result of its “tension-free” status). Patients no longer needed a Pfannenstiel incision, and thus could go home within 12–24 h, as they were highly likely to void normally. However, there was a very small risk of major vascular injury (0.012%) because the tape was passed blindly into the retropubic space. Also the risk of bladder perforation was 4% (although morbidity was minimal, because the trocar diameter is 0.4 cm (Fig. 9.6a), so the bladder penetration heals with overnight catheterization).

Because of these concerns about vascular injury and bladder perforation, Delorme [17] introduced the transobturator tape (TOT) in 2001. Instead of passing the introducer needle/tape under the urethra and high up into the retropubic space, a spiral introducer was created so that the tape was inserted into the middle of the obturator foramen in the medial aspect of the groin, passed medially across the obturator membrane and emerged into the suburethral space in the anterior vaginal wall. Instead of creating the typical U-shaped sling, a wider “hammock”—shaped sling support was created. The risk of bladder perforation was negligible, so that time-consuming cystoscopy was no longer deemed essential.

As will be seen from the following discussion, the long-term outcomes of these two mid urethral sling procedures are significantly different.

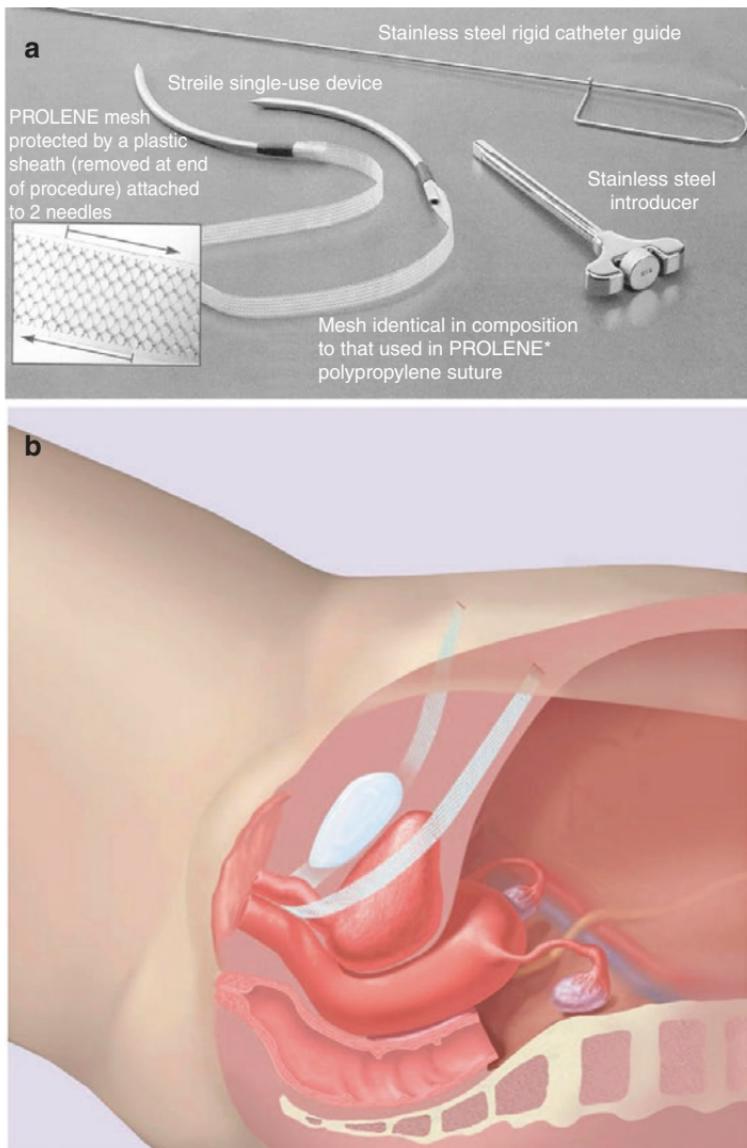


FIGURE 9.6 (a) TVT tape, guide wire, and introducer device. (b) Lateral view of TVT tape under the urethra (Reprinted with permission from Gynecare)

## The Tension-Free Vaginal Tape (TVT)

*Preoperative Consent Advice:* The TVT confers a 5–6% risk of detrusor overactivity and a 1–2% risk of short-term voiding difficulty, with a 0.5% risk of long-term voiding dysfunction. The risk of mesh exposure/mesh erosion needing removal is 3%–1.5%, respectively. Postoperatively, patients should rest for 1 week or until comfortable, then light duties for 3 weeks.

*Cure Rate:* As mentioned, the cure rate at 3 years is 93% on pad test. At 17 years, the cure rate on cough stress test is 84% (see below for further details).

## The Technique of TVT

The TVT under local anesthesia (LA) with sedation involves the following (see Fig. 9.6):

- Prepare 100 ml of LA solution, e.g., Naropin 0.2% with 1 ml of 1/1000 adrenaline.
- Anesthetist to give antibiotic prophylaxis, for insertion of a mesh into non-sterile vaginal environment, and administer midazolam or propofol IV infusion for sedation.
- Empty the bladder.
- Inject LA above the pubic bone, into the retropubic space (21-gauge spinal needle), then underneath the pubic bone, then into the anterior vaginal wall, 2 cm below the urethra.
- Vertically incise the anterior vaginal wall, 2 cm below the urethra, for about 1.5 cm.
- Dissect under the vaginal skin, toward the pubic bone, left and right.
- Make a 1-cm incision at the suprapubic LA insertion sites, bilaterally.
- Insert guide wire into 16-G Foley catheter and pass into the bladder.

- Assistant holds the guide/catheter to the ipsilateral side for insertion of TVT tape, to move the urethrovesical junction out of the way.
- Assemble the TVT introducer (Fig. 9.6a).
- Hold edge of vaginal incision with fine Gillies forceps; insert TVT needle into incision.
- Direct needle about 30° to the lateral; aim upward toward the abdominal wound.
- Push needle firmly through the urogenital diaphragm, under strict control.
- Drop the handle of the introducer, so the needle is felt to be running up the back of the pubic bone. Very gradually advance the needle up in the retropubic space until it emerges at the abdominal wound.
- Perform cystoscopy with a 70 degree telescope to ensure no needle puncture of bladder, especially behind the pubic bone; empty bladder.
- Repeat procedure for the other side.
- After second cystoscopy, do not empty bladder.
- Stop IV sedation; prepare patient to cough.
- Elevate tape so it lies just under urethra (Fig. 9.6b), but insert fine scissors between tape and urethra.
- Patient coughs repeatedly; gradually elevate the tape so that only a few drops of fluid spill over the edge of the meatus at the height of the cough (no projectile spurt).
- Assistant removes plastic covers of the tape while surgeon holds scissors to maintain tape position under the urethra (otherwise, removal of the plastic covers can cause further elevation of the tape itself).
- Empty the bladder; close all incisions.
- No pack. No catheter (unless other surgery performed at the same time).

*Is the Cough Test Necessary?* The very name of the operation, “tension-free vaginal tape” was based on meticulous attention to placing the tape so that a drop of urine was just

seen at the meatus during the cough test. However, an RCT of 93 women in 2011, with 2-year follow-up, revealed that not using a cough test did not affect any of the objective outcome measures of success or voiding dysfunction [18]. Therefore, many urogynecologists now perform the procedure under a light general anesthesia, without performing a cough test (but many older surgeons gained understanding of the correct “minimal tension” needed by performing the cough test for the first 10 years).

## Postoperative Instructions for Simple TVT

The patient should drink as much as she desires but not force fluids. She should void whenever she feels the desire, not at a set time. If she has not voided within 4 h, bladder scan to check volume.

After each void, check residual. If two residuals are less than 100 ml and patient is comfortable, examine the patient and discharge home if no pain/ tenderness. If residuals are greater than 200, insert Foley catheter overnight; remove 6 A.M.; restart the Trial of Void.

If residuals >100 ml but <200 ml, ask patient to double void and rescan; generally residuals will be less than 100 after a double void. Patient should be taught this technique.

Once patient voids completely and is comfortable, discharge. Review at 6 weeks: repeat uroflowmetry/post-void ultrasound residual to check for asymptomatic voiding difficulty.

If concomitant prolapse surgery was performed, involving greater postop pain, the postoperative management (in our department) includes a suprapubic catheter, and trial of void starts at about 36 h using the SPC residual volumes.

Long term we always ask post-menopausal women to use vaginal estrogen cream 2–3 times per week to prevent mesh erosion (although no study exists on this topic).

## Outcome Data for the TVT

The first objective report of 3 year follow-up showed a dry rate on pad test of 93% [16]. The largest RCT [19] showed no significant difference in objective cure rate between the TVT and the colposuspension at 6 months and at 2 years [20].

Five-year follow-up of TVT showed 85% objective cure rate [21], with the same authors finding a 91% objective cure rate on pad test at a mean of 11 years (subjective cure 77%) [22]. In this report, the de novo rate of OAB symptoms was 4.7%. Tape exposure occurred in 3.1%, requiring resection/closure in 1.6% due to discomfort.

Recently, we have two publications of 17 year follow-up. The first report [23] comes from the cohort of 90 patients in the original 1999 publication, all of whom had USI with no prior continence surgery, a urethral pressure profile of >20 cm, and no detrusor overactivity. Cure was defined as negative Cough Stress test and ICIQ, IIQ and UDI. Objective cure was noted in 91.3% of 46 women who were well enough to attend for examination, with 79% of 53 women having no stress leak on a telephone appointment. All seven failures (13%) complained of severe urge incontinence. The median post-void residual (PVR) was 16 ml (one large PVR in a woman who developed Parkinson's Disease).

The second report comprises 56/61 patients who had TVT for pure USI with no detrusor overactivity (UPP > 20 cm) in Greece [24]. Cure rate on cough stress test at 210–350 ml was 83.9%, with subjective improvement of 78.6% on patient satisfaction questionnaire. Urge incontinence was noted in 12%. The risk of mesh exposure on examination was 1/46 and 1/56 respectively.

The efficacy of TVT in the low-pressure urethra appears to be lower than in primary procedures (37–86% cure., versus 88–94% cure in primary cases). For review, see Atherton and Stanton [25].

The complete risks of TVT include:

- Intraoperative perforation of bladder (4–6%)
- De novo detrusor overactivity (5–6%)
- Urinary tract infection (4–17%)
- Retropubic hematoma (2.4%) always managed conservatively
- Short-term voiding difficulty (2–3%)
- Long-term voiding dysfunction (<0.5%)
- Tape exposure, asymptomatic (3.1%)
- Tape resection due to pain (1.6%)
- From manufacturer's log of rare complications in 260,000 cases:
  - Bowel perforation 0.007% (three deaths worldwide)
  - Major vascular injuries 0.012% (two deaths worldwide)
  - Urethral penetration 0.007%

Some surgeons manage short-term voiding difficulty by cutting the tape, which requires a return to the operating theatre; the optimum time for performing this is controversial. The tape can be cut at the midline (6:00 O'clock) or on the lateral margins (4:00 and 8:00 O'clock). Continence is often preserved because the lateral arms of the tape have already become enmeshed in the periurethral tissue, providing residual support.

## The Transobturator Tape

Because the TVT involves penetration of the retropubic space "blindly" (without direct vision), the above small but important risks of bowel/vascular injury are not unexpected. The transobturator tape was developed partly to avoid these risks and partly to avoid the risk of penetrating the bladder in the retropubic space (thus, cystoscopy was thought to not be required, with shorter operating time).

In 2001, Delorme [17] introduced the transobturator tape (TOT) in which a spiral-shaped needle applicator penetrates the upper margin of the obturator foramen and then is passed to the suburethral space (see Fig. 9.7, the so-called “outside in” approach). De Leval then modified the procedure in 2003 [26] to be an “inside out” approach called the TVT-O, whereby the inner aspect of the obturator foramen is penetrated from within the vagina, then the tape emerges laterally, near the origin of the Adductor Brevis muscle (and subcutaneous nerves).

Both the TVT and the TOT/TOT-O have been the subject of numerous RCTs comparing these new procedures with the TVT [8]. In many trials, the outcomes are not significantly different. Only Araco et al. [27], who performed stratified randomization between mild and severe incontinence, showed 100% cure for the TVT versus 66% cure for TVT-O in those with severe incontinence.

As regards the issue of severe stress incontinence versus mild, Schierlitz et al. [28] performed an RCT of women with a low-pressure urethra ( $MUCP < 20$  cm), comprising 164 women at 3 years. The primary outcome was symptomatic

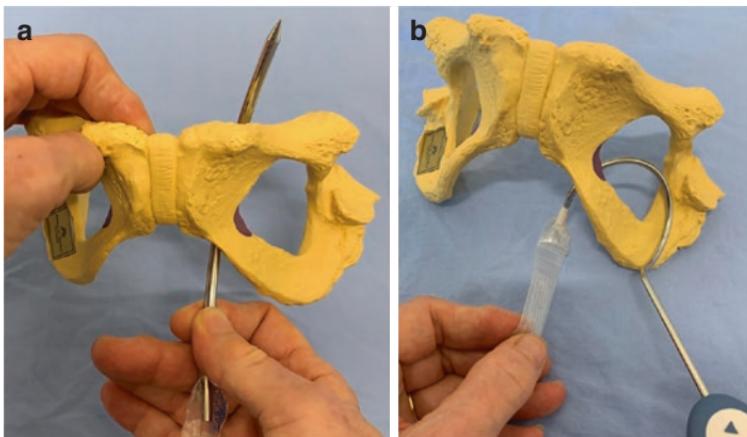


FIGURE 9.7 (a) Comparison of insertion of TVT into retropubic space (b) Insertion of transobturator (Monarch) tape into the obturator foramen (“outside in”)

stress incontinence requiring repeat surgery, which occurred in 20% of the women who had a Monarc TOT versus 1.4% in the TVT group. They concluded that testing for a low urethral closure pressure should determine the correct minimally invasive sling. Their patients were followed for 12 years, showing similar results [29].

