6 The Operations

Basic Principles

Fistulae come in all different shapes, sizes and sites, but the basic principles of fistula surgery can be applied to all.

Fistula surgery can be very challenging, but one must start by selecting easy cases that have a good chance of being cured, and following the basic principles of fistula repair. The first principle is to close the hole in the bladder and also the vagina. When selecting a simple case you should start with small fistula, less than 2cm, not involving the urethra and with minimal scarring. To cure these you need only to follow the first principles, which involve five basic steps. For more difficult fistulae—that is involving the urethra, circumferential defects, more scarring and those with more tissue loss; you must follow the more advanced principles if you are to have a chance of not only closing the fistula successfully, but restoring continence and restoring sexual and reproductive function. Closing the fistula is straightforward with practice, but restoring continence and sexual function is much more difficult.

Let's explore the principles further. Fistula surgery has three aims:

1. ***Close the hole in the bladder and the vagina.*** Remember that a fistula is caused by loss of tissue by ischaemic necrosis and there is tissue loss not only in the urinary tract (bladder, urethra and sometimes ureter) but also in the reproductive tract (vagina, cervix and sometimes even the uterus). You will never cure a patient unless you repair the fistula or holes in the urinary tract and the reproductive tract.

2. ***Restore continence.*** With experience and training it is possible to close a fistula successfully in over 95% of cases at the first operation. However this doesn't mean that the patient will be continent. As a surgeon you might label her as cured as you have closed the fistula, but the patient will be disappointed because she is still leaking. In published series from Addis Ababa, 33% of women had some incontinence after fistula closure, often so severe that they were leaking all the time, just as they did before the operation. Another unpublished series from Addis put the figure at 45%. These series were done in the early 2000's and there have been a lot of surgical advances since then. By applying surgical continence techniques during the repair, the incontinence rate after surgery can be reduced to around 15%. When you repair a fistula you must try and restore normal anatomy as much as possible which means reconstructing the urethra, supporting ligaments and vagina. By performing these more advanced steps you will increase the number of patients who are fully continent and cured.

3. ***Restore sexual and reproductive function.*** Once a patient is cured of her incontinence she will often get re-married and want to have a child. Some fistula patients have such severe loss of vaginal tissue that after you repair the hole in the vagina, there is nothing left but a

small rigid scarred dimple of a vagina making intercourse impossible. There are some new vaginal reconstructive techniques that have been used recently with good results, enabling intercourse and some patients getting pregnant. (Some patients will remain infertile from other causes like Ashermanns syndrome which is much harder to treat). Interestingly, by restoring normal vaginal anatomy the rate of ongoing incontinence after fistula repair is further improved.

For a simple fistula case, less than 2cm in diameter not involving the urethra and not much scarring, (Goh type 1) generally successful closure of the fistula is all that will be needed to restore continence and sexual function.

Five Basic Steps

1. *Close the hole in the bladder and vagina.* To do this, follow the five basic steps of fistula surgery. These are the only principles needed to close a simple fistula, the type that a beginner should start with.

    a. ***Exposure.*** Make sure the operative site is adequately exposed with speculae, retractors and sutures retracting the labia.

    b. ***Protect the ureters.*** In all but the smallest fistula or very distal ones it is prudent to identify and if need be catheterise the ureters to ensure you don't cut or ligate them. This can be fatal if you tie both ureters and don't recognise it.

    c. ***Mobilise.*** You need to mobilise the bladder off from the vagina and cervix adequately, taking care of the ureters of course.

    d. ***Tension free closure.*** As with any surgery, if there is tension on the wound it will break apart, so mobilise until you can repair the defect without tension. As the bladder can fill with urine, the bladder needs to be kept empty during the healing phase by a drainage catheter. A full bladder will put tension on the repair and risk rupturing the repair.

    e. ***Check you have it closed with a dye test.*** As Kees Waaldijk famously says 'the dye no lie'. Check you have got the bladder watertight by injecting at least 60ml of dye into the bladder. Sometimes you can be surprised by a second fistula that was previously undetected. (Figure 6.32)

Advanced Principles

Aims number 2 and 3 are technically demanding and apply to more difficult cases requiring a more experienced fistula surgeon.

2. ***Restore continence.*** Many fistulae involve the urethra and depending on how much urethra has been destroyed this affects the prognosis. The more urethra that has been

lost, the higher the chance on ongoing incontinence. The chances of restoring continence will increase significantly if you apply the following two principles:

a. ***Maintain the urethral length.*** A short urethra will almost never be functional. The required length has not been studied in depth. However the impression of several fistula surgeons is that a urethra shorter than 2cm will rarely become continent. You need to repair a urethral defect longitudinally or otherwise make the urethra longer from bladder, usually from a flap of anterior bladder.

b. ***Support urethral defects with a sling.*** In normal anatomy there is a ligament running from the pubic bone to the mid-urethra, imaginatively called the pubo-urethral ligament. This needs to be recreated, as often it has been destroyed in the ischaemic process. This is recreated by the use of a sling. Create a sling using either pubo-coccygeal muscle or scar tissue on the pelvic side walls, or by harvesting some fascia from fascia lata or the rectus sheath.

3. ***Restore sexual and reproductive function.***

a. ***Restore normal vaginal anatomy, depth and elasticity.*** There is often great loss to the vagina as well. It is tempting just to pull the vagina together, but this just puts tension on the vaginal repair, increasing the risk of breakdown, and forms scar resulting in dyspareunia or even apareunia. Also it tethers the vagina which results in pulling the urethra open, making a rigid drainpipe urethra. You need a supple elastic vagina covering the urethra. This will not only restore sexual function, it will greatly improve patients' continence rates. There are several ways of doing this, including by rotational labial flaps and vascular island skin flaps (giving the best results in my experience). Some people even use bowel to recreate a vagina. This is a much more invasive procedure with a higher morbidity and even mortality. Only a few centres perform this operation.

When beginning fistula surgery it is important to select the right case for your level of experience. If you select a case that is too demanding, you risk failure of the operation, demoralising the surgeon and a catastrophe for the patient. The best chance of success in any fistula operation is the first time. If the repair breaks and you re-operate, the chance of success significantly decreases.

The following section will guide you to select a suitable case when you are starting out.

Selection of Cases for the Beginner

We shall repeatedly emphasise that selection of cases is the most important aspect of fistula management for a trainee.

Less than one-quarter of new cases presenting will be suitable for a beginner. History taking does not help that much in selecting the easy ones. A small hole may leak just as much as a big one.

There are some clues that should make suspect a serious or difficult fistula:

- Neurological weakness (usually foot drop), even if it has recovered, suggests a difficult case.
- Rectal fistulae usually occur in association with a serious bladder injury. This does not apply to anal sphincter injuries, which often occur in isolation but can occur with a bladder fistula.
- Fistulae following caesarean section are often in the region of the cervix and therefore high and often difficult to access for the beginner.
- A fistula following hysterectomy for a ruptured uterus will usually be in the vault and may have an accidental ureteric injury.

The only clue to a potentially easy case is when a patient gives a history of pregnancies in spite of having a fistula. Clearly, there cannot have been too much damage to the genital tract. Fewer than 10% of cases have had pregnancies while suffering from a fistula.

Examination is the key to selection. The features to look for are:

- a vagina without shortening or stenosis
- a fistula that is easily palpable or visible, and that is small, soft and accessible, but not too close to the cervix or to the external urethral orifice so not involving the urethra.

There is no need to examine such a patient under anaesthesia. If the fistula cannot be seen easily in the conscious patient using a Sims speculum then it is not a simple case.