## TOT Groin Pain/Other Complications

In the first 5 years of experience with the TOT, including mostly follow-up at 12–24 months, groin pain appeared to be a minor short term problem. However, in the last 20 years, evidence has been increasing that groin pain at the site of the adductor longus insertion on the inferior ramus of the pubic bone is a major problem. Numerous case reports have also appeared in the literature regarding other severe problems, e.g., necrotizing fasciitis [30], substantial hematoma medial to the obturator foramen [31], adductor brevis myositis [32] pudendal neuropathy [33], and vaginocutaneous fistula [34]. Some studies show that the risk of mesh erosion is also greater than TVT at 6.2% [35].

The 2017 Cochrane review of TVT versus TOT by Ford et al. [36] found a significantly higher risk of groin pain after the trans obturator procedures (RR 4.12, 95% CI 2.71–6.27). In the medium term, more women required repeat incontinence surgeries in the TOT group (RR 21.89, 95% CI 4.36–109.8), with a similar trend in long-term studies (RR 8.97, 95% CI 3.36–23.00). A recent editorial by Rovner (2020) commented that “pain in the region of the inner thighs in patients after TOT occurs because the obturator nerve that exits the obturator foramen cranially and laterally splits into three major branches that variably run downwards between the adductor muscles (adductor longus and brevis, pectineus, gracilis). They contain the afferent sensory fibers of the inner thighs that are at risk of being affected by the trocar and/or the TOT sling. Several meta-analyses have demonstrated a significantly higher risk of thigh/groin pain with TOT in com-

parison with TVT This applies particularly for the inside-out technique (3.1% TOT versus 15.7% TVT-O) where the trocar is directed more laterally in this critical area thus getting much closer to the nerve stem. More serious complications in this area include myositis, fasciitis, and abscess formation” [37]. The British NICE recommendations in 2020 concluded that trans-obturator tapes should not be provided as first-line surgical therapy for USI [38].

In our department, we generally *reserve* TOT procedures for women who have had previous abdominal surgery that is likely to incur scarring in the suprapubic region (making a TVT more hazardous). Therefore the technical details of the TOT procedures are not provided.

## Overview re Mesh Complications after Mid Urethral Slings

The reader needs to understand that, in contrast to the TOT procedure (especially the “inside out” tapes), the likelihood of symptomatic “mesh complications” for the retropubic sling (TVT) is quite rare, generally 1–2%. Often these complications comprise small mesh extrusions, i.e., the mesh fibers can be felt protruding through the vaginal epithelium, diameter < 1 cm. We find that many of these patients have not been asked by their surgeons to use long-term vaginal estradiol cream, which improves vaginal skin thickness and elasticity. As will be seen in Chap. 13 (Mesh Complications) vaginal estrogen cream is first-line therapy for mesh extrusions, hence we believe that long term estrogen cream is important (see RANZCOG position statement, [www.RANZCOG C-Gyn32](http://www.RANZCOG.C-Gyn32)).

## A Word About “Mini-slings”

In the last 10 years, a variety of new “mini-slings” were introduced, which do not require passage of the introducer needle into either the retropubic space or the obturator foramen.

Rather, the short mesh tape is inserted into the suburothelial fascia on either side of the urethra. It was hoped that these new procedures would be outpatient procedures with absolutely no risk of voiding dysfunction. Unfortunately, a systematic review of nine studies of these slings has shown a much higher failure rate with a relative risk of repeat surgery of 6.72, CI 2.39–18.89, so they have shown no useful benefit [39]. The most commonly used mini-sling (TVT Secur) was withdrawn from the market, and most urogynecologists do not employ these new devices.

## The Use of Bulking Agents for USI

Bulking agents such as GAX collagen, Macroplastique, and DuraspHERE are attractive because they can be performed as a day-only or outpatient procedure, have minimal risk of provoking voiding difficulty, and can be performed under local anesthesia with sedation. Unfortunately, the cure rate for this procedure is variable, depending upon the agent used, the type of stress incontinence, and the number of repeat injections.

Controversy exists as to whether bulking agents should be reserved for patients with a relatively fixed bladder neck, mostly after previous continence surgery. This is probably the “standard teaching.” A further controversy concerns whether patients with a low urethral closure pressure (<20 cm) should be offered bulking agents. Gorton et al. [40] showed clearly that the success rate over 5 years was significantly poorer when GAX collagen was used in women with a low urethral closure pressure. The median duration of continence for those with a low-pressure urethra was 15 months, compared to 72 months in the remainder. On regression analysis, a low-pressure urethra was strongly predictive of failure ( $p = 0.03$ ). Such data are not known for the other agents.

*The procedure involves injecting approximately 4–6 ml of the bulking agent into the midurethra, under the mucosa, via cystoscopic needle, either transurethrally or periurethrally so as to “bulk up” the midurethra (Fig. 9.8).*

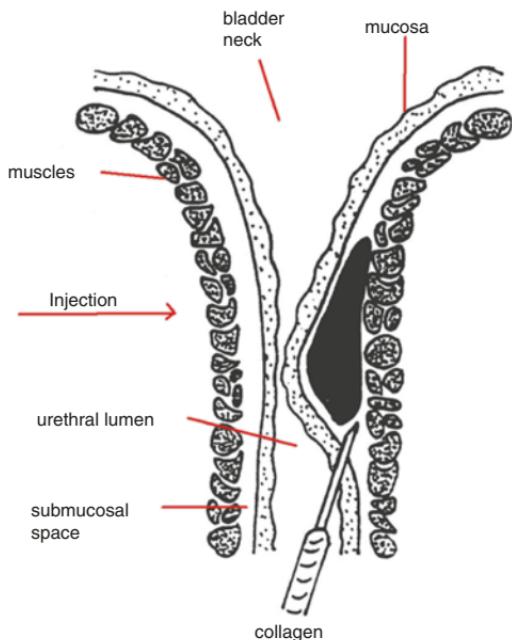


FIGURE 9.8 Bulking agent injected into the submucosa

The main features of each bulking agent are as follows.

*GAX Collagen (Contigen)*: This was made of bovine dermal collagen, cross-linked with glutaraldehyde, to reduce antigenicity, first described in 1989. Allergic reactions to the bovine material were not uncommon, so that skin testing is required 30 days beforehand to exclude allergic response in each patient. This product was removed from the market in 2013.

*Macroplastique*: This is a hydrogel-suspended cross-linked polydimethylsiloxane elastomer (silicone rubber particles), first described in 1991.

- Because the particles are 100–450 µm in diameter, they do not migrate and are quickly encapsulated in fibrin.
- It is not known to produce allergic reaction.
- Initially, injection was via cystoscopic needle, transurethrally or trans-perineally, at 2, 6, and 10 O'clock. Each vial costs 320 lb.; two are normally used.

FIGURE 9.9 Macroplastique application device



- In 2000, a simple applicator with specialized needle was described [41], which avoids the need for cystoscopic visualization of the injection site (Fig. 9.9). A specialized injection gun is also provided.
- On subjective score, 74% of 40 women were dry at 3 months [42].
- Using objective urodynamic measures, 59% of 32 women were dry at 12 months; 28 of these had undergone previous continence surgery [43].
- Postoperative short-term voiding difficulty and detrusor overactivity do occur with this procedure, although less commonly than for other procedures. For review, see [43].

*Durasphere:* This is a suspension of carbon-coated zirconium beads, first reported in 2001.

It is not known to be allergenic.

- Using the Stamey score to grade incontinence (a non-validated measure), 80% of 176 women had “improve-

ment” of at least one Stamey grade at 12 months (versus 69% of 188 women given GAX collagen; difference not significant) [44]. Long-term studies involving objective outcome measures are awaited.

The first Cochrane Review of periurethral injection therapy for urinary incontinence. Pickard et al. [45] found insufficient evidence to recommend this as a first-line therapy (implying that it should be reserved for those with previous continence surgery). They concluded that bulking agents “may represent a useful option for relief of symptoms for a 12 month period although repeat injections are likely to be required.” The current Cochrane Review [46] is full of studies that have *no* objective outcome measures and describe “improvement” rates of 40–60% at 12 months. None of the comparative RCTs revealed significant differences in efficacy between the different agents.

## Conclusions

The surgical management of USI has advanced tremendously in the last two decades. Each procedure still has risks, requiring meticulous preoperative counseling. The most appropriate procedure must be chosen for each patient, considering her previous surgical history, her willingness to undergo minimally invasive versus major surgery, and her perioperative risk factors. Careful and sympathetic management of postoperative detrusor overactivity, voiding dysfunction, and rarer complications, is vitally important.

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# Chapter 10

## Management of Prolapse



Uterovaginal prolapse is very common. The largest epidemiological study to date ( $n = 1547$  women interviewed, age 15–79) showed that 8.8% had symptomatic prolapse and a further 23% had undergone some form of prolapse surgery MacLennan et al. [1].

### Does the Patient with Prolapse “Need” Surgery?

Until recently, the treatment of symptomatic prolapse has been considered to be largely surgical, with vaginal rings offered to those who were unfit for anesthetic. However, the *median* lifespan of women in developed countries is now around 83 years old, so many women live well into their 90s. Thus, prolapse is becoming more common. Patients with mild symptoms and mild–moderate prolapse often ask whether they “need” surgery.

Studies of women with either asymptomatic or symptomatic prolapse have shown that the condition does not always get worse, if they choose to be observed over time. In 2013, a study of 64 women (median age 66) with minimal to mild bulge symptoms and mostly mild-moderate prolapse (Stage 2–3 POPQ) chose to be re-examined every 6 months [2]. At a

median follow-up of 2.3 years (IQR 0.8–3.5 years, range 1–7 years), 78% demonstrated no change in the leading edge of the prolapse, 3% improved by at least 2 cm, and 19% worsened by at least 2 cm. A long-term study of 96 women with asymptomatic rectocele who had no treatment over a median of 6 (range 4–12) years found that only new-onset constipation provoked worsening of the prolapse on the subsequent physical exam [37].

If a patient has mild asymptomatic prolapse, dealing with the precipitating factors (Chap. 1), particularly chronic cough and chronic straining to defecate may well help to prevent worsening of the condition (and perhaps regression).

*As regards the use of physiotherapy*, a large RCT of pelvic floor training, versus a leaflet about lifestyle advice, was performed in 447 women with mild to moderate prolapse (POPQ stage II 74%, remainder stage III or stage I). In the active group (4–5 physiotherapy visits over 12 weeks) assessed at 6 months, there were highly significant improvements in symptom severity, quality of life tests, and desire for further treatment, compared to control. The change in POPQ was moderate ( $p = 0.052$ ) [3].

## Use of Ring Pessaries

In patients with symptomatic prolapse, who decline to have or are unfit for surgery, a vaginal ring pessary is very useful in selected cases. The main reasons for which patients are totally unfit for surgery are as follows:

- Severe respiratory embarrassment, unable to lie flat without dyspnea.
- Severe Alzheimer's disease, unable to tolerate hospitalization/give consent.
- Morbid obesity, poor surgical access to the vagina.
- Unstable heart disease with cardiac stents cannot stop anti-coagulants.
- Recurrent thromboembolic events, multiple previous stroke.

Patients may decline surgery if they are an elderly sole caregiver for a disabled relative with no suitable respite care. Some women have had unpleasant surgical or anesthetic experiences and do not want another surgical episode. These reasons should be respected, especially if a ring pessary can be easily fitted.

Traditional vaginal ring pessaries (Portex) come in a range of sizes, from 56 to 100 mm diameter. Fitting a ring pessary is like assessing cervical dilatation in labor ward. Insert two fingers into the vagina, spread them apart, and mentally measure the vaginal diameter. The ring pessary sits anteriorly behind the pubic bone and posteriorly rests on the perineal body (Fig. 10.1a).

Hence, if the perineum is very deficient, a ring pessary may not “sit” properly and be extruded during defecation. In a series of 100 patients with prolapse, 73% could be fitted satisfactorily [4]. A deficient perineum with large introitus was often associated with failure.

In some cases, it may be possible to overcome this by fitting a “double ring,” using the largest ring possible in the upper vagina and the next smaller ring beneath it. This will not solve the problem if the patient has had multiple previous surgeries with scarring/thickening of the walls and vaginal shortening—such women are often very difficult to fit.

Aside from the standard Portex ring, most urogynaecologists now also offer a Ring with Support (the membrane across the ring stops enterocoele from falling down through the hollow Portex ring. In more difficult cases, we use a solid ring that has perforations to allow mucous to drain out, thus creating a suction (e.g., Schaatz and Gellhorn rings Fig. 10.1b).

*Topical vaginal estrogen cream* (e.g., Ovestin) should be used 2–3 times weekly (see Fig. 10.2) because the ring pessary is a foreign body that may increase desquamation of the vaginal epithelium, leading to a watery creamy discharge. It is traditional to change the ring every 4–5 months to inspect the vagina to ensure no major vaginal inflammation is occurring. In a snugly fitting pessary, when Ovestin is not used or when the pessary is not changed regularly, there is a recognized incidence of vaginal bleeding. If this occurs, remove the ring,

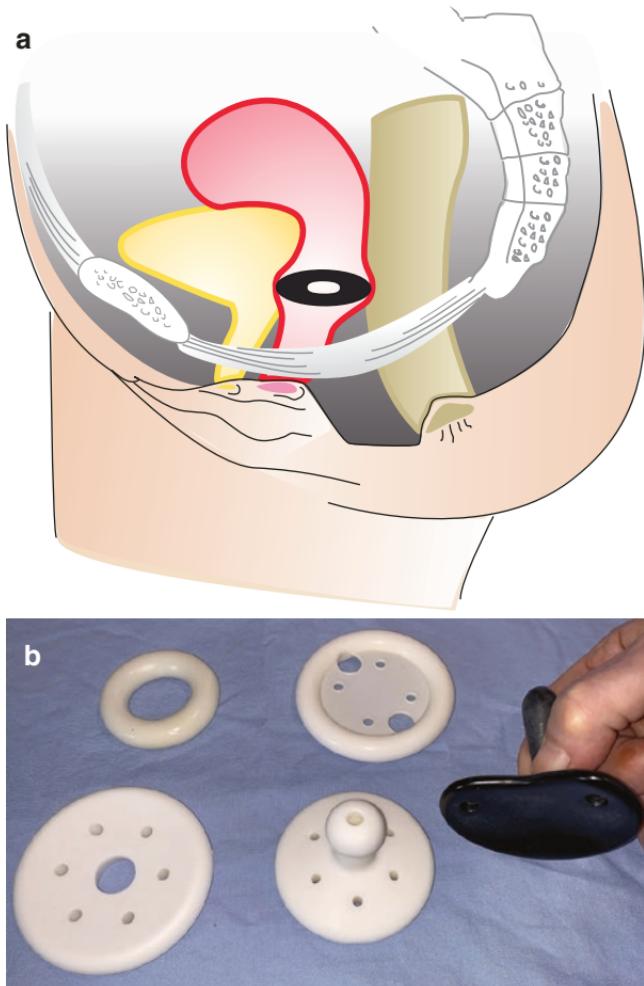


FIGURE 10.1 (a) Portex ring pessary sits anteriorly behind the pubic bone and posteriorly rests on the perineal body. (b) Portex ring top left, Ring with support top right, Schaatx, Gellhorn, Shelf bottom row

**OVESTIN CREAM - for Prolapse**

- You have been prescribed a local oestrogen cream Called "Ovestin" to help with your prolapse.
- This oestrogen cream dissolves across the urethra lining making it more supple and stronger to help with the prolapse, making the tissues more elastic.
- The oestrogen cream comes with an applicator, which is messy and annoying.
- We recommend placing a small "dollop" of cream on your finger and placing it around the vaginal opening.
- This cream should be applied THREE times a week. (suggest Monday/Wednesday/Friday at night).  
This is a long term treatment.
- If you have a ring fitted, the oestrogen cream makes the ring "sit" in the vagina more comfortably.
- The cream is not absorbed significantly into the body, so it does not affect the breasts nor cause any weight gain.
- If you proceed on to surgery, the oestrogen improves the quality of the tissues, making them better for the procedure.



FIGURE 10.2 Information diagram about applying Ovestin cream for prolapse

ask the patient to cleanse the vagina with salt baths twice daily for 5–7 days, and apply Ovestin nightly for 3 weeks. If there is an associated purulent discharge, metronidazole 400 mg TDS for 7 days will resolve this.

A long-term study of 167 women using vaginal ring pessaries up to a median of 7 years (range 14 years) showed that, over time, about 45% of women may experience bleeding, infection, or both. However, these women were having their ring changed every 4 months by a nurse or doctor [5]. As a result, we now teach women to remove their ring every month, wash it in hot soapy water and re-insert. Once they learn how to do this, they can just return for a speculum exam and be given a new ring every 12 months: an audit of this protocol showed a marked reduction, down to 7%, in the likelihood of bleeding or infection [6].

## Preoperative Evaluation of Risk Factors for Recurrence After Surgery

Throughout the rest of this chapter, one should keep in mind that all prolapse surgery has a substantial risk of recurrence, because you are operating on tissue that is, by definition, already weakened. Numerous studies have recently examined risk factors for recurrence, a good meta-analysis [7] recently showed that bad prognostic factors are:

- Size of the genital hiatus (more than 4.5 cm markedly increases recurrence).
- Family history, relative risk 1.84, (95% CI = 1.2–2.8).
- Preoperative Stage 3–4 prolapse, RR 2.11 (95% = CI 1.6–2.7).
- Levator muscle avulsion defect, RR 2.76 (95% CI 2.2–3.5).
- Obstructive defecation RR = 1.3, not statistically significant.

Note that Levator Muscle avulsion defect is diagnosed by 3D ultrasound, for review see Dietz [8].

*Preoperative use of vaginal estrogen* to improve tissue quality has not been studied by RCT, but many urogynaecologists would prefer to operate on tissues that appear healthy/pink, not frail, pale or thinned out, and give preoperative and postoperative topical oestriol cream. A recent laboratory study of 29 women who used topical estrogen, versus 23 controls found that biopsy of the prolapse tissue showed significantly increased level of collagen and elastin in those on estrogen cream [9].

### Note re the POPQ “Stages”

In Chap. 2 on physical examination, the POPQ system of anatomical assessment using centimeters of prolapse descent was described, but the “Stages” were not listed. Because

POPQ Stages are commonly used to describe the outcome of prolapse surgery in the literature, they are now given:

- Stage 0: no prolapse, anterior and posterior walls = -3 cm above introitus, cervix or vault—8 cm.
- Stage 1: leading edge of prolapse = -1 cm, e.g 1 cm above introitus.
- Stage 2: leading edge of prolapse = from -1 cm to +1 cm, i.e., leading edge just above or below introitus.
- Stage 3: leading edge greater than +1 cm below the introitus, but less than +4 cm (or half of the total vaginal length, TVL).
- Stage 4; complete eversion of the total length of the genital tract.

We find that doctors starting out in urogynecology should just describe the centimeters of descent of each organ (use the POPQ grid as per Chap. 2). For letters written to the GP, it is more user-friendly to stick to the Baden Walker terms of “mild/moderate/severe” because GPs (and other medical specialists) do *not* understand the POPQ Stages. Also, Stage 2 is quite controversial, because a prolapse of -1 cm to 0 cm was “moderate” on the Baden Walker grade, but +1 cm (well beyond the introitus) was “severe” on the Baden Walker grade.

## Surgery for Cystocele

The opening paragraph of the ICI textbook chapter on prolapse states that “experts and the majority of published literature suggest the anterior wall is probably the most challenging part of prolapse to cure” [10]. This is largely because there are few structures to “anchor” onto. Unlike repair of posterior wall prolapse, in which one can suture onto the sacrospinous ligament or the presacral ligament of the sacral promontory, the pubourethral/pubocervical fascia and paravesical fascia on the undersurface of the pubic rami may be thin and weak.

The main surgical options for repair of the anterior wall (also known as the “anterior compartment”) comprise:

1. Anterior colporrhaphy with plication of the pubourethral and vaginal fascia.
2. “Ultralateral” Anterior colporrhaphy with more vigorous plication of subpubic fascia.
3. Paravaginal repair.
4. Use of mesh to reinforce the anterior colporrhaphy (now controversial).
5. Colpocleisis in the frail elderly.

*Anterior Colporrhaphy* for cystocele is performed as follows (see Fig. 10.3a):

- Inject local anesthetic with adrenaline into subcutaneous plane of anterior wall.
- Dissect vaginal epithelium off the bladder and proximal urethra.
- Plicate the paraurethral and paravesical tissue with a sagittal tier of horizontal mattress sutures 1 Vicryl, without tension.
- Insert 2.0 PDS purse-string suture around the prevesical fascia of the prolapsing bladder
- Trim the redundant vaginal skin sparingly and close with 2.0 Vicryl.
- Insert pack and catheter.

*The Ultralateral Anterior Colporrhaphy procedure comprises: (see Fig. 10.3b).*

Starts with same dissection of vaginal epithelium from bladder, but in this case, dissect well back into the pelvis; get underneath the pubic symphysis.

Place delayed absorbable vertical mattress sutures into the pubourethral/pubocervical or paravaginal fascia, that border the levator hiatus (underneath the pubic bone), to plicate this tissue across the midline under moderate tension, thus replacing the bladder into the abdominal cavity [11].

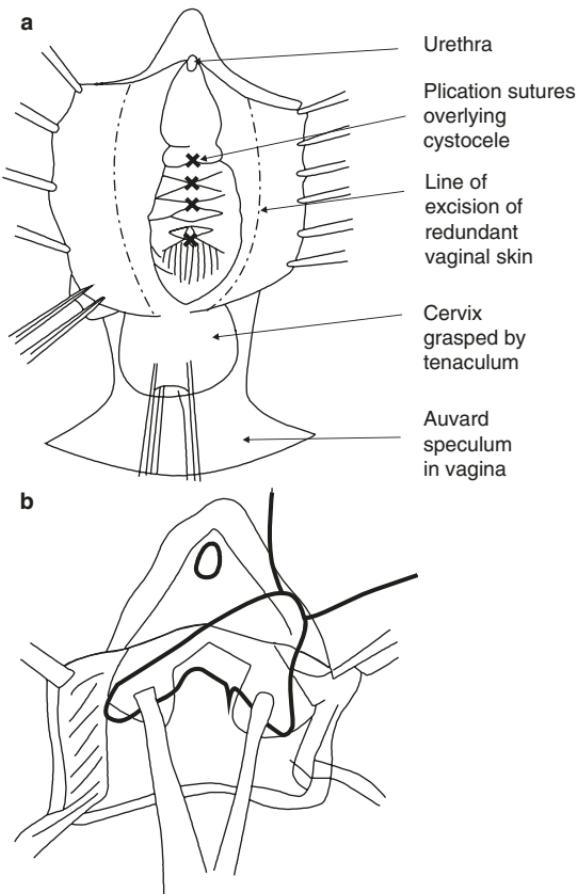


FIGURE 10.3 (a) Routine anterior colporrhaphy. (b) Ultralateral Anterior Colporrhaphy

Closure with trimming of vaginal skin is identical to anterior colporrhaphy.

The recurrence rate for cystocele after routine anterior colporrhaphy is up to 40%. The procedure remains popular because of minimal surgical morbidity. In contrast, a 9-year follow-up of the ultralateral colporrhaphy revealed a 7% reoperation rate (although recurrent non-bothersome symptoms of cystocele did occur in 21% of patients on direct enquiry during the audit process) [12].

## Paravaginal Defect Repair

This procedure is usually published as a treatment for stress incontinence, rather than for cystocele alone. Because cystocele remains a difficult area, a long-term follow-up study of paravaginal repair for cystocele alone is needed. If cystocele coexists with stress incontinence, then the colposuspension is highly curative of both.

The paravaginal defect repair is generally performed transabdominally, as the vaginal approach requires illuminated retractors and is no longer used. However, most gynecologists would be reluctant to perform an abdominal procedure (even if laparoscopic) for an isolated cystocele. A review article on this procedure actually stated that “clinical results are lacking with respect to the laparoscopic approach to paravaginal repair” [13]. Therefore, transabdominal repair of paravaginal defect is not considered further (but see Shull [14]).

## Use of Mesh for Cystocele Repair

In 1997, Olsen et al. published a widely cited article showing that 30% of women who had prolapse surgery in the USA ended up having repeat prolapse surgery at some stage [15]. But, if one reads the article carefully, actually many of the women had surgery for incontinence, not prolapse. Also, Olsen did not state whether the repeat surgery was necessarily for a recurrence of the same prolapse or a newly developed prolapse in a different vaginal area. Nevertheless, many gynecologists read this article with dismay and felt that prolapse surgery needed to be made more durable. Therefore, vaginal mesh was increasingly employed. Initially, a square piece of mesh was sutured at the four corners into the vaginal vault, in the manner of Hung et al. [16]. This was called a “hand-sewn mesh inlay.” No outcome studies of this procedure were found in the literature.

Surgical mesh companies (who had been providing mesh for hernia repairs for decades) then began producing a variety of mesh “kits,” which were anchored into the vagina by mesh “arms” protruding from the four corners of the central mesh.

An RCT by Altman et al. [17] showed that, in 389 women with primary prolapse, Gynecare Prolift Anterior mesh yielded an 82% anatomic success, compared to 47% of those having native tissue repair (see Fig. 10.4). These excellent results were not counter-balanced by the risks over time.

A major study compared simple anterior repair, versus anterior repair including use of polyglactin (Vicryl) mesh, versus “ultralateral” anterior repair, in 83 patients reviewed at 2 years. Results (using POPQ and symptom score) revealed that 30% of the anterior repair group, *42% of the repair plus mesh*, and 46% of the “ultralateral” repair patients achieved normal vaginal anatomy (POPQ stage 0 or 1). This definition of “cure/normal anatomy” is quite strict. The authors pointed out that anterior colporrhaphy often simply does not replace the midpoint of the vagina to a level 3 cm above the introitus,



FIGURE 10.4 Four cornered mesh kit

so that such a strict definition of “cure” was inappropriate. They concluded that the addition of mesh did not significantly improve cure rates [18].

An Italian study of polypropylene (Prolene) mesh repair for cystocele in 32 women, at a mean follow-up of 1.5 years, found that *dyspareunia* was increased by 20%; also 6.5% of women had mesh erosion. Despite a 94% anatomical cure rate (using POPQ), the authors concluded that the use of Prolene mesh repair of prolapse should be abandoned because of associated morbidity [19]. Use of Atrium polypropylene mesh in 64 women with cystocele in Australia yielded 4.7% erosion rate and 10% recurrence at 2 years [20]. These series varied in the selection of patients (primary versus previously failed prolapse surgeries). Several authors endeavored to develop a risk of recurrence score, based upon factors such as a large genital hiatus [21] or a complete avulsion of the subpubic attachment of the levator ani [8], which could be used to select primary prolapse in which mesh would confer a significant advantage. However these academic gynecology efforts were not followed by the general gynecological community, in which vaginal mesh kits were widely used for primary prolapse repair (unfortunately).

It is now clear that vaginal mesh kits for prolapse repair are associated with a 5–15% risk of mesh erosion, with a weeping discharge and vaginal discomfort. This is not surprising, because the vagina is not a sterile environment, unlike the abdomen. About 5–10% of patients experience dyspareunia/apareunia, and some are not able to sit down comfortably. Removal of mesh from the vagina can be quite difficult and sometimes requires more than one operation.

In mid-2011, the Food and Drug Administration of the USA issued a product warning regarding the use of vaginal mesh. The FDA was concerned because there had been 1503 adverse event reports from Jan 2008 to Dec 2010, which was a fivefold increase in such reports over the previous triennium (see Web site <http://www.fda.gov>). An editorial in *International Urogynecology Journal*, entitled “To mesh or not to mesh?” gives an excellent summary of the situation

[22]. Subsequently, vaginal mesh kits have been completely withdrawn from the market.