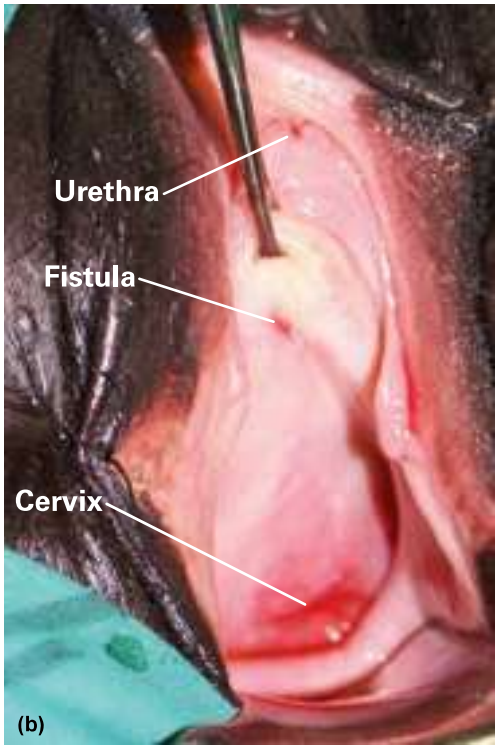
In summary, novice surgeons should confine themselves to:

- small fistulae not involving the urethra
- those with minimal scar
- those that are easily accessible.

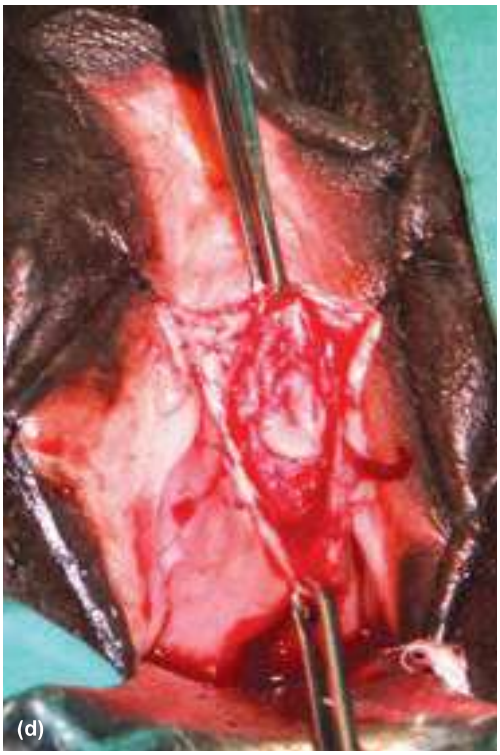
An Ideal Case

Unfortunately, less than 10% of cases are as easy as the one shown in Figure 6.1 a–e.

Figure 6.1
a) A simple fistula. It initially looks to be deep in the vagina, b) but when you grasp the distal vagina and retract it, it easily comes into view. Goh classification 1ai. c) Applying the basic principles of exposure, then mobilise. The initial incisions are around the fistula and laterally either side. d) The vaginal flaps are raised and e) after the bladder has been repaired, the vagina is repaired over it.


Urethra
Fistula
Cervix
(b)


(c)


(d)


(e)

Some Relatively Easy Cases

Some other examples of cases suitable for a trainee are shown in Figures 6.2–6.6.

Figure 6.2
a) Another simple case, soft, no scarring midline and far from the urethra and cervix, Goh 1ai.

b) It becomes more visible once you retract the distal vagina. The vaginal flaps mobilised off the underlying bladder.

c) The bladder is closed in one layer with interrupted sutures.

Figure 6.3
Another simple case but slightly harder than Figure 6.1 and Figure 6.2. It is soft, located about the junction of the bladder and urethra, 2cm in diameter. Goh 2bi.

Figure 6.4
Two more relatively simple cases. a) Deeper in the vagina, Goh 1ai. b) Another deeper in the vagina closer to the cervix and slightly to the left hand side of the patient.

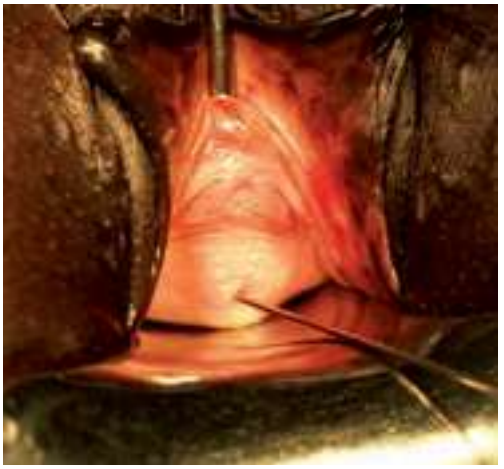


Figure 6.5
This is a pinhole fistula, Goh 1ai. It appears simple but it's very easy to lose it after you mobilise. It's best to try and leave the probe in situ until you have repaired it.

Figure 6.6
Another Goh 1ai but note the tissues appear tight around the fistula margin. This signifies some scarring and tethering. When you release the scar the defect in the bladder can spring open and become much larger.

Some Difficult Cases

The cases shown in Figures 6.7–6.10 are more difficult, and should not be attempted by a beginner.

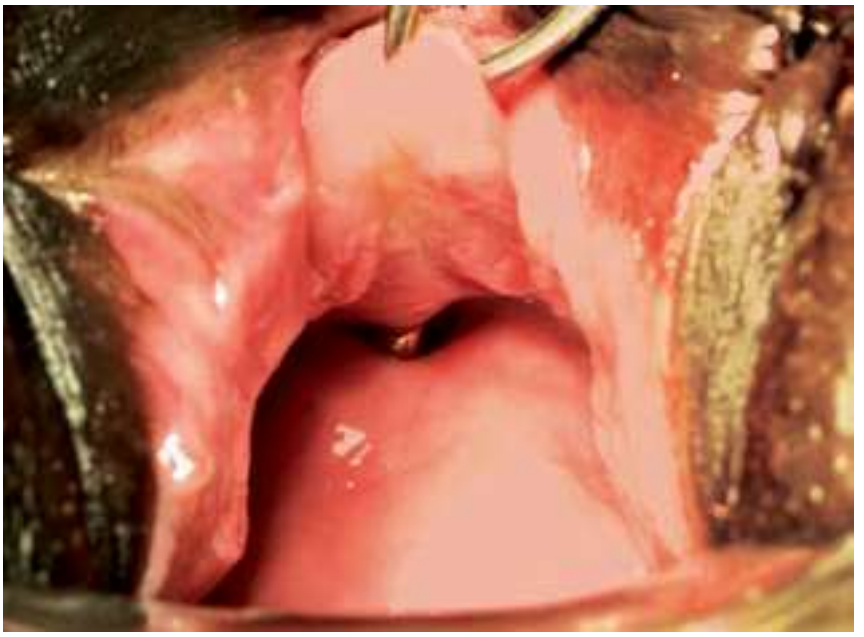


Figure 6.7
This is more difficult and not suitable for a beginner. It's at the bladder neck and pulled up to the pubic bone. There's also a defect anteriorly making it circumferential, Goh 2aiii.