## What Is the Value of Manchester Repair/ Retention of a Nonprolapsed Uterus?

In a patient with a cystocele, in whom the cervix is bulky, protuberant, and elongated, with little evidence of actual uterine descent, a Manchester repair is useful. This comprises anterior colporrhaphy with amputation of the cervix, as well as plicating sutures from the transverse cervical ligaments to enhance elevation of the upper vagina.

The Manchester repair (Fig. 10.5) was developed in the 1950s, at a time when anesthetic risks were substantial. Thus, a simple procedure to remove an offending organ (the bulky protuberant cervix) without the prolonged anesthesia of a vaginal hysterectomy was attractive. As anesthetic agents/morbidity improved, a concept evolved that if any part of the uterus/vagina was prolapsing, it should be removed. The extra time required for a vaginal hysterectomy was no longer an anesthetic issue.

In the last decade, this concept of “If any part of the uterus prolapses, remove it all.” has been replaced by a gradually increasing perception of the risk of vault prolapse in the urogynecological community. Procedures to suspend the uterus from the presacral ligament or the sacrospinous ligament have been widely reported (see next section). Gynecologists have appreciated that not all women want their uterus removed unless the evidence proves this will give the best result. Inasmuch as we do not know how to predict vault prolapse, a “fallback” approach may be to leave the uterus intact unless it is truly prolapsed.

Of course, the converse argument is that one is leaving a potentially malignant organ (the uterus) *in situ*. Furthermore, because one cannot guarantee that the cervix is completely removed, Pap smears are still required after Manchester repair.

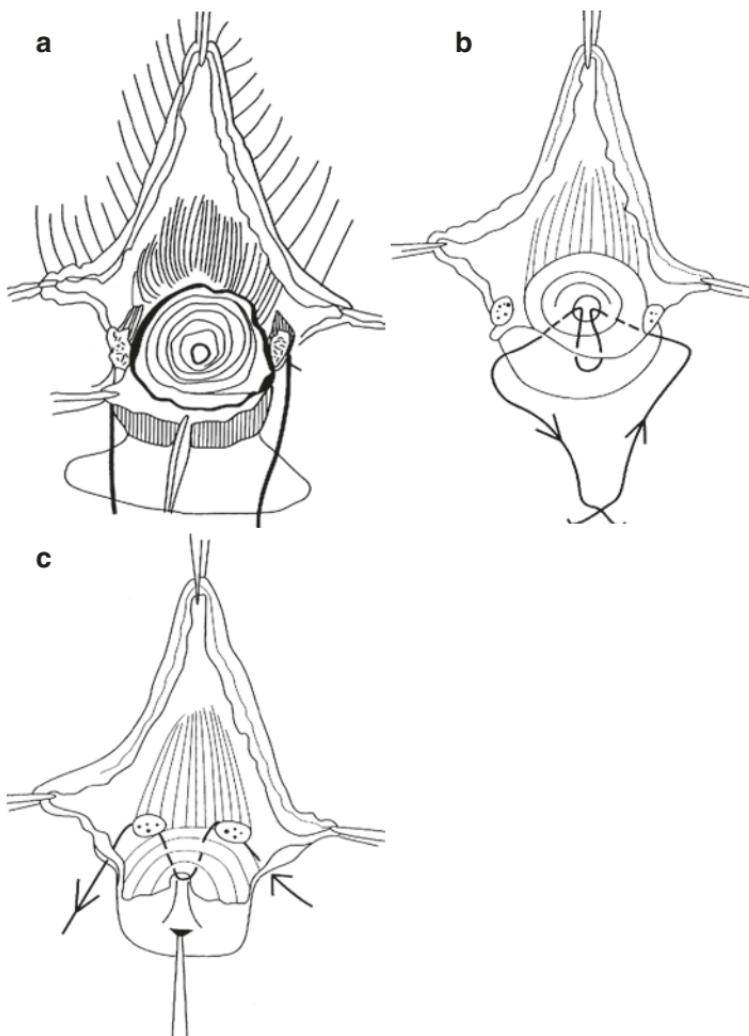


FIGURE 10.5 Posterior Sturmdorf suture in the Manchester repair. After amputation of the cervix, seen in (a), then the posterior leaf of the vaginal vault is brought up over the posterior cervix, and the Sturmdorf suture is used to fix the vault to the cervix while leaving the cervical os patent (b). The transverse cervical ligaments are then plicated (c) to facilitate elevation of the uterine body within the pelvis

Nevertheless, the Manchester repair has been used for 60 years and is worthwhile in selected cases. The procedure is as follows:

- Inject local anesthetic into the anterior and posterior walls of the cervix.
- Circumferentially incise the cervix, as for the commencement of a vaginal hysterectomy, but simply amputate the cervix (Fig. 10.5a).
- Push up the bladder anteriorly.
- Use curved Kocher's forceps to clamp the transverse cervical ligaments.
- Suture with No. 1 Vicryl and place ties on Kryal's forceps.
- Perform a posterior Sturmdorf suture to cover the posterior cervix with vaginal epithelium but leave the os patent (see Fig. 10.5b). Then, plicate the transverse cervical ligaments (Fig. 10.5c).
- Carry out anterior colporrhaphy, but when closing the anterior leaves of the vaginal skin, the lower margin of the skin is again used to cover the cervix, to the level of the os.

*As regards effectiveness*, the previous discussion about failed cystocoele repair still applies, even though vaginal mesh kits have been withdrawn. As regards success of Manchester repair, a publication from the Swedish National Registry of gynecologic surgery audited over 3000 women who had undergone either Manchester Repair or vaginal hysterectomy for prolapse. At 1 year 81% of both groups reported no symptoms of vaginal bulge and 89% were satisfied with the operation [23]. An age-matched case control study of Manchester repair versus vaginal hysterectomy in 196 patients showed no difference in prolapse recurrence rates or functional outcomes at a median of 6 years [24].

## Further concepts re Uterine Preservation: Vaginal Sacrohysteropexy and Abdominal Hysteropexy

Because of concern from patients about the removal of the uterus, partly because of reports that sexual orgasm is centered in the cervix or the uterus, there has been increasing interest in uterine preservation. Several publications occurred in the last two decades about vaginal procedures that attach the cervix to the sacrospinous ligament, or abdominal procedures that attach the cervix to the presacral ligament. Thus the uterus can be preserved. The literature is quite difficult to interpret, because many of the trials do not compare equivalent operations for precisely defined prolapse, in the same trial. At the level of the first-year registrar, it is reasonable to summarize these studies to say that all hysteropexy procedures have a substantial risk of recurrent uterine descent, as high as 40% over 1–5 years. For example, Dietz et al. [25] found a 27% recurrence rate of uterine prolapse 1 year after sacrospinous hysteropexy, but also see [26]. Therefore, hysteropexy procedures are not a first-line surgery, but may be offered to specific patients who particularly wish to preserve their uterus.

## Preoperative Consent Discussion for Anterior Compartment Repairs

Consent discussion involves routine discussion of the risks of hemorrhage, infection, and vaginal scarring. The risk of voiding difficulty is small. If anterior repair is performed in isolation, a urethral catheter may be sufficient, especially if no bladder neck buttress suture (described in Chap. 10) is needed. For patients having cystocele repair combined with

other procedures, a suprapubic catheter is usual; hence, trial of void protocol should be explained. Postoperative convalescence depends on whether other procedures are performed: if an isolated anterior repair, patient should rest for 1 week, then have light duties for 4 weeks, and avoid heavy lifting for another 4 weeks.

## Surgery for Rectocele/Deficient Perineum

Before embarking upon a “posterior repair,” check whether the patient truly has:

- A deficient perineum, requiring perineorrhaphy.
- An isolated rectocele, requiring posterior colporrhaphy, which may just involve the lower third of the rectum.
- Or the hernia may include the mid rectum and the upper rectum. The latter is often associated with enterocele (in which case a sacrospinous fixation is worthwhile).

Note that the deficient perineum and low rectocele are usually associated with insufficiently repaired obstetric lacerations, whereas the mid/high rectocele is often associated with constipation.

In the 1950s, the standard repair of rectocele (posterior colporrhaphy) and deficient perineum (perineorrhaphy) involved tight plication of the edges of the levator ani, known as “levatorplasty.” In 1959, Jeffcoate [27] published a series revealing that 50–60% of patients undergoing this procedure experienced dyspareunia, especially when the levatorplasty is extended upward to repair a defect of the middle third of the rectum (pre-rectal fascia). This is often associated with enterocele. Therefore *sacrospinous fixation* is now considered best-practice management for this defect, to avoid the risk of dyspareunia.

## Technique of Repair for Isolated Mid–Low Rectocele and Deficient Perineum

- Inject local anesthetic into the subepithelial plane of the posterior vaginal wall.
- Decide the lateral margins of the repair.
- The final opening should admit two or three fingers easily.
- A midline vertical incision is made up to the apex of the rectocele.
- The vaginal skin is dissected off the rectovaginal septum.
  - If a low rectocele only, and levatorplasty is desired, dissect out as far laterally as possible, to reach the medial margins of the levator ani and the terminal ends of the bulbocavernosus and transverse perineal muscles in the lower vagina/perineum.
  - The fascia of the rectovaginal septum is closed over the rectocele using PDS purse-string sutures, or sutures laterally from left to right. (“site-specific defect repair”)
  - Interrupted sutures of No. 1 Vicryl are taken deeply through the medial borders of the perirectal fascia and levator ani from left to right, to appose the muscles and fascia in the midline over the defect in the lower rectal wall (Fig. 10.6).
  - The perineum is then reconstituted, by placating medial fibers of the pubococcygeus muscles and reuniting torn fibers of the superficial transverse perineal muscles.
- The redundant vaginal mucosa is excised with care. Skin closed with subcuticular 3.0 Vicryl.

## Surgery for Enterocoele

This is quite a controversial area in urogynecology. At the level of the pre-membership registrar, the question is whether to perform:

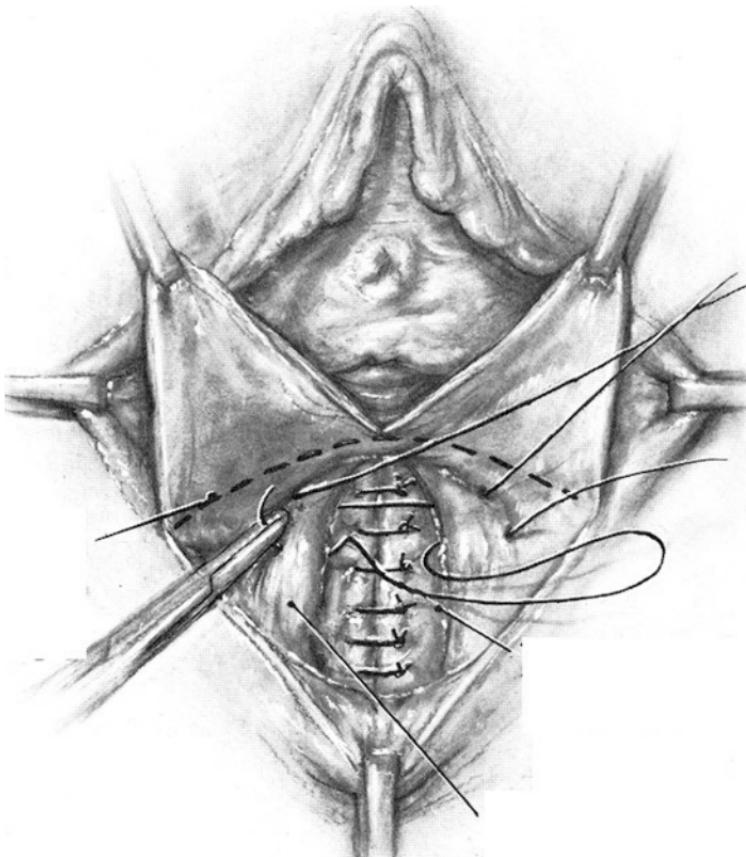


FIGURE 10.6 Posterior colporrhaphy

- A routine posterior colporrhaphy with ligation of the enterocèle sac.
- A vaginal sacrospinous fixation with posterior colporrhaphy.
- An abdominal sacrocolpopexy using mesh attached to the sacrum.
- A colpocleisis (only if patient is frail and not sexually active).

The judgment as to which is best depends upon:

- The frailty of the patient.
- Whether the patient wishes to be sexually active.
- Whether the enterocele is primary or follows previous surgery.
- Whether a concomitant vaginal or abdominal procedure is required.
- Whether previous vaginal repair has rendered the vaginal introitus firm, so that a vaginal procedure would necessitate reentry into an adequately built-up perineum.

In a frail patient who does not wish sexual activity, posterior colporrhaphy with enterocele sac ligation is reasonable, or else colpocleisis.

In a fit, sexually active woman with a primary enterocele, the vaginal approach via sacrospinous fixation would be chosen by most surgeons. Others would argue that the higher long-term failure rate of the sacrospinous fixation indicates that, especially in younger women, an abdominal sacrocolpopexy should be performed. In our unit, we would not normally undertake an abdominal incision in an active young woman, as a primary procedure. In the case of recurrent enterocele (after previous repairs, but certainly if a sacrospinous fixation has failed), abdominal sacrocolpopexy is generally chosen, unless the woman is quite elderly/frail and prefers to have a bilateral vaginal sacrospinous fixation (after appropriate counseling). The other choice in a frail woman is colpocleisis (obliteration of the vagina). Note that vaginal mesh kits were briefly available for use in the posterior vaginal wall, but yield an unacceptably high risk of dyspareunia and mesh erosion and were rapidly withdrawn from the market.

## Vaginal Sacrospinous Fixation

This involves the following:

- Assess where the apex of the vagina will lie by grasping the apex with an Allis forceps, then reducing it into the vagina, placing it at the level of the ischial spine.
- Leave about 2 cm of vaginal tissue intact at the apex so as to be able to run the two pulley sutures under this segment of intact vagina (this segment will then be fastened to the sacrospinous ligament; see Fig. 10.7).

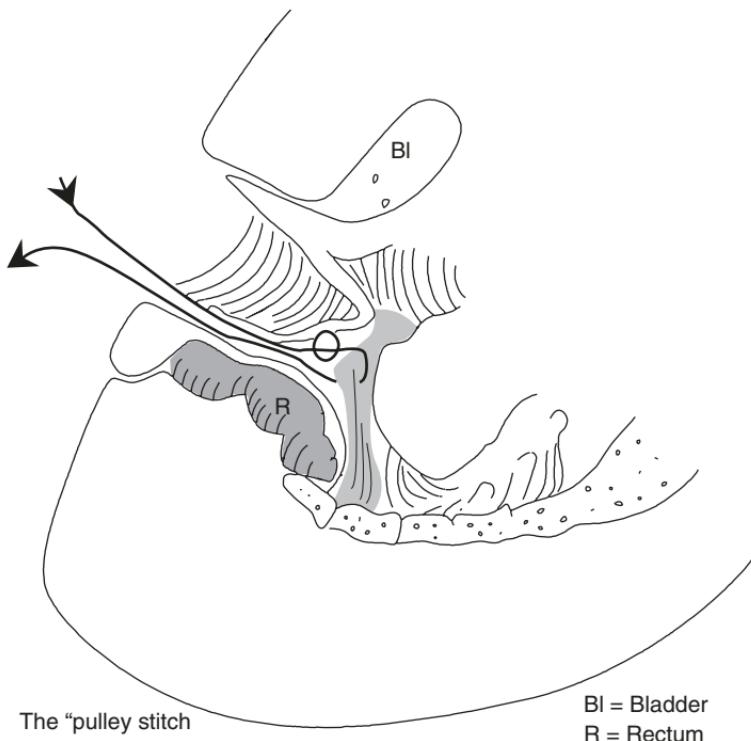


FIGURE 10.7 Insertion of the pulley stitch to vaginal apex, and attachment to sacrospinous ligament

- Dissect the posterior vaginal wall, as for commencement of posterior colporrhaphy.
- Just to the right of the midline, dissect deep into the perirectal space.
- Gently dissect with the index finger a window in the rectal pillar, allowing one to palpate the ischial spine directly; then, gradually enlarge the window to admit both index and third fingers.
- Insert the two pulley sutures (1 nylon and 1 PDS) onto sacrospinous ligament at a point two fingerbreadths medial to the ischial spine (to avoid the pudendal nerve and vessels).

Initially suture placement was done under direct vision, using a Miya hook, with substantial risk of blood loss from the pudendal artery/vein. A much simpler technique is to use a Schutt arthroscopic needle holder (also called a Caspary needle holder) shown in Fig. 10.8. The thread is fed through the device and caught between the two fingers as it emerges from the ligament. The Cappio disposable device is similar.

- Before tying down the pulley sutures, commence closure of the apex vaginal skin for about 3 cm (this section will become inaccessible once the pulley sutures are tied down).



FIGURE 10.8 Schutt Arthroscopic needle holder; open jaws that encircle the sacrospinous ligament

- Also, ensure that rectovaginal septum repair sutures or levatorplasty sutures have been inserted appropriately and held out of the way of the pulley sutures.
- After tying down the pulley sutures, tie off the mid or low rectocele repair sutures, then complete closure of posterior vaginal mucosa.
- At the perineum, insert appropriate perineorrhaphy sutures before closing perineal skin.
- Insert vaginal pack and suprapubic catheter.

## Preoperative Consent Discussion for Vaginal Sacrospinous Fixation

Consent discussion involves [28, n = 239 patients]:

- Risk of buttock pain (6%) (chronic 1%)
- Risk of de novo stress incontinence (2.6%)
- Risk of de novo dyspareunia (2.7%)
- Risk of de novo cystocele (8%) (if no concomitant anterior repair)

The success of the procedure is variable depending upon method of assessment, for example, 88% success at 6 weeks on strict anatomical criteria (no prolapse below the mid vagina [29]) or 97% at 1 year (symptomatic prolapse or an asymptomatic prolapse at or beyond the introitus).

## A Note re McCall's Culdoplasty/Uterosacral Ligament Plication

In patients who require a vaginal hysterectomy (see general gynecology texts), a method of vault support was commonly employed, involving midline plication of the uterosacral ligaments, which was incorporated into the top of the vaginal cuff. This was also called McCall's Culdoplasty. Unfortunately, this procedure is associated with a 4–8% risk of suturing the

ureters into the vaginal vault, causing acute ureteric obstruction. Since the advent of the sacrospinous fixation, it is not commonly used by urogynaecologists (for further details see [30] Joint Report on Terminology for Surgical Procedures to Treat Pelvic Organ Prolapse, 2020).

## Abdominal Sacrocolpopexy

In patients with a complete vault descent, particularly if there is a cystoenterocoele, or if there has been a previous failed sacrospinous fixation, then an abdominal (or laparoscopic) sacrocolpopexy is indicated. The open abdominal procedure involves the following:

- A Pfannenstiel or vertical midline incision (depending on previous scars and obesity).
- The vagina is elevated with a probe wrapped in gauze.
- The peritoneum over the vaginal vault is incised abdominally.
- The bladder is reflected forward from the anterior vaginal wall.
- The peritoneum is entered in the pouch of Douglas.
- The rectum is deflected to the left so that the peritoneal incision is extended up along the right paracolic gutter toward the sacral promontory.
- The peritoneum over the sacral promontory is carefully incised and spread open, taking care not to injure the presacral vessels.
- A wide-pore mesh such as Vipro-II is fashioned into a Y-shape by the surgeon, or a pre-manufactured Y-shaped mesh can be used (Fig. 10.9).
- The bottom of the Y (both leaves) is attached over the apex of the vagina with nonabsorbable sutures.
- The top single leaf of the Y is run laterally up to the presacral ligament over S1.

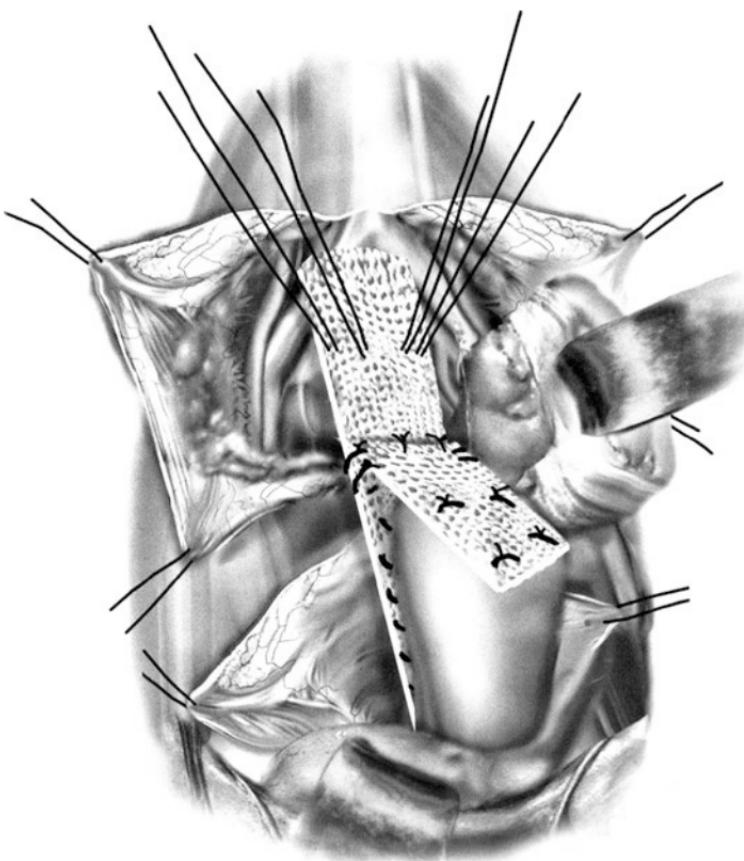


FIGURE 10.9 Y-shaped mesh inserted over the vaginal vault; the long end of the "Y" is attached to the presacral ligament (Reprinted with permission from Baggish and Karram [31]. Copyright 2001, Elsevier)

- It is attached to the ligament by nonabsorbable sutures.
- The peritoneum is closed over the mesh entirely.
- The pouch of Douglas is closed to prevent further enterocele, by a Moscovitch or Halban's procedure:
- The Moscovitch procedure involves a spiral suture around the edges of the pouch of Douglas to close it circumferentially.

- The Halban's procedure involves a series of left to right sutures in the sagittal plane that close the anterior and posterior leaves of the pouch of Douglas.
- At end of abdominal procedure, assess the lower vagina:
  - A low cystocele may indicate need for anterior repair.
  - A low rectocele or deficient perineum may indicate colporrhaphy or perineorrhaphy.
  - Vaginal pack and choice of catheter depending upon whether low vaginal procedures were undertaken.

## Preoperative Consent Discussion for Abdominal Sacrocolpopexy

Consent discussion involves the following:

- Careful management of constipation (Chaps. 6 and 8) must be undertaken preoperatively.
- Complications (Valaitis and Stanton [32]) include:
  - New or worsened detrusor overactivity (7%).
  - New or worsened stress incontinence (12.5%).
  - Risk of mesh erosion 1–4% (abdomen is sterile).
- The success rate varies from 88% at 2 years [32] to 100% cure of enterocele at 2 years [33]

The Cochrane Review concluded that abdominal sacrocolpopexy conferred a lower rate of recurrent vault prolapse, versus vaginal sacrospinous fixation (relative risk 0.23, 95% CI, 0.07–0.77) and less dyspareunia, but there was no significant increase in reoperation rates between the two operations (i.e., the recurrences must not have been bothersome). Furthermore, the vaginal sacrospinous fixation was quicker, cheaper, and allowed earlier return to activities of daily living [34].

Note: The subject of uterine prolapse is dealt with in standard gynecological textbooks.. If the uterus prolapses below the middle of the vagina, then vaginal hysterectomy is generally indicated, which may be a part of any of the procedure in this chapter. Procedures to suspend the vault (McCall's cul-doplasty, sacrospinous fixation.) should always be considered.

If the uterus descends within the upper vagina, the decision for removal should be based upon gynecological considerations (menorrhagia, etc.), tempered by a discussion of the patient's wishes. The option of Manchester repair has been described. In the frail elderly, uterine prolapse and any vaginal prolapse can readily be cured by Colpocleisis (Fig. 10.10).

## Colpocleisis

The colpocleisis operation (classical Greek for “*colpo*” = vagina, “*cleisis*” to close) will obliterate the vagina and has traditionally been considered a gynecological procedure [35]. However, urogynaecological patients are becoming increasingly elderly, so that colpocleisis is becoming much more common in our field. The procedure is typically indicated for severe uterine or vault prolapse in frail elderly women, who have absolutely no desire for future sexual intercourse. However, one needs to be careful interpreting “age” as lack of sexual interest, because older women are increasingly healthy. Having considered these issues carefully with the patient, the colpocleisis procedure is as follows;

- Perform a D&C to send endometrium for histopathology (this is your last chance!)
- Mark out rectangles about 5 cm wide by 8 cm long with a sterile pen on the vaginal skin, both anteriorly and posteriorly.

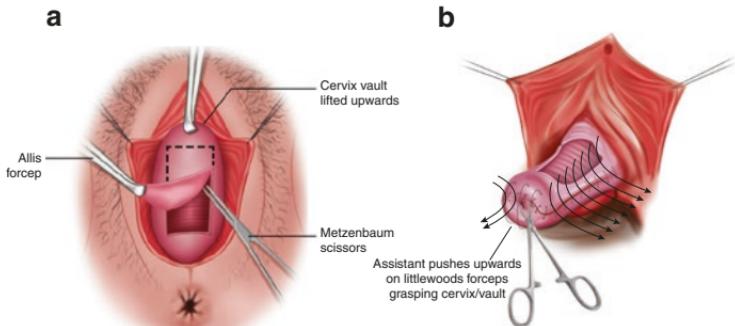


FIGURE 10.10 (a) Schematic diagram of initial dissection and (b) closure, Colpocleisis

- Leave at least 3 cm of vaginal skin intact on each lateral side of the uterus/vault.
- Mark up to 2 cm below the urethra anteriorly and 3 cm above the introitus posteriorly.
- Excise the rectangular skin only in the marked areas.
- Place a Littlewood's forceps on the os/leading edge of the vault.
- Start by inserting sutures to the skin above the cervix and to the skin below the cervix (or vault) whilst the assistant pushes the Littlewood's forceps caudally.
- Then place sutures from the innermost area of pre-uterine mucosa on the front wall laterally to the innermost area of the pre-uterine (or pre-vault) area on the posterior wall, and put each suture on artery forceps.
- Once all the sutures are in place, with the assistant pushing the cervix/vault upwards, progressively tie the sutures from the area above and below the cervix and then move upwards along the lateral margins, tying the sutures progressively so as to invaginate the uterus/vault and "imprison" it within the vaginal canal.
- Finish by performing a very generous perineorrhaphy, so that the introitus becomes very small.

If performed carefully, with a strong perineorrhaphy, the risk of recurrence is less than 1% long term [36].

## Conclusions

The median lifespan of women in the Western world is currently about 83 years and is gradually increasing. Hence, prolapse is likely to increase. Although the "mesh kits" were hoped to provide greater success for cystocele repair, they have been withdrawn because of severe complications. The use of mesh for the sacrocolpopexy is still very successful with a low risk of mesh erosion, because the abdomen is sterile. The Cochrane Collaboration criticizes a serious lack of randomized controlled trials of new interventions. Several

procedures have been mentioned only briefly in this chapter because little objective data were available. It is hoped that in the next decade, more objective studies with long term (5–10 years) will be published.