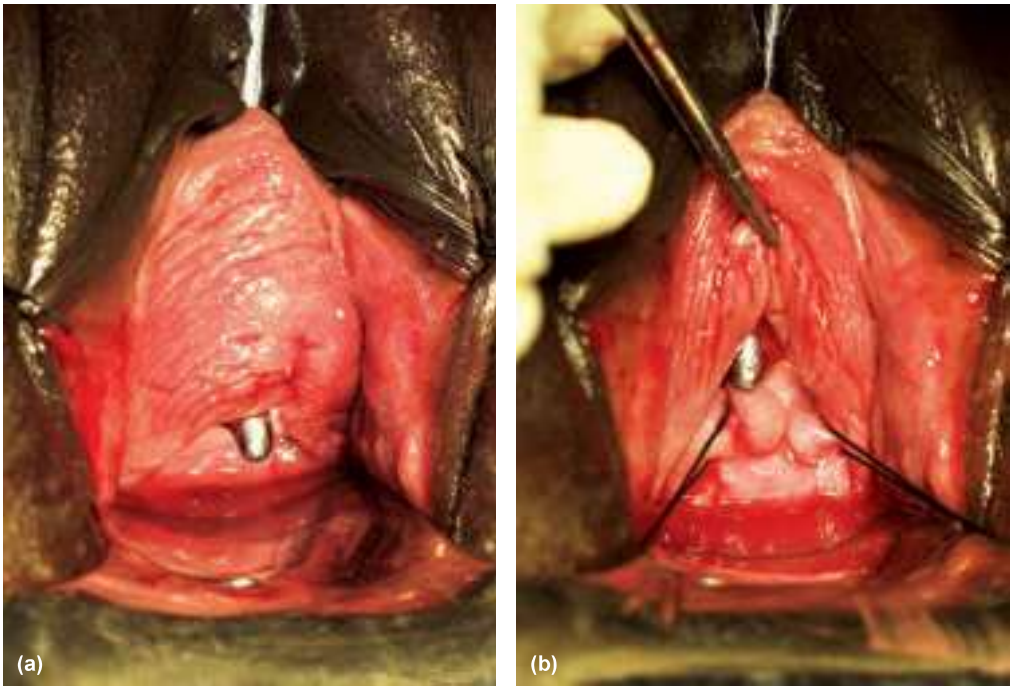


Figure 6.8
a) This initially appears to be juxta-cervical. b) When you retract the vagina you can see the anterior cervix is missing and the bladder is split up along the cervix. This is more technically demanding to repair and not suitable for a beginner, although it does have an excellent prognosis. They are almost always cured with no ongoing incontinence as the urethra is not involved. You will also need to repair the cervix.

Figure 6.9
The fistula is so large that the dome of the bladder is inverted out through the cervix and out the introitus.

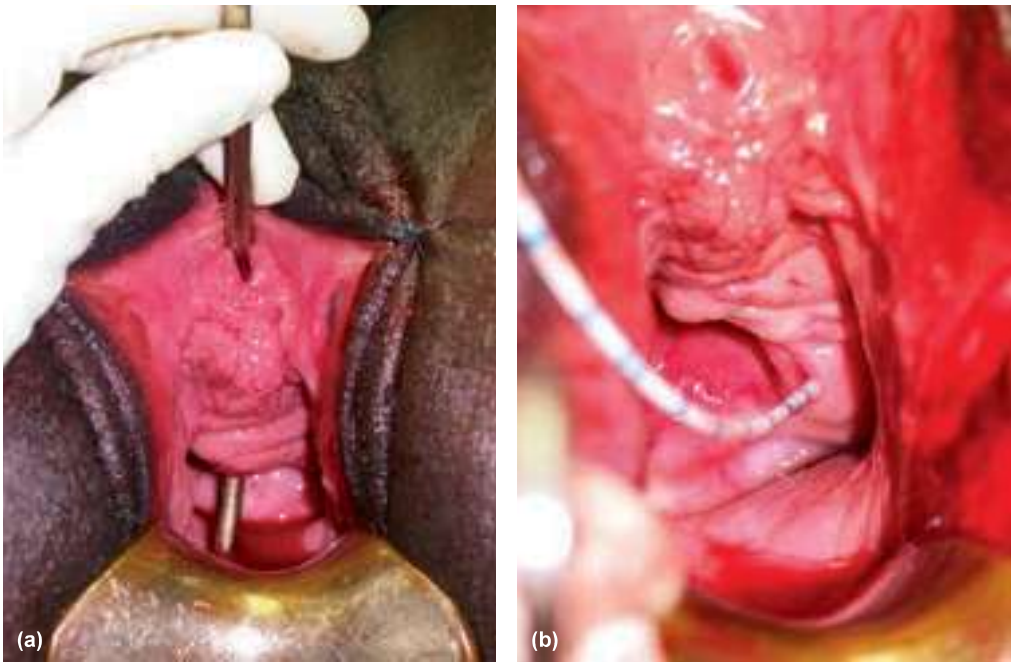


Figure 6.10
a) This fistula seems easy initially. b) But when the vagina is retracted you can see it involves the cervix and the left ureter is just on the edge. Goh 1ciii. Not suitable for the beginner.

Basic Principles Repeated

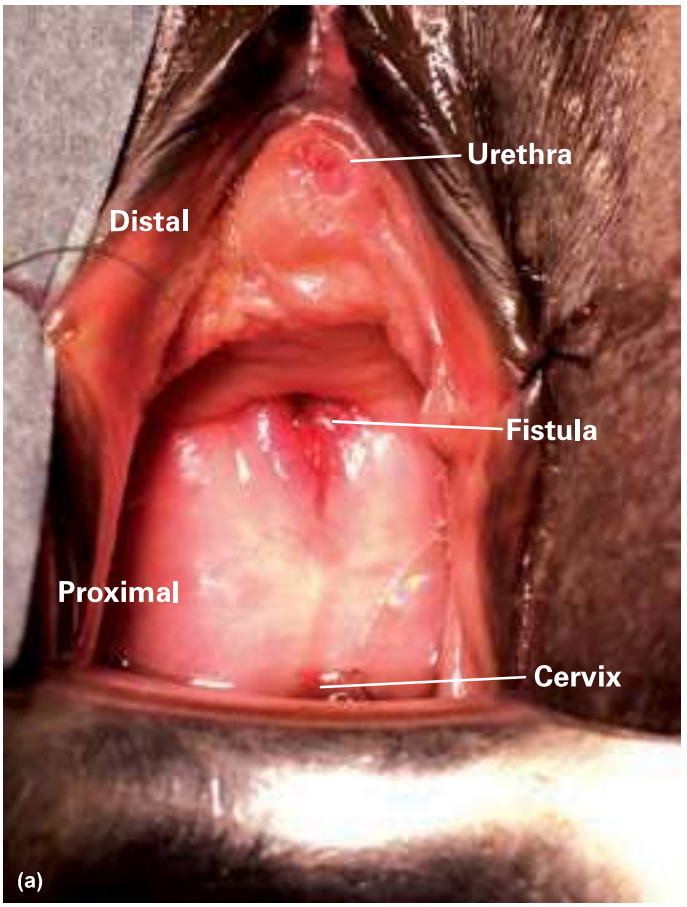
A simple repair always aims to close the hole in the bladder and vagina, to restore normal anatomy. Its essential requirements are:

- adequate exposure
- protection of the ureters
- mobilisation of the bladder from the vagina, cervix and pelvic side walls around the fistula
- mobilisation of enough bladder (after excision of scar if needed) to allow a tension-free closure of the defect that shows no leakage on dye test
- a dye test to confirm that you have closed the hole.

Procedure in a Simple Case

First let's orientate the fistula so you know what parts we are referring to. We use the terms distal and proximal in the true anatomical definition when referring to the patient, but when you view the defect on the operating table those terms can seem confusing. Distal is closer to you, the surgeon, whereas proximal is deeper in the vagina. The proximal edge of the fistula is closer to the vaginal vault or cervix while the distal margin of the fistula is closer to the vaginal introitus. (Figure 6.11)

After positioning and prepping the patient, sew the labia out of the way. Don't stretch them too tightly as you will end up tearing the tissues. Just sew them gently up and out of the way on both sides. Usually one suture at about the level of the urethra is enough but we used two in Figure 6.12. It's good to cover the anus with a gauze or by suturing the drape over the anus.