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# Chapter 11

## Recurrent Bacterial Cystitis in Women



Although this chapter focuses on recurrent cystitis, the urogynecologist may often treat sporadic cases of cystitis. The patient with cystitis symptoms should have a dipstick urinalysis to strengthen clinical suspicion, but a Mid Stream Urine (MSU) should be collected with a careful labial toilet. Empiric treatment should employ either Macrodantoin 100 mg QID for 5 days, or Trimethoprim 300 mg daily for 7 days, as these agents are less likely to cause monilia than broad-spectrum antibiotics, and are likely to treat the most common organism (*E. coli*). Sensitivity results should then be checked on the MSU result in 2–3 days.

Recurrent bacterial cystitis is defined as recurrent significant bacteriuria [more than  $10^5$  Colony Forming Units (CFU) per ml of a single organism], with significant pyuria (more than ten white blood cells per ml), in the absence of upper tract pathology. “Recurrent” is now usually taken to mean more than three proven UTIs in the last 12 months [1]. The abbreviation “UTI” is commonly used, but this chapter focuses on infection of the bladder. If upper urinary tract disorders are causing the UTI, then referral to a urologist is required. Also, if there is no upper tract disorder, but the patient has recurrent bouts of hematuria associated with the UTI, then urology referral is also indicated.

Recurrent UTI is common in urogynecological patients. About 4% of women aged 15–65 years have significant bacteriuria at any given time, and the prevalence rises with age. About 25% of women experience at least one proven recurrence within 6 months of the first attack [2]. In the last two decades in the USA there has also been a 52% increase in hospital admissions associated with acute UTIs with an estimated cost of \$3.5 billion in 2015 [36]. Furthermore, recurrent cystitis is becoming a major problem, as 20–30% of females with an acute UTI will have a recurrence within 3–4 months [37] and recurrence occurs in 48% of women who have had more than one episode [3].

## Guide to Management of Recurrent UTI: Start with a Proper History and Exam

At the first visit, take history of “recurrent” carefully. Did the patient actually get urine samples sent for culture, or did the GP only perform a dipstick urinalysis (which is recommended in the general practice setting, partly for economic reasons).

Obtain old MSU results from GP if possible, and check whether the patient has episodes of multiresistant organisms, which may explain why there are “recurrences” (the treatment may have been incorrect). Look for unusual bacteria such as *Proteus mirabilis*, *Pseudomonas*, *Citrobacter* that may suggest upper tract disease.

Check any previous/family history of renal calculi, which may promote chronic bacterial growth. Also, a previous history of recurrent UTI in a first-degree relative is now known to be a significant risk factor [4].

Ascertain whether UTI is mainly triggered by intercourse.

Check whether previous colposuspension or TVT may have caused voiding dysfunction/high residual urine volumes >100 ml; a pool of stagnant urine may promote UTI.

*Examine* the renal angles for tenderness, suggesting silent renal calculi.

Percuss the abdomen for an enlarged bladder/subacute retention.

Check for atrophic vaginitis, which increases susceptibility to UTI.

Consider whether the urethral orifice sits low down, just on the upper margin of the vaginal introitus (recently shown to increase the risk of cystitis [5]).

Check for a large cystocele that may harbor a stagnant pool of urine.

Examine for urethral diverticulum, run your finger under the urethra looking for a cystic swelling, watch to see if creamy purulent material is extruded from the urethra after you do this.

## Investigations for Recurrent UTI

We find it useful to give the patient three sterile urine culture jars and ask her to give a specimen at the first symptoms of any infection, to check what bacterial organism is isolated. Make sure that the patient understands how to perform labial toilet (part the labia with one hand, and rinse both the urethra and the vaginal introitus with a moistened tissue or baby-wipe, using the other hand). Although dipstick testing is cost effective in general practice, in patients with recurrent UTI and incontinence/prolapse, the organisms should be identified on culture. Particularly in refractory detrusor overactivity, low-grade UTI may exacerbate the OAB symptoms [6].

Ask the laboratory to report all organisms down to the level of only  $10^2$  CFU per ml, with pyuria.

Order a renal ultrasound and post-void residual to exclude:

- Renal calculi or pyelonephritis/hydronephrosis.
- Large complex renal cysts that do not empty out (small simple cysts seldom need concern).
- Narrow-mouthed bladder diverticulum that may collect a stagnant pool of urine.
- Dilated ureters that may suggest vesicoureteric reflux.
- The above conditions also indicate referral to a urologist.

If the post-void residual is greater than 100 ml, perform a Urine Flow Rate, which may show a picture of obstruction (as per Fig. 4.4), suggesting urethral stenosis.

## Initial Treatment

If the patient is postmenopausal, treat with topical vaginal estrogen (as explained in Fig. 7.4). A large RCT showed a significant reduction in the incidence of UTI after estrogen versus placebo [7].

A recent RCT [8] showed that increasing fluid intake by 1.5–2 l per day reduces the risk of UTI (Hooten et al., 2018), because washing out the bacteria is the normal first-line defense, but we often find that women with recurrent UTI drink very little—check their bladder chart!

If postcoital UTI, we advise patients to practice the self-help regime of Kilmartin [9], which contains many helpful points about pre- and postcoital techniques to reduce the risk of this distressing problem, such as salt washes to the perineum. We also recommend postcoital antibiotic therapy with Macrodantoin 100 mg stat or Trimethoprim 300 mg stat as it is of proven value.

If associated with large prolapse and residual urine >100 ml, consider using a vaginal ring pessary to elevate the prolapse. If this eradicates the UTI, then repair of the prolapse should be discussed. If the recurrent UTI is associated with persistent residual urine volumes >100 ml (but no prolapse), teach the technique of double emptying (see Chap. 9, managing voiding difficulty).

## At the Second Visit

First, check the results of the renal tract ultrasound, to seek upper tract disorders that mandate referral to a urologist. Second check the results of the three urine jars that you gave to the patient, to be tested for low count bacteriuria. She may

not have sent any samples off, if the ovestin cream, increased fluids, postcoital therapy, and ring pessary/double emptying have cured the problem!

*Why is low count bacteriuria important?* Many patients tell us that they go to the GP with symptoms of a UTI, but are told their “results” (either dipstick or traditional MSU) are negative, which distresses them. We often find in such cases that the low-count bacteriuria testing is positive, because some countries (such as the United Kingdom and Australia) have not changed to the most recent European Urology Association guidelines [10]. Also, you may find that the results show “mixed growth,” which GPs are trained to ignore, especially if epithelial cells are seen on microscopy. Certainly, heavy counts of epithelial cells mean that the MSU should be repeated with a more careful labial toilet. However, a recent study using RNA-PCR testing for bacteria shows that mixed growth may be quite significant in woman with recurrent UTI [11].

Therefore, if there is evidence of any further proven UTI, consider 3–6 months of macrodantoin or, trimethoprim therapy. In the *non-incontinent* woman, bacteriuria without pyuria is often not treated because it may spontaneously resolve. In the incontinent woman who has frequency and urgency and may use continence pads that promote cystitis [12], we generally treat. In vitro bacteriological studies have shown that the endotoxins produced by bacteria can reduce the contractile strength of the urethral sphincter or decrease the contractility threshold of the detrusor, thus promoting incontinence [13]. These antibiotics are preferred because they are not well absorbed into the bloodstream, not broad spectrum, and are not likely to cause vaginal monilia. At least 3 months of therapy is chosen, to completely eradicate “microbiological communities” [14] that may form within the epithelium and lamina propria of the bladder. The classic advice over the last 20 years has been, that if the patient takes 3–6 months of such therapy and still has “breakthrough” UTI, then cystoscopy is indicated.

## The Problem of Multidrug Resistance, Need for Antibiotic Stewardship, and the Possible Benefits of Nonantibiotic Prophylaxis

In the last 10 years, the problem of Multidrug Resistance has swept through all of medicine. This has arisen partly because of the widespread practice of feeding antibiotics to livestock animals prior to slaughter for human food, so as to reduce animal infections and increase profits, and partly because of inappropriate prescription of antibiotics for viral respiratory infections or perioperative surgical prophylaxis. As a result, there has been a worrying rise in the prevalence of Beta-lactamase producing bacteria (ESBL), methicillin-resistant *staphylococcus aureus* (MRSA), or Vancomycin-resistant Enterocobacteriae (VRE), *all of which can now cause bacterial cystitis*. An important Lancet editorial [15] called for an international effort to achieve Antibiotic Stewardship: clinicians should not prescribe long-term antibiotics unless other strategies have failed. Hence, the four simple management strategies that we describe for the first visit are extremely important. Nowadays, the classic advice to prescribe 3–6 months of nitrofurantoin or trimethoprim needs to be reconsidered, and discussed with the patient.

*There are three non-antibiotic prophylaxis options that need to be considered; Hipprex, Cranberry, and D-Mannose.*

*Hipprex* (Methamine hippurate) converts to formaldehyde in the urine, which has a bacteriostatic effect. Evidence is accumulating that Hipprex must be given at a dose of 1 g twice daily, and that the urine must be acidified by the patient having 1–2 g of Vitamin C twice daily. A recent systematic review of six studies found a trend toward benefit for Hipprex in preventing UTI [16], which was not statistically significant but there were no adverse events.

*Cranberry* juice was popular for many years, but recent studies have shown that patients must consume at least 36 mg twice daily of the active ingredient PAC (proanthocyanidin) to see the benefit. It is not possible for patients to drink

enough juice to achieve this dose, they must take tablets. A recent meta-analysis showed some evidence for reduced symptomatic UTI rate [17]; but the urine should be neutral pH, so that bicarbonate of soda or Ural sachets should be given concurrently. A recent small RCT ( $n = 72$ ) showed that only 33% of patients on Cranberry versus 89% of placebo patients developed a further UTI over 12 weeks [18].

*D-Mannose* is a large molecular weight sugar that binds to the fimbrial ends of *E. coli* and *Pseudomonas*, to prevent adherence of the bacteria to the urothelium, so that the microbes are washed out in the urine. One RCT ( $n = 308$ ) showed promising results, i.e., the risk of developing UTI was 15% on D-Mannose, versus 60% on placebo ( $p < 0.001$ , [19]). A much larger RCT with full microbiology details is currently being recruited in the USA (the MERIT [20] study, Fransser 2021).

## What to Look for on Cystoscopy?

First of all, if the patient has hematuria, or ureteric dilation on ultrasound, the cystoscopy should be performed by a Urologist. This is because hematuria may represent a tumor that could be resected on the same day, but urogynecologists are NOT trained to use a resectoscope. Also, if there is ureteric dilation/possible ureteric stone, the patient needs ureteric catheters to be passed with dye infusion for a retrograde exam of X-ray contrast in the ureters under imaging in theater, which a urogynecologist is NOT trained to perform. Unfortunately, GPs often refer patients with recurrent UTI to a urogynecologist because they just want someone to examine the patient for cystocele and exclude residual urine.

If the patient has none of the above conditions, and fails either nonantibiotic or antibiotic prophylaxis for 3–6 months, then she would benefit from a cystoscopy. This should be performed under general anesthesia in the urogynecology context. Urethral dilation, if the patient is properly

oestrogenised, may improve urethral stenosis and facilitate bladder emptying. In patients with a previous mid-urethral mesh tape (TVT or TVT-O), ask for a zero-degree cystoscope and perform a urethroscopy to exclude mesh erosion into the urethra, which can be cut and removed. At this point, look for the urethral lumen of a urethral diverticulum. One should also exclude a narrow-mouthed bladder diverticulum that does not empty out (although this is rare). One also may see small waxy-yellow raised areas of microabscesses, as part of “follicular cystitis” appearance (Fig. 11.1). Diathermy will eradicate these, and is shown to result in a four fold reduction of UTI [21].

Summary, recurrent UTI is an increasing and difficult problem. Patients need to be evaluated very carefully, with early recourse to basic conservative treatments. Antibiotic prophylaxis versus other newer prevention strategies needs to be discussed with the patient. Cystoscopy (in the absence of suspected urological conditions) must be carried out meticulously.

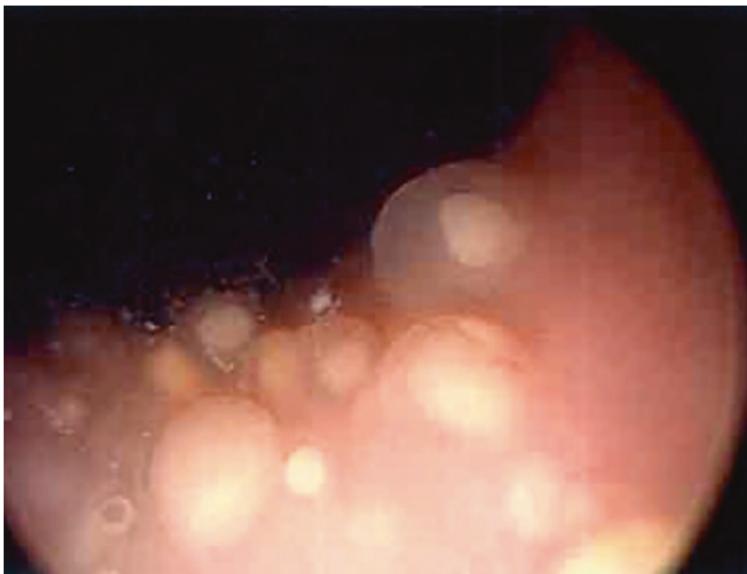


FIGURE 11.1 Cystoscopy appearance of Follicular Cystitis

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# Chapter 12

## Interstitial Cystitis



Unlike the other conditions considered in this text which are very common, interstitial cystitis (IC) is quite rare. This chapter is a short summary of a great deal of research and clinical studies that have been directed at this fascinating problem. The broader concept of Bladder Pain Syndrome is discussed at the end of the chapter.

### How to Diagnose Interstitial Cystitis (IC)

IC is a chronic pain syndrome characterized by a *history* of the following:

- Recurrent episodes of suprapubic pain/pelvic pain.
- Symptoms often wax and wane over time.
- Pain is worse when the bladder is full.
- The symptom of urgency is actually painful (in 92% of cases).
- Severe frequency (can void 20–30 times per day or more).
- Generally, severe nocturia (5–10 times per night or more, in 51% of cases).
- Leakage of urine is not typical (but can occur).

Less common symptoms include:

- Chronic pelvic pain or pressure symptoms (64–69%)
- Dysuria (61%)

- Dyspareunia (55%)
- Pain for days after sexual intercourse (37%)
- Hematuria (22%)
- IC is more common in women (ratio 9:1)

The diagnosis of IC is based on:

*History:* The classic symptoms of suprapubic pain with severe frequency/urgency/nocturia. The Bladder Chart is essential; along with *severe* frequency/ nocturia, patients usually have small voided volumes (i.e., 75–150 ml) with small maximum voided volume (seldom above 350 ml).

*Physical examination:* On bimanual exam, if you place your vaginal hand just in front and above the cervix, then place your abdominal hand in front of uterus just behind pubic bone, then press gently on the trigone of the bladder, it is often quite tender in these patients. You should also palpate the levator muscles on pelvic sidewall, looking for levator spasm, which can coexist with Bladder Pain Syndrome (see below), and needs physiotherapy treatment.

*Urodynamic testing* is not required as patients seldom leak urine. It is quite painful, and just shows small bladder capacity (although in some cases detrusor contractions are seen). Voiding function is usually normal (flow rate and residual urine).

*Urine cultures*, by definition, must be sterile for 3 months, but low-count bacteriuria should be looked for as these patients can sometimes have a chronic low-grade bacterial cystitis (which is treated quite differently, see Chap. 11).

*Cystoscopy with cystodistension and refill examination* [1] must be performed under general anesthesia (Whitmore et al., 2019) as follows:

- Filling bag of water should be about 1 m above pubic symphysis.
- To allow hydrostatic cystodistension, with digital compression under urethra.
- To stop spillage of fluid from the urethra.
- The mucosa often looks fairly normal during the first fill, although white patches of inflamed/vascular mucosa may split during filling.

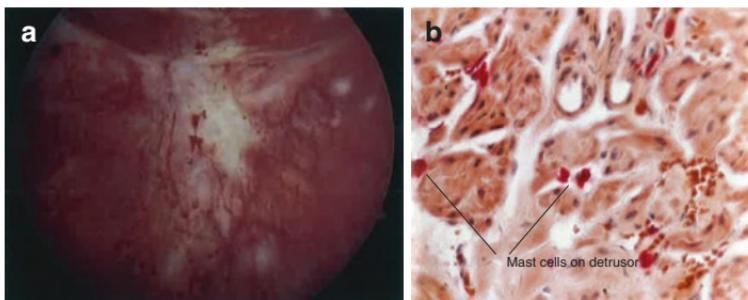


FIGURE 12.1 (a) Typical lesions of IC. (b) Mast cells in the detrusor muscle from a biopsy taken from a patient with classic features of IC

- These are called Huhner's Ulcers (See Fig. 12.1a).
- Capacity under GA is often reduced, for example, 400–600 ml (normal 8–900 ml).
- Leave the bladder to distend for 3–4 min, as this can give symptom benefit.
- Refill exam must be performed: Huhner's ulcer or mucosal splitting may be more obvious.
- And petechial hemorrhages with “waterfall hemorrhages” often occur.
- Bladder biopsy is recommended. Biopsy needs special stains for mast cells (see Fig. 12.1). It often but not always reveals excess mast cells in the detrusor muscle.

*If features of IC are seen, then diathermy “fulguration” is of proven benefit [2]. Hemostasis must be secured, and postop antibiotics are given for 5 days.*

## Prevalence/Epidemiology

Large studies indicate the prevalence of about 30 per 100,000 women [3]. The annual estimated incidence is about 8 per 100,000 total US population. The average IC patient sees three or four urologists or gynecologists before diagnosis.

Evidence is accumulating that patients with Huhner's ulcers represent a more severe spectrum of the IC disease [1]. They tend to have much smaller bladder capacities, to be older, and to be more likely to have abnormal cytokine levels (inflammatory markers such as Macrophage Inhibitory Factor and CXCL).

## Etiology

The etiology of IC remains unknown, although several theories have been put forward.

*The Defective Epithelial Barrier Theory:* The bladder mucosa is lined by a chemical layer of glycosaminoglycans (GAGs), which are thought to render the urothelium impermeable to harmful solutes (such as urea). Early histological studies suggested that the urothelium of IC patients was more readily penetrated, but later functional radioisotope studies showed no significant differences between IC patients and controls.

*The Detrusor Mastocytosis Theory:* Because mast cells release histamine, which causes pain, hyperemia, and fibrosis, an excess of mast cells in the detrusor muscle could explain the pathophysiology of IC. An early study of 115 IC patients suggested that a finding of >28 mast cells per mm [4] in the detrusor muscle (on biopsy) indicated "true" IC and a lower mast cell count indicated early disease. Although this basic concept is still probably true, high mast cell counts can be seen in patients with prostate cancer, so the finding is not pathognomonic. Later studies showed that high mast cell counts in the lamina propria are also a marker of "classic IC." For review, see the text by Hanno et al. [5].

*The Autoimmune Theory:* Several studies have shown that patients with severe IC are more likely to have antinuclear antibodies. Thus, IC has been likened to scleroderma (fibrosis) but the data are inconsistent. Coexistence of IC with Sjogren's disease, rheumatoid arthritis, SLE [6], and Hashimoto's thyroiditis has been reported in large prevalence studies.

In the United States, the National Institute of Diabetes and Digestive and Kidney Diseases (NIDDK), which is part of the National Institutes of Health (NIH), has a major interest in funding research into IC [<http://www.niddk>]. The NIDDK has established a national database of patients with IC, to study the long-term natural history of the disease. So far as we know at present, IC tends to wax and wane over time, but is not “curable.”

## Treatment

*Cystodistension* is routinely performed in our department as part of the initial cystoscopy. Up to 60% of patients obtain benefit for several months. At cystodistension, Huhner's ulcers/mucosal splitting areas/waterfall hemorrhages should be diathermied, which is of proven benefit for up to 12 months (for example, voids per day reduced from mean 14 (SD 7) down to 8 (SD 3) in one series of 72 cases [2]).

*Dimethyl sulfoxide (DMSO)* installation is usually first-line therapy (after cystodistension, and diathermy of relevant lesions). It is the only intravesical treatment approved by the FDA in the United States. After catheterization, a 50-ml solution of DMSO is instilled into the bladder; the patient is encouraged to retain it for 15–30 min. Weekly treatments are given for 6–12 weeks. Response usually occurs after 3–4 weeks. An initial worsening of symptoms for 1–2 weeks may occur. A garlic-like taste and skin odor are often noted for up to 3 days. Marked reduction in pain and frequency occur in 50–90% of patients lasting 8–12 months; relapse (occurs in about 40%, but repeat treatment is usually effective [7]). The drug is cheap and has no major side effects.

In our department, once the patient has had cystodistension +/- diathermy, then DMSO, we usually provide maintenance therapy to prolong the success of the installation (as weekly visits for 6–12 weeks are burdensome). Our usual routine is as follows:

*Amitriptyline*, 25–75 mg daily, is useful in patients who can tolerate its sedative effects, with major benefit in 70–80% in such cases [8]. Imipramine 25–50 mg is also used.

*Transcutaneous nerve stimulation (TENS)* has been used successfully to inhibit the perception of suprapubic pain. The electrodes are placed suprapublically; the stimulus is 10 Hz, in keeping with other chronic pain therapy (see Chap. 7 for methodology). Acupuncture can be useful [9].

*Oxalate-free diet* has been used with some success. Patients avoid acidic foods such as tomatoes, strawberries, chilies, citrus fruits, tea, coffee, vinegar, and alcohol. A further modification of this diet involves avoiding foods high in tyrosine, tyramine, tryptophan, aspartate, and phenylalanine. Several studies show substantial benefit Friedlander [10].

*Pentosan polysulfate sodium (Elmiron)* is an expensive oral drug, 100 mg TDS, for at least 6 months. Clinical improvement may not start until after 2–4 months, so therapy is recommended for 6 months. In open trials, up to 80% of patients note 80% reduction in pain. In placebo-controlled RCTs, the drug has about double the effect of placebo (32% vs. 16% objective benefit; see Giannantoni [11]).

If the above therapies fail, then surgical options are available:

*Surgical resection of Huhner's ulcers* by endoscopic resectoscope, involves deep excision of Huhner's lesions, but there is risk of postoperative scarring, fibrosis, and reduction of bladder capacity. Pain will improve, but frequency/nocturia may not.

*Clam cystoplasty*, as described for refractory detrusor overactivity (Chap. 7), does enlarge bladder capacity and reduce pain, but has major morbidity.

*Continent diversion* can be used in end-stage disease [5].

The NIDDK operates a useful Web site for patient information; a very good leaflet can be downloaded: <http://www.niddk.nih.gov/health/urolog/pubs/cystitis/cystitis.htm>. In the United States, an IC patient support group is run, with a useful newsletter that is available worldwide; details are at [www.ichelp.org](http://www.ichelp.org).

## Bladder Pain Syndrome

In the last 10 years, urologists and urogynecologists have realized that not *all* patients with a painful bladder with sterile urine have the classical features of IC. Thus, the term Bladder Pain Syndrome has been introduced to encompass such patients. Patients with an early desire to void and small bladder capacity, but a stable bladder on urodynamic tests (previously called *sensory urgency*) are now included in this term. Such patients are more likely to also have levator muscle spasm on vaginal examination, and respond to trigger point therapy by a subspecialty physiotherapist. A variety of guidelines have been developed to help with management of these patients (for example, by the American Urological Society, [www.AUA](http://www.AUA)), which are somewhat controversial. For review, see Bresler et al. [12].

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# Chapter 13

## Overview of Management of Mesh Pain/Complications

### Introduction

Unlike other chapters in this book, the surgical procedures used for mesh removal will not be given in a “how to do it” format, because not all Urogynaecology units will choose to focus on mesh problems. Mesh removal should only be performed in high-volume centers that have dedicated urogynaecologists who are thoroughly trained and prepared to spend a considerable amount of time counselling the often highly distressed women who suffer mesh pain. Such women often tell us that they feel “let down” by their original surgeon, as lack of fully informed consent about the risk of mesh erosion and mesh pain, particularly in women who had four-cornered mesh kits for prolapse, was common.

The distress of women who went to get help for a prolapse/lump in their vagina, but now cannot sit properly, cannot defecate without pain, and cannot have intercourse, is substantial. Such women need to tell their stories and be heard in a sympathetic manner. Then they need to participate in a detailed evaluation, and understand that they will have a

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“stepwise” management plan. It is important to note that mesh complications rates differ greatly between vaginal prolapse mesh kits and midurethral slings, and these will be discussed separately.

## History Taking for Mesh Pain/Complications

As mentioned in Chap. 1, patients may come to see you because, either they have vaginal pain/discharge/sexual dysfunction/other impairment, or they have seen adverse press about mesh complications and present with mesh “anxiety” and are frightened that they will get dangerous mesh problems in the future. To fully assess the patient, you need to ask:

- What sort of pain do they have, is it worse with exertion/defecation/sitting down?
- Can they feel a mesh extrusion when they wash in the vagina?
- Do they have dyspareunia (is it on entry or deep and which side it is located)?
- Can partner feel the mesh (“hispareunia”)?
- Do they have vaginal discharge (fouls smelling, blood-stained, or other colors)?
- Any difficulty with incomplete urination or poor stream?
- Any history of recurrent bacterial cystitis (can indicate mesh in the bladder or urethra)?
- Difficulty with complete defecation, need to push fingers in the vagina to defecate.
- Painful defecation or per rectal bleeding (can indicate whether mesh is in the rectum).
- Check old urine results from GP, make sure there is no hematuria.
- Has the patient had any treatment, e.g., vaginal estrogen or amitriptyline cream?
- Obtain operation reports relating to mesh insertion (very important as mesh kits differ).
- If mesh kits had distinct “arms,” or if there was perforation of any viscera/structures at the time of surgery this would affect your clinical assessment)?

## Physical Examination for Mesh Complications/Pain

Examination for mesh complications needs to be systematic. The approach is to start with the abdomen and then move to the most painful aspect of the exam last (in the order listed out below):

- *Abdomen*
  - Inspection and examination of the abdomen to look for previous abdominal surgeries and any suprapubic pain, skin tethering, which can be related to mesh.
- *Vulva*
  - Assess vaginal tissue quality and look for untreated postmenopausal atrophy.
  - Look for lichen sclerosis which can cause vulvovaginal symptoms that are unrelated.
- *Vagina*
  - Carefully inspect all vaginal walls on speculum exam, to look for mesh exposures (naked mesh) and extrusions (protruding fragments), then measure their dimensions.
  - Write down which wall they are located on (anterior, posterior, posterior fornix, or vault) and record how far up into the vagina they are located, in centimeters.
  - Carefully palpate all vaginal walls, feeling for any extrusions that were too small to see visually but may still be tender.
  - Palpate for any mesh tenderness or thickening deep in the vaginal walls.
  - Describe which wall they are on and their location in the vagina.
  - The size of mesh visible should be quantified as > or <1 cm (Fig. 13.1).
  - If any purulent discharge, take microbiology swabs from each area.



FIGURE 13.1 A typical mesh exposure high in the vagina, approx. 2.5 cm diameter

- *Levator ani muscles*

- Observe spasm of the levator ani muscles when you palpate (as patients may have secondary pain in the muscle). Also, observe whether any mesh arms are tethered into levator ani muscles.

## Investigations

An MSU with a careful labial toilet should be sent to exclude UTI. If there is a recurrent UTI get the old urine results looking for atypical organisms that may suggest a foreign body.

CT scans and MRI are of limited value unless the recurrent UTI suggests bladder stones.

A 3D transperineal ultrasound of the mesh is often helpful to define the size and location of the mesh, but is not always available (Fig. 13.2). Customarily it is performed by the surgical team when evaluating whether mesh removal is warranted.