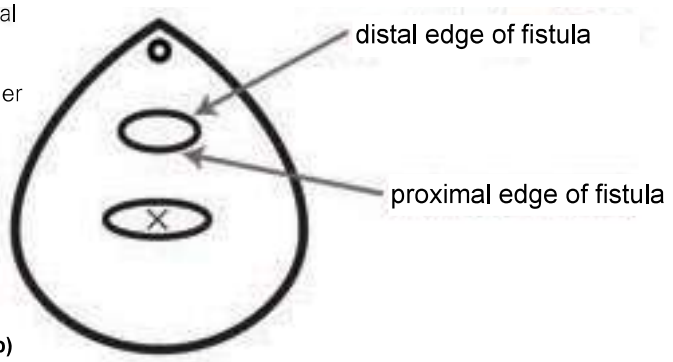


Figure 6.11
a) and b) Orientating proximal and distal terminology. When you look at the fistula at operation the distal part is closest to you (distal actually being used in reference to the patient anatomical orientation) and proximal is higher in the vagina, that is proximal in relation to the patient.

Figure 6.12
The labia are sutured out of the way (don't pull them too tight and tear them). The anus is covered. Note that urine has pooled in the vagina already.

Documentation of the Fistula

The fistula must be described. We use Goh's classification (see Chapter 1—Classification Systems).

First, the vagina is assessed for depth and stenosis. The fistula is described by its site, size and surrounding scar. By palpation, an attempt should be made to determine whether the bladder has been separated from the urethra (the circumferential fistula). The cervix should be inspected and palpated for damage, and the posterior wall checked for any missed rectal, anal or sphincter injury.

When you describe and record a fistula, there are certain things you should measure. (Figure 6.13) It's easiest to measure with the metal catheter, especially if you can mark centimetre

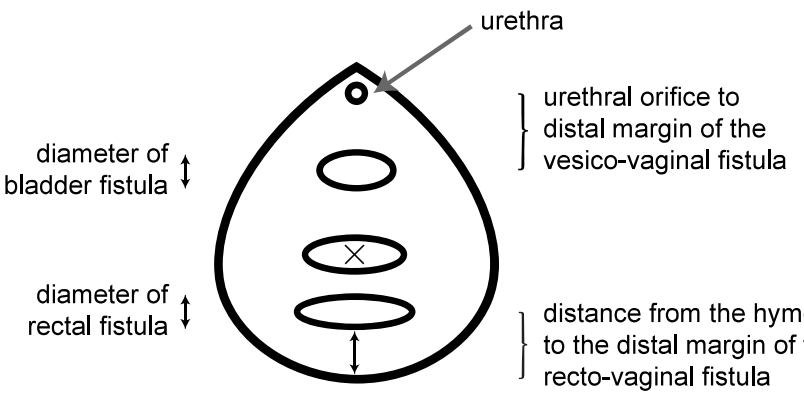


Figure 6.13
The important things to measure also help to classify the fistula according to the Goh and Waaldijk systems. Measure the distance between the external urinary meatus and the distal edge of the fistula and also the maximum diameter of the fistula. For recto-vaginal fistulae, measure the distal edge of the fistula to the hymenal remnant and as for the bladder fistula, measure its maximum diameter.

gradations on its side so you can use it as a ruler. Measure the distance of the external urethral meatus to the distal margin of the fistula by inserting the metal catheter through the urethra to the fistula. Sometimes there's a urethral stricture that can be broken with the metal catheter. If it is severe it is best to excise it. If there's no centimetre markings on the metal catheter it's useful to know the length of the tip of your finger to your first and second knuckle to get a good estimate.

Every operation should begin by sounding the bladder. Use the metal catheter to see how big the bladder is—measure the length from the urethral meatus to the dome of the bladder at its maximum. Always check for bladder stones. You feel the metal catheter hit the stone as you sound the bladder. Missing a stone can be a disaster. (Figure 6.14)

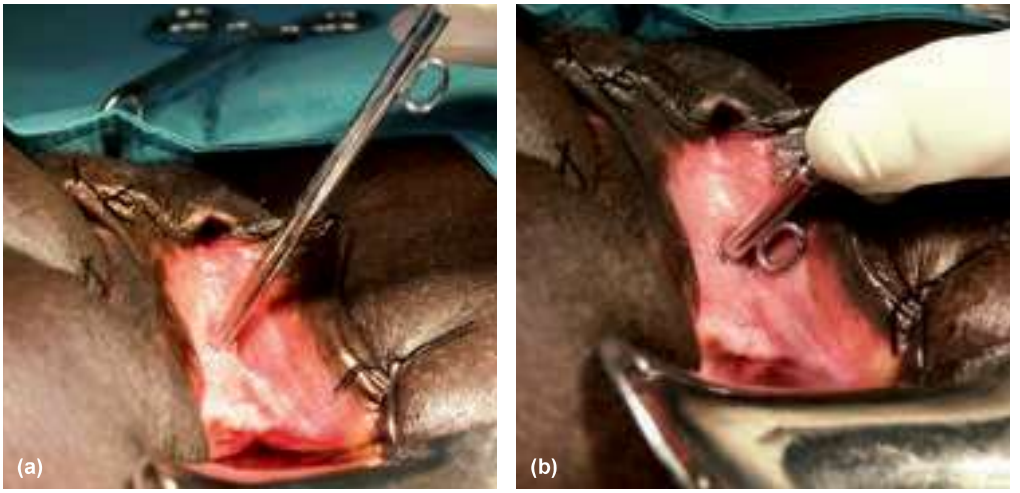


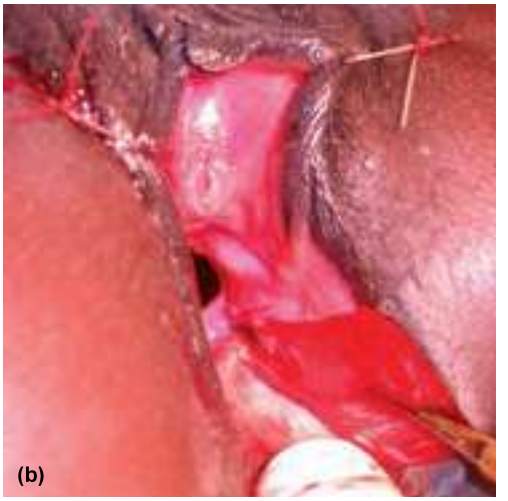
Figure 6.14
a) and b) Make sure you sound the bladder, primarily to check for stones and also to sound the size of the bladder. Record the depth from the external urinary meatus to the bladder fundus.

Exposure

Suturing the labia laterally to improve access, and suturing a swab or drape to cover the anus are usually to get good exposure. (Figure 6.12) In more complex cases, it is common to find scarring inside the vagina that is sufficiently severe to prevent the insertion of the Auvard speculum. Most commonly, there is a thick band of scar on the posterior vaginal wall. The scar is released by incising the band laterally either side, staying away from the rectum in the midline and the bladder anteriorly. If there is any doubt, a finger can be inserted into the rectum for guidance. Incising the scar in this way may result in a reasonable vaginal capacity. In cases of extensive scarring, the lateral incisions can be brought infero-laterally out into the ischio-rectal fossa, making large episiotomies. An Auvard speculum can then be introduced, exposing the fistula.

More frequently, a simple episiotomy, bilateral on occasions, will improve access greatly. (Figure 6.15) Beginners will need to make episiotomies more frequently than experienced surgeons.

Some surgeons infiltrate the vaginal wall around the fistula margin with a mild haemostatic agent (1:200 000 adrenaline (epinephrine)). This reduces blood loss, thus aiding dissection.



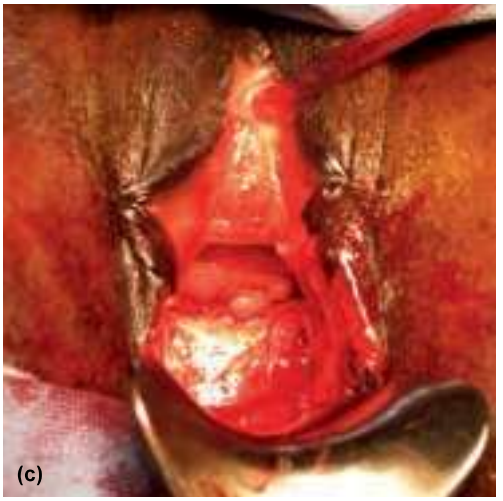
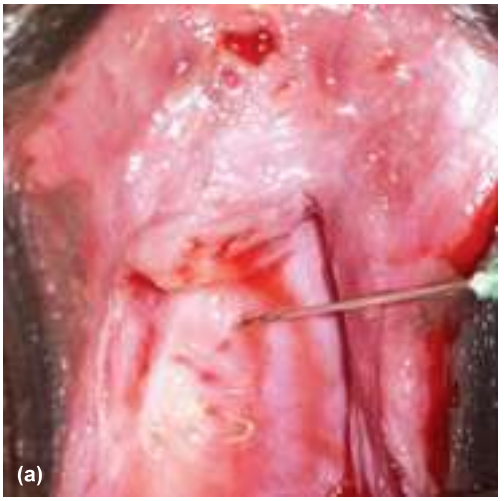
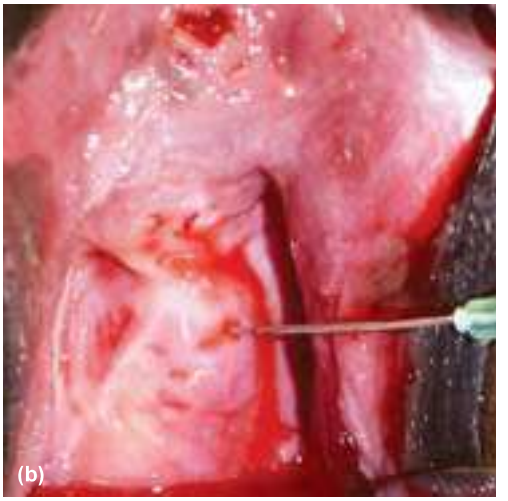


Figure 6.15
Improving access with an episiotomy. a) There is a ridge of scar on the posterior vagina holding up the speculum and making access to the fistula difficult. b) Make sure to incise laterally, away from the rectum. c) Bilateral episiotomies have been made. Exposure is greatly improved.

Figure 6.16 *(below)*
Hydrodissection. a) The needle is inserted just under the vagina and above the bladder. b) Injection of the fluid dissects the plane, lifting the vagina away from the bladder making the surgical dissection much easier.





There is a small risk of reactionary haemorrhage when the effect wears off. Others prefer isotonic saline just to help with hydrodissection. If the infiltrate is being introduced into the correct tissue plane beneath the vaginal skin, it should be introduced easily (except when there is severe scarring). Although many surgeons do not infiltrate at all, we believe that it is helpful for beginners. Introducing a lot of infiltrate also helps to separate the planes, making dissection easier (hydrodissection). (Figure 6.16)

Protection of Ureters

It is wise to identify the ureters in all cases except for the very smallest fistulae. The ureters enter the bladder just distal and lateral to the cervix and are identified with a ureteric probe. (Figure 6.17) If the ureters are difficult to identify, 10mg intravenous furosemide and a bolus of intravenous fluid will produce an intermittent spurt of urine from each ureteric orifice, aiding localisation. (Figure 6.18) If the ureters are close to the fistula margin, they should be catheterised, advancing the catheters up to the renal pelvis and then withdrawing them slightly. This is done to avoid incorporating the ureters in the repair. Even with this step, ureters have been injured during dissection. Still take great care (see Chapter 13—An Injured Ureter). Bring the catheters out through the urethra by threading them into a metal catheter or by pulling them through with a small curved artery forceps. (Figure 6.19) Then secure them onto the mons pubis with a simple stitch. Wherever possible, it is best to catheterise the ureters before beginning dissection but sometimes some dissection is needed to make visualisation of the ureters possible.

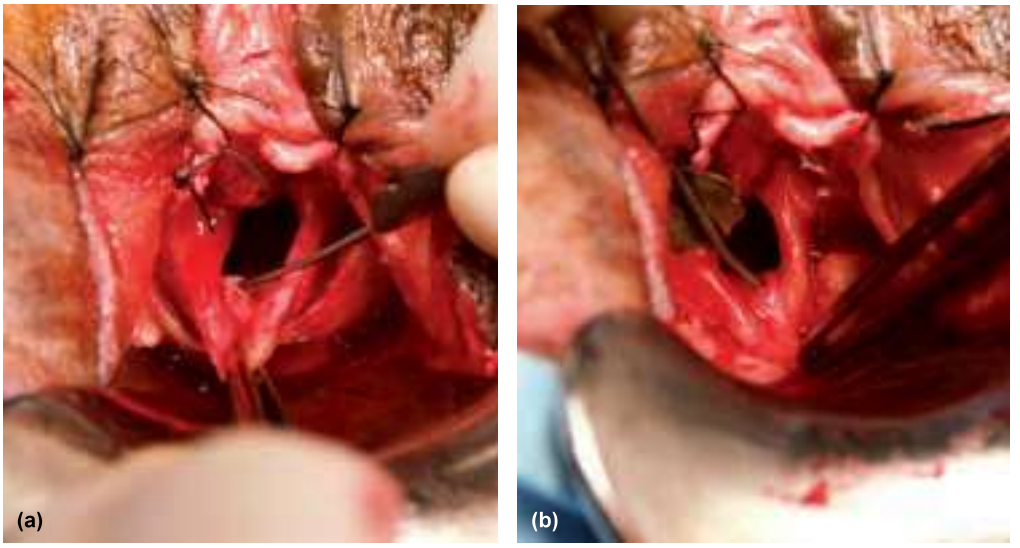


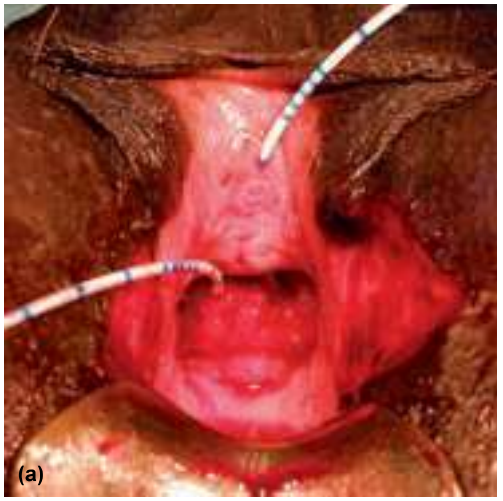
Figure 6.17
a) The right ureter is identified. b) The left ureter is identified.

Mobilisation, Dissection and Separation of the Layers

Initially, the vaginal wall distal to the fistula should be held with the Allis forceps. Upward traction brings the fistula into view. (Figure 6.20)

Figure 6.18
Frusemide 10mg has been given intravenously and the left ureter is seen spurting here, aiding identification.

Figure 6.19 *(below)*
a) and b) The ureteric catheters are pulled through the urethra. In this case with a curve mosquito. Another option is to pass a metal catheter through the urethra and out of the fistula and then thread the ureteric catheter through the end of a metal catheter and withdraw it. The catheters are then sewn onto the mons pubis, securing the right ureteric catheter on the patient's right and the left ureteric catheter on the patient's left.