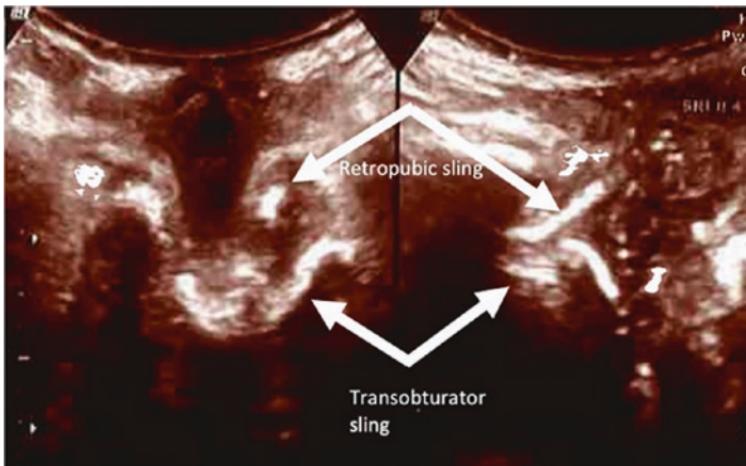


FIGURE 13.2 Three-dimensional ultrasound of sagittal and horizontal planes of 2 midurethral polypropylene tape

## Explain Findings to the Patient

At the end of the assessment, you need to summarize your findings and very carefully document them. The joint IUGA/ICS mesh complication classification code (<https://www.ics.org/comPLICATION>) gives a very good framework for categorizing type of mesh complications, using the correct terminology. After this you will need to explain it to the patient in a very transparent manner, diagrams are often useful. This is part of rebuilding the patient's trust. Then outline the initial conservative management plan for mesh erosion or pain. Briefly mention that if basic treatment is not sufficient to resolve their problem, the need for partial or complete excision of the mesh will be discussed. But referral to a regional mesh treatment center will be needed at that point.

## Understanding the Mesh Problem: Vaginal Mesh for Prolapse Vs. Midurethral Slings

*Vaginal mesh for Prolapse:* The main problem with vaginal mesh for prolapse is the use of four-cornered mesh kits [1]. Vaginal meshes for prolapse have a 10–15% risk of mesh erosion as described in Chap. 10. The reason is that the vagina is not a sterile environment and a large rectangular piece of mesh, is inserted under the skin via large vaginal incisions into this non-sterile environment.

*Abdominal sacrocolpopexy* mesh has been placed into the abdominal cavity for the last 60 years with a very low risk of erosion and infection (approximately 2%) (see Chap. 10, Fig. 10.9), which is not discussed further discussed here.

As you can see from Fig. 13.3, there is a large bulky rectangular sheet of mesh approximately  $5 \times 10$  cm with four separate arms each with arms  $1.5 \times 8$  cm. One of the major problem with vaginal mesh is that it shrinks over time resulting in thick clumps of fibrous band [2] which cause pain, dyspareunia, inability to sit for long, painful defecation, and chronic pain in up to 20% of patients [3].

Clinicians should be aware of the main types of mesh that were used in the last two decades as knowing the types and location of mesh arms helps you conceptualize the patients' symptoms. The "mesh kits" consist of first-generation prolapse meshes, which had a high mesh load with arms that traversed the obturator foramen or buttock (Fig. 13.3). Second-generation meshes reduced the mesh load, but still had mesh arms often with sharp permanent barbs that are anchored into the sacrospinous ligament or obturator membrane.

- Anterior wall:
  - First generation: Perigee (AMS), Prolift (Gynaecare), Avulta Plus (Coloplast).
  - Second generation: Anterior elevate (AMS) See Figure in Chap. 10 (AMS shot), Proxima (Gynaecare).
- Posterior Wall:
  - First generation: Apogee (AMS).
  - Second generation: Posterior elevate (AMS).

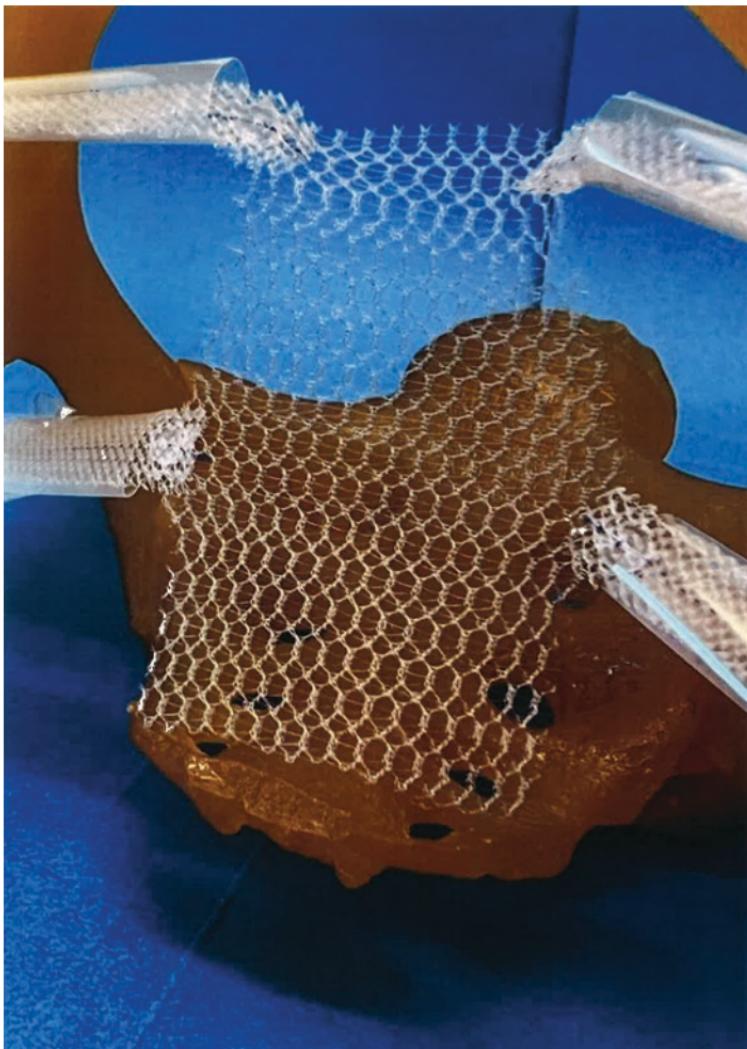


FIGURE 13.3 Typical four-cornered Perigee Mesh Kit for cystocele

- Apical:
  - First generation: Pinnacle mesh (Boston Scientific).
  - Second generation: Uphold (Boston Scientific).

*Midurethral Slings:* Polypropylene mesh suburethral tapes in contrast have a much lower risk of erosion (2%) and pain

(1–6%) compared to mesh kits. This is because there is less mesh present (strip approximately 10 cm × 1 cm). The TTV® or Boston Advantage® are placed mostly into the retropubic space which is sterile, only 3–4 cm portion under the urethra is in the vaginal environment [4]. However, there is still a risk of periurethral and suprapubic pain. If the mesh sling was a transobturator tape (Monarc®, TTV-O®, or Mini sling (AMS®) (see Fig. 9.7 in Chap. 9) then the risk of periurethral and groin pain is fourfold greater than that of retropubic tapes. The mesh can be in close proximity to the obturator nerve and mesh shrinkage and pulling on adductor muscles can cause chronic groin pain in up to 6% of women [5]. Numerous case reports have also appeared in the literature regarding other severe problems for Transobturator tape, e.g., necrotizing fasciitis [6], substantial hematoma medial to the obturator foramen [7], adductor brevis myositis [8], pudendal neuropathy [9], and vaginocutaneous fistula [10]. For full discussion see Chap. 9 (surgery for stress incontinence).

## Management of Mesh Problems

Management of mesh complications depends on the type of mesh issues, which can be broadly divided into four categories: Pain, Erosion, Sexual dysfunction, and Perforation. Multiple complaints may be seen in one patient and need to be managed concurrently. This applies to both mesh kits and midurethral slings. International guidelines provide an algorithm for management which is recommended reading for those interested [11, 12]. Here we will go through the key points of management:

### 1. *Erosion*

- If the mesh erosion is small, and not painful, <1 cm in maximum diameter, then 6–12 weeks of vaginal oestriol crème may allow the vaginal tissues to close over the erosion.
- “Office trimming” of small mesh extrusions is not recommended, as 75% of such cases eventually need full surgical trimming [13].

- If there is mild tenderness on palpation of the mesh area, then add daily amitriptyline cream 2%–4% for 6–12 weeks as it is often very helpful.
- If the mesh erosion is larger than 1 cm, or painful in daily life, then the patient is likely to warrant removal of the erosion with oversewing of the vaginal epithelium.
- If there is mild inflammation or a mucopurulent discharge, then 2 weeks of broad-spectrum antibiotics should also be trialed.

## 2. Pain

- If the patient's pain occurs in conjunction with erosion and is located to erosion site, then management of erosion via estrogen cream or excision and oversew may resolve their pain.
- If the pain is in the groin and related to tethering of a mesh arm, division of arms may help with pain, but if the pain is directly related to palpation of the mesh itself without erosions, or obvious tethering, more extensive mesh removal needs to be discussed.
- This can be partial or complete mesh removal discussed below.
- Gynecologists and Urologists who are not part of a Mesh Centre should not 'dabble' in mesh removal, as prior mesh removal distorts residual meshes, makes subsequent surgery more challenging.
- If the pain is more diffuse, or associated with levator muscle hypertonicity, then arrange for subspecialist physiotherapy [14] for Trigger Point therapy. Chronic pain team review for consideration of Pregabalin or gabapentin prior to offering surgical intervention is advised. Be wary of patients with connective tissue disorders such as Sjogren's syndrome, Fibromyalgia, who may have undiagnosed pain syndromes.
- Patients need to be informed as part of consent process that removal of mesh for *chronic* pain is associated with 30–50% risk of persistent postoperative pain.
- Management of the expectations of patients is very important.

### 3. Sexual dysfunction

- If the problem is only hispareunia, do a very careful vaginal examination and you will find mesh exposure/erosion/extrusion somewhere and treat this as per mesh erosion.
- If it is dyspareunia, you need to assess whether this is due to mesh erosion, vaginal scarred bands (which can happen from bunched up mesh), or levator spasm. The first two require surgical excision and the latter needs extensive physiotherapy.

### 4. Perforation into visceral organ

- Diagnosis of this should be prompted by history of UTI, bladder pain, per rectal bleeding which would lead to a EUA, Cystoscopy or Colonoscopy depending on the symptoms.
- Any perforation of mesh into surrounding organs such as bladder, rectum, ureter require surgical removal of mesh (see Fig. 13.4). Patient is counselled about the risk of recurrent prolapse, incontinence, and importantly fistula formation. MDT approach with colorectal or urologist may be needed.

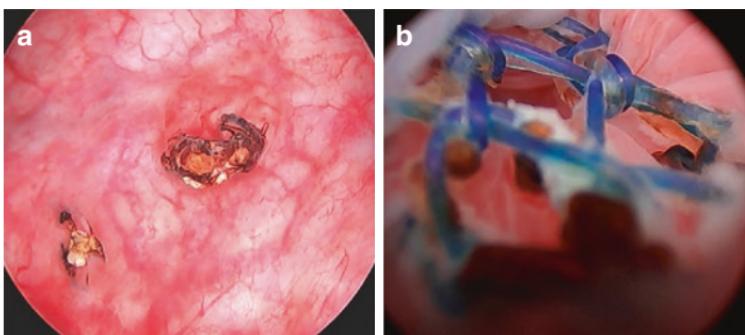


FIGURE 13.4 Mesh erosion in the bladder (a) and in the urethra (b)

## Controversy Surrounding Partial Versus Complete Mesh Removal

The preliminary evidence suggests that partial mesh removal, of any mesh areas that are focally tender, or comprise an obvious tight band, is the best first-line therapy. Complete mesh removal should generally only be undertaken if carefully conducted partial removal does not resolve pain.

1. *In the case of Transvaginal Prolapse Mesh*, one often needs to excise tight “banded” or exquisitely tender portions of the four mesh arms. One may incise *all* four mesh arms if *any* are tender, to loosen up the whole compartment. Any “bunched up” or obviously shrunken, nodular, tender sections of the mesh rectangle are excised. There is little data as to the risks of prolapse recurrence after partial (but clearly the risk is lower than if the prolapse mesh is completely excised).
2. *In the case of Retropubic midurethral sling*, total removal for pain is rarely seen. Generally, suburethral portion is first removed to see whether periurethral pain is resolved. If there is suprapubic pain then retropubic portion can also be removed. The retropubic space is very easily accessible via laparoscopy, thus total removal of the mesh can be performed in combination with the vaginal approach.
3. In the case of Transobturator midurethral sling, removal for pain is more common. Partial removal of suburethral portion can resolve pain as the tethering is solved. But this can make later removal of the distal portions of the transobturator sling more difficult due to retracted arms. However, total tape removal requires extensive bilateral groin dissection as shown in Fig. 13.5.

## Risk of Recurrent Stress Incontinence

In partial removal of TVT or TVTO, the risk of recurrent stress incontinence is about 17–22%, depending on whether you remove all of the mid-portion of the suburethral support. We normally perform a simple bladder neck buttress/



FIGURE 13.5 Surgical groin dissection for removal of lateral transobturator sling arm

Kelly plication at the time of partial removal, which can provide enough urethral support to avoid incontinence that is severe.

In complete removal, the risk of recurrence is 56% [15]. In such cases, we have found the best result arises by letting the patient heal for 12 weeks minimum. Then if the suburethral tissues give good access, an autologous pubovaginal sling is the most effective procedure. If access is poor, a “sling on a string” (see Chap. 9) still gives a high likelihood of continence.

## Conclusions

Mesh-related complications are variable, ranging from small erosions that are simple to manage, to severe chronic pain. Careful assessment and sympathetic and supportive management is vital. All gynecologists should be able to offer initial advice, and treatment such as vaginal estrogen or amitriptyline cream, or subspecialty physiotherapy for levator muscle spasm. Explaining to the patient the above treatment algorithm, as it relates to her case, can also provide initial comfort to the patient, as well as explain the role of the mesh removal center multidisciplinary team.

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