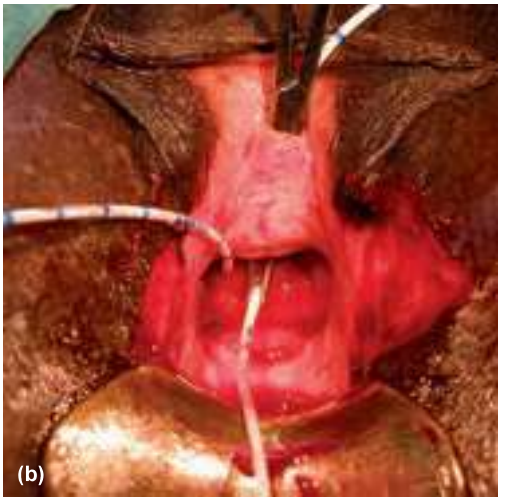


Figure 6.20
The distal vagina is grasped with the Allis forceps and lifted upwards, exposing the fistula very clearly.

The proximal margin of the fistula is incised, with the incision being made through the full thickness of the vaginal wall, but not into the bladder. The incision is taken around the fistula where the bladder epithelium meets the vagina. The incision is then advanced onto the lateral walls of the vagina from the left and right angles of the fistula. This incision is made horizontally, not going too far towards the introitus. I try and make these incisions parallel with the floor, especially when extending them onto the lateral vaginal walls. This assists with access for the dissection (Figure 6.21) and you can also make a nice flap with this vaginal tissue that could be useful in repairing the vagina at the end of the operation. If you direct your lateral incision too far forward/distally towards the introitus, the vaginal flap will not be large enough to cover the repair later. A size 15 blade is most suitable for this step.

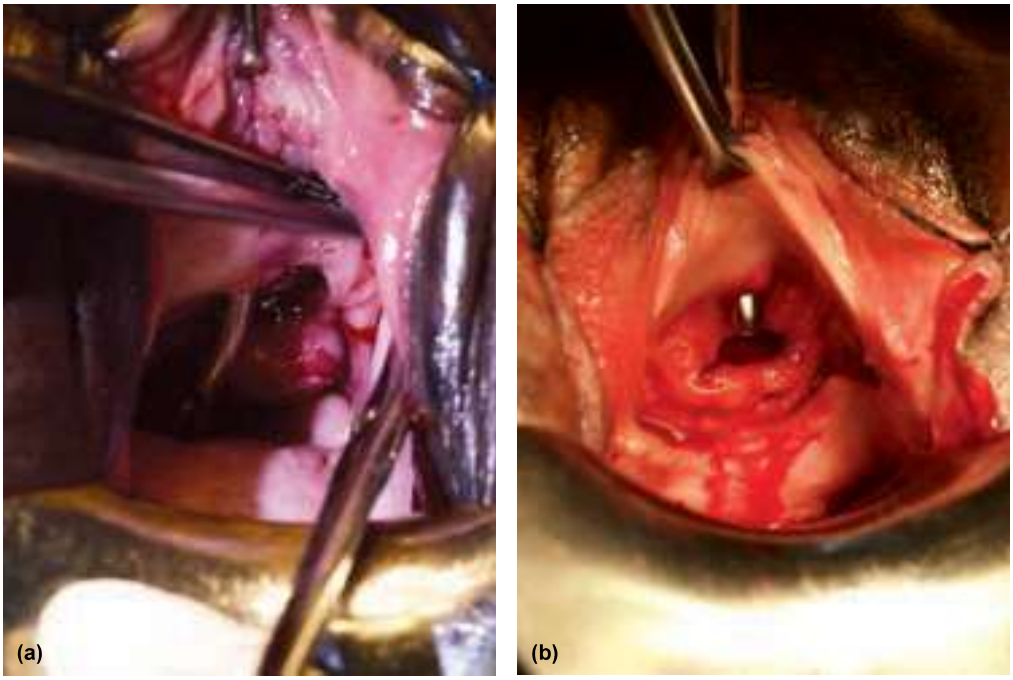


Figure 6.21
a) In larger fistulae it's helpful to extend the lateral incision to the lateral vaginal wall, making it parallel to the floor. b) You can now access the fistula very easily.

The proximal bladder wall is grasped with the Allis forceps and held by the assistant. The surgeon holds the vaginal wall with dissecting forceps and gently applies counter-traction to expose the operative plane. A combination of sharp and blunt dissection (Figure 6.22) is used to develop the plane between the bladder and the vagina. Note that the bladder and vagina are held apart with the Allis forceps to show the space between them. Opening the tips of the scissors in this plane helps to develop it. Tension should be maintained on both the bladder and the vaginal walls during dissection. This helps to find the right tissue plane for dissection. It is important to stay just under the vagina. Always make sure the curve of the scissors is pointing away from the bladder towards the vagina. Bleeding is a warning sign that the bladder wall has been entered and you are in the wrong tissue plane.

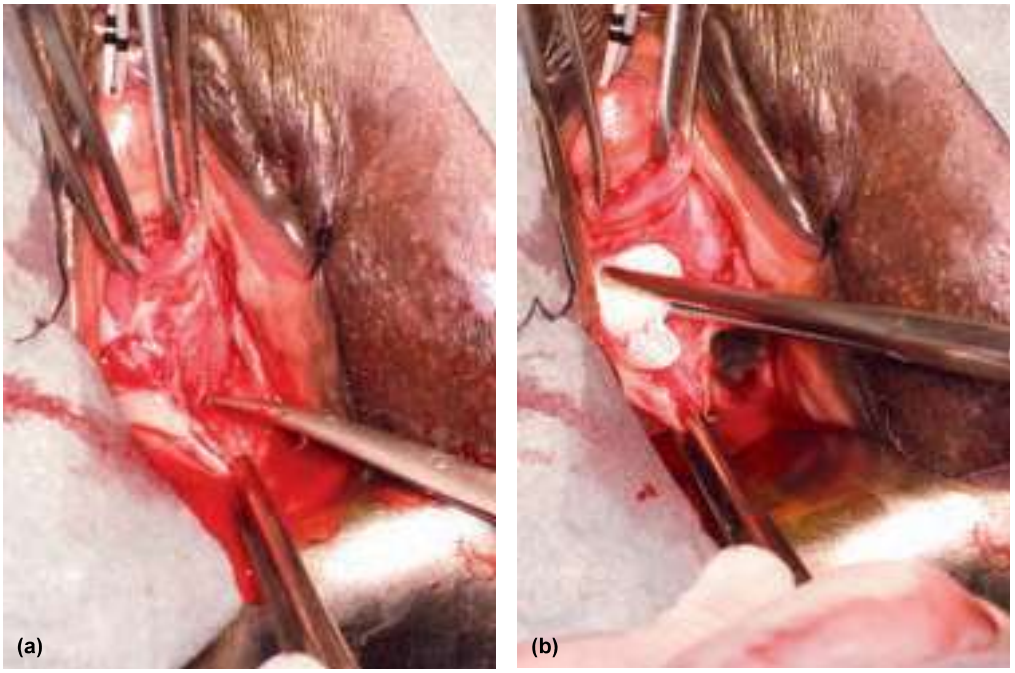


Figure 6.22
a) The bladder is helped up with Allis forceps and the vagina pulled down with tissue forceps. Sharp dissection is used, making sure the curve of the scissor is pointing away from the bladder. b) When you are in the correct plane, gentle blunt dissection can be used with a fingertip or in this case a small gauze in artery forceps.

The dissection is extended laterally until the angles of the fistula are free. Make sure you don't injure the ureters. You can easily feel where the ureters lie after they have been catheterised. The dissection can appear rather extensive to the novice fistula surgeon, but it must be extensive enough to free the bladder off the vagina to enable a completely tension free closure of the bladder. Much more dissection will be done in a proximal direction than in the distal dissection. The mobilisation often extends up to or beyond the cervix. This is where you will get bladder mobility, not distally over the urethra, which is fixed. This is the most crucial lesson for the fistula surgeon. If the bladder is closed under any tension, the operation will fail.

In more severe injuries, the lateral margin of the fistula attaches to the pubic bone, and clearly a different strategy is required. Management of this situation is discussed in 'Operative Steps for Circumferential Fistulae' later in this chapter.

After the proximal margin has been mobilised sufficiently, attention is given to the distal margin. Most surgeons new to fistula surgery find this plane difficult to dissect, especially when the fistula is pulled up behind the symphysis.

The metal catheter is a useful retractor in the urethra, and it also helps the surgeon to gauge the thickness of the tissue planes, which are thin when approaching the urethra. To help with this, a small vertical incision may be made from the distal margin of the fistula in the midline. The incision around the distal fistula margin joins the previous proximal dissection.

A lateral extension is made down the axis of the vagina. This may have already been done from the lateral ends of the proximal dissection. This is particularly important when a fistula is pulled up behind the symphysis.

The distal flap must now be dissected off the proximal urethra and para-urethral region. The elevation of the distal flap should always commence with dissection at its lateral edge (Figure 6.23 a and b), working towards the midline using the curve of your scissors to help get into the plane. If this is not done, the urethra can easily be damaged and the flap can be torn. Keep advancing the mobilisation onto the patient's right. If the fistula is pulled up behind the symphysis, the right-angled tips of the Thorek scissors (see Chapter 5—Additional Instruments) are most helpful. The Allis forceps are again useful in providing traction to bring the upper margin into view and in providing traction and counter-traction to find the correct tissue plane.

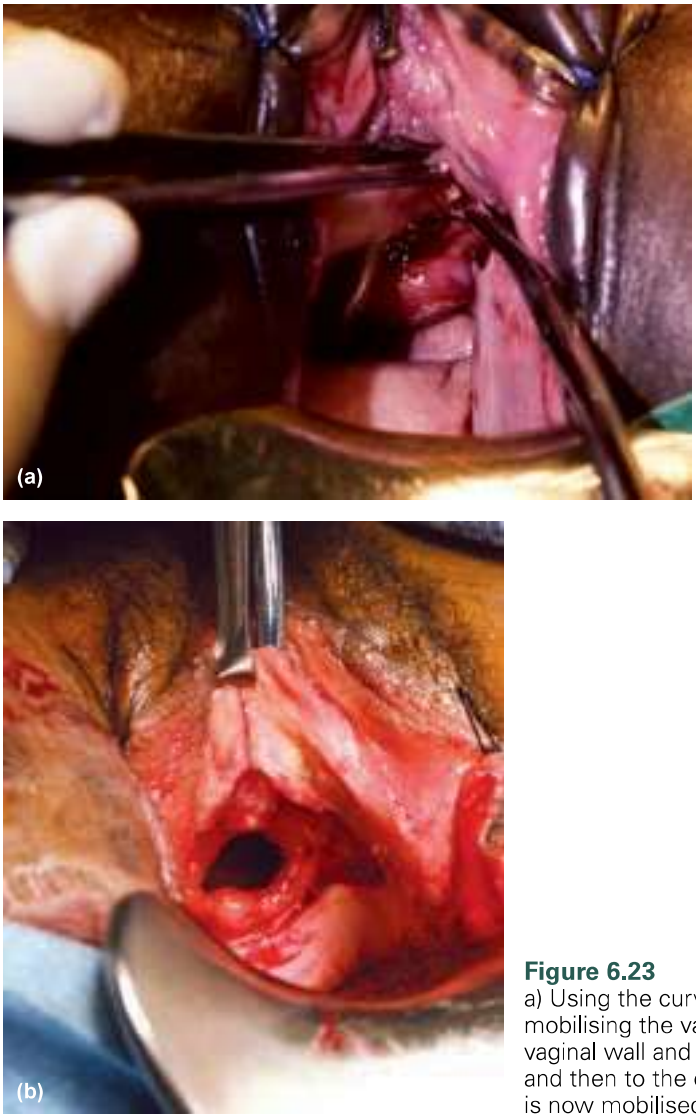


Figure 6.23
a) Using the curve of the scissor, start mobilising the vagina off from the lateral vaginal wall and work towards the midline and then to the other side. b) The distal flap is now mobilised.

If you have made a vertical incision in the midline, you can dissect from the midline and develop a right and left flap—but make sure you get the lateral angles of the fistula well mobilised and free.

When the surgeon judges that there has been enough dissection to enable a tension free closure, the reflected tissue is sewn to the labia on each side with a suture. (Figure 6.24)

The fistula edge is trimmed of any scar tissue or residual vaginal skin. The angles are examined again to ensure that they are not tethered to the inferior pubic ramus on either side. If the angles are still tethered then further dissection is needed until they are nice and free and can be repaired with no tension.

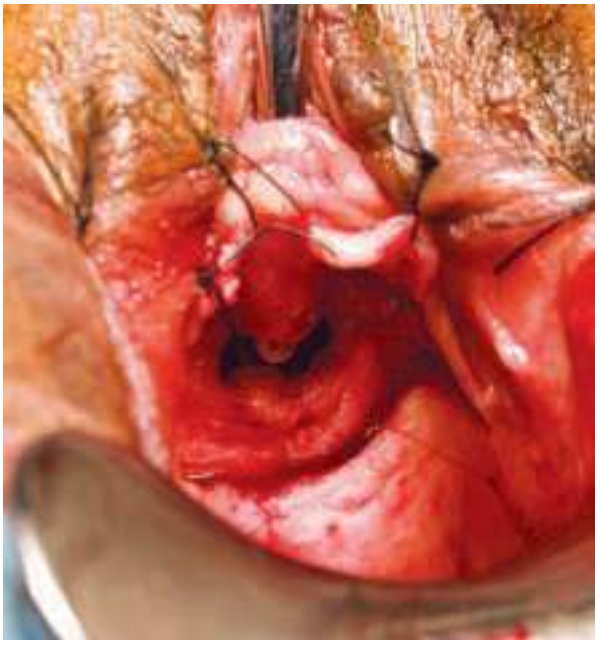
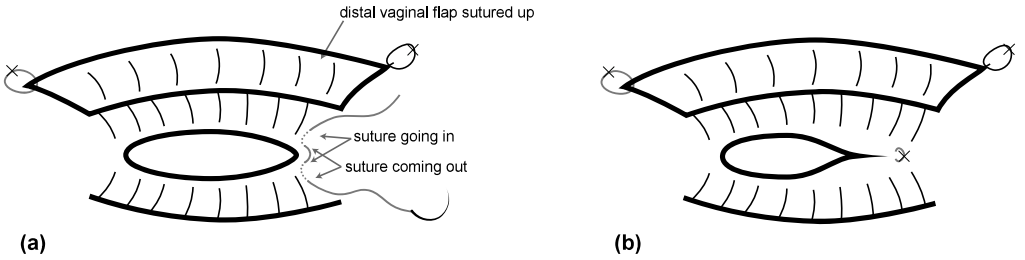


Figure 6.24
The distal vagina flap is now sutured out of the way. Don't pull the sutures too tight and tear the tissues, all you want is just to retract it out of the way.

Tension Free Closure

The fistula is then repaired with interrupted 2–0 absorbable sutures. The vagina is a confined area in which to operate, and suturing can pose a problem. Small, strong needles are needed. The old fish-hook (J) needles are wonderful but are getting harder to find. Recently we started to use the 5/8-circle needles which are just as good as the J-shape needles if not better. The angles are secured first, taking two bites just lateral to the angles, one distal, making sure the needle comes out just in the angle of the fistula, then one proximal, following in the same line of the first bite, starting in the angle and coming out proximally. (Figure 6.25) One experienced fistula surgeon takes this in three bites, one distal, then an extra suture just picking up the angle of the fistula and then the proximal suture. The principle is that the angle should be securely closed with no space behind the suture for urine to track out. (Figure 6.26) These should be good bites of the bladder muscle layer. The corner sutures are clipped after tying for identification. (Figure 6.27) For the central sutures, it may be easier if they are not tied until all have been inserted.



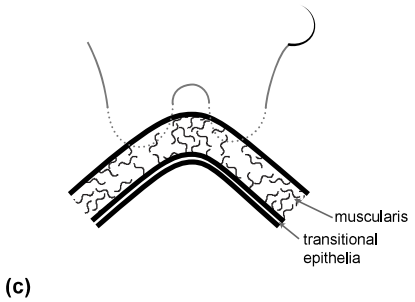


Figure 6.25
a) The first angle sutures should be just lateral to the angle. Make sure you pull the needle completely through at each step—that is proximal to the fistula first, coming out just at the angle, then distal, entering at the angle and coming out a little laterally. b) When you tie the suture, it will push or invert the bladder epithelia inside. c) Make sure you just get the muscularis layer. Don't push the suture too deep and enter through the epithelia.

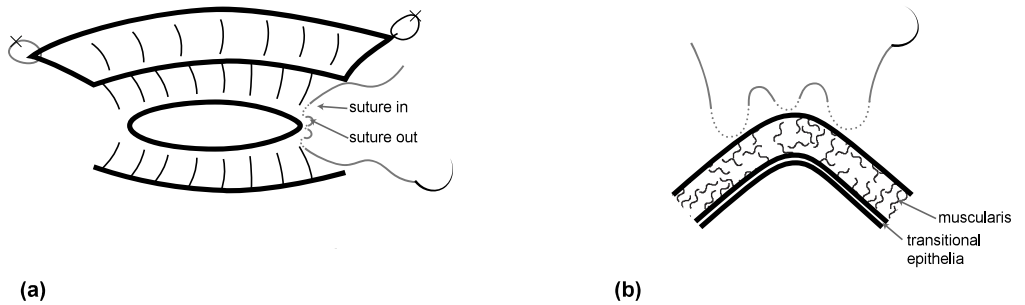


Figure 6.26
a) and b) Another technique is to take the suture in three stages, the extra step is to pick up the muscularis right at the angle for the fistula, really making it secure.

It is very important to ensure that there is no protrusion of bladder mucosa at any point along the suture line. This is especially so at the corners. The suture includes only the bladder muscle; the mucosa is excluded from the repair so as to invert it into the bladder. (Figure 6.28)

One Layer or Two?

Traditionally, two layers of sutures to the bladder have been recommended, but most surgeons use only one layer as a general rule. The bites must be accurately and evenly spaced about 4mm apart. One technical tip is never to try to hold forceps and needle holder while tying knots.

Figure 6.27
The two angled sutures are now secure and held with artery forceps.

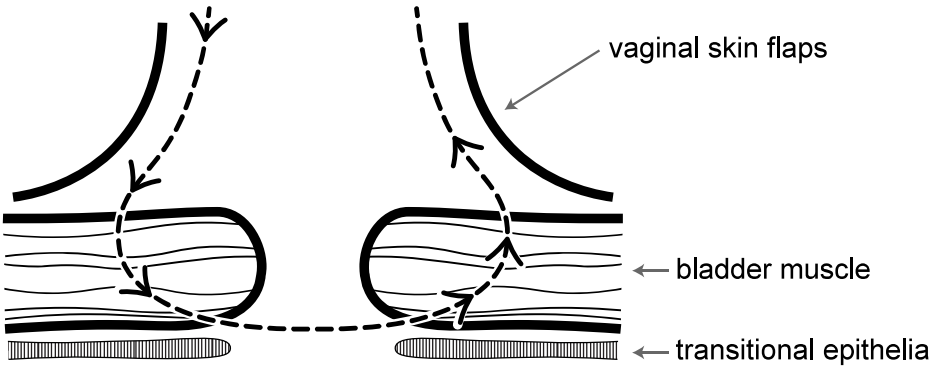


Figure 6.28
The suture only includes the muscle layer of the bladder, trying to exclude the transitional epithelia of the bladder.

It is much easier to judge tension accurately when both hands are free. (Figure 6.29) A second layer should never be used when suturing to urethra. There is a high chance that this would cut out or effectively shorten the urethra. One mantra that I teach the trainee is that if you get a good bite of healthy tissue under no tension, then there is no reason for it to break down.

Check the Closure with a Dye Test

Once the repair has been completed (Figure 6.30), a dye test is performed to ensure sound closure of the bladder. (Figure 6.31) A no. 16 Foley catheter is passed, saline coloured with methylene blue is introduced into the bladder (around 60–100cm^3 should suffice) and the suture line is checked for leaks. A common error is to use the dye too concentrated. Leakage from the repair or urethra will stain everything too much, making identification of the leak difficult.

Figure 6.29
It's best to put your instruments down and tie your knots with both hands free.

Figure 6.30
The bladder is now securely closed.

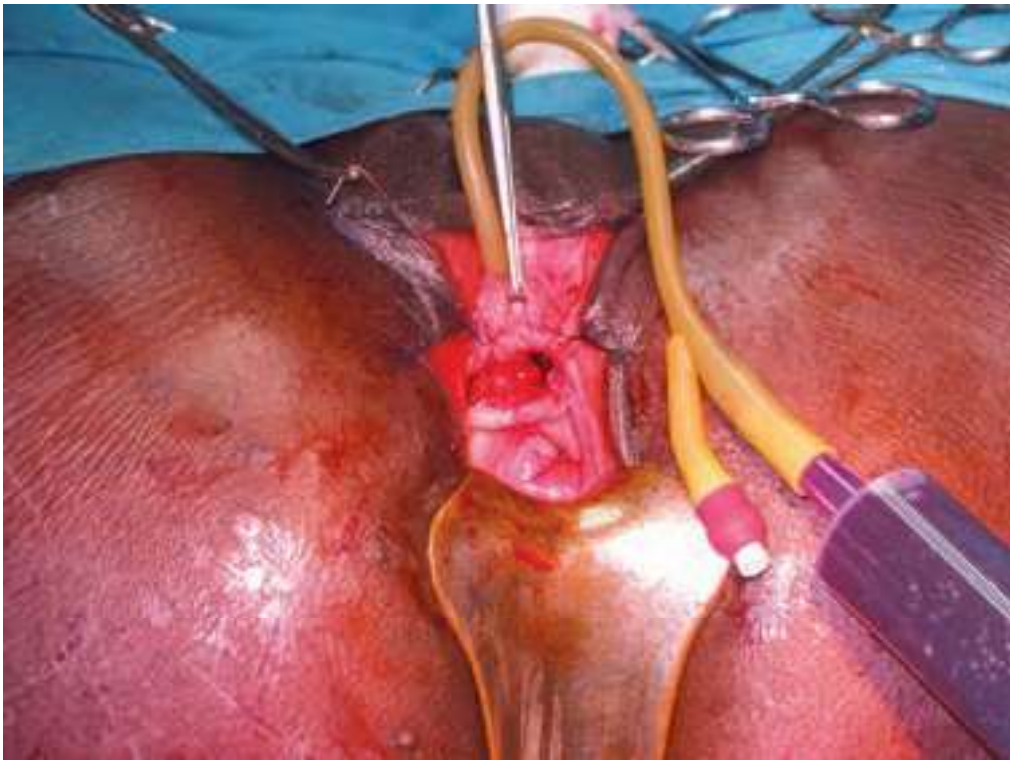


Figure 6.31
Checking the closure is secure with a dye test.

A more objective method is to fill the bladder via a filter funnel or open syringe, pouring in the dye until the intravesical pressure is about 30cm H_2O. This is judged by the height of the fluid in the vertically held catheter. The volume instilled gives a measure of the functional capacity of the bladder.

A patient may have more than one fistula, so while the dye is still in the bladder it is important to inspect the rest of the vagina carefully for leaks. (Figure 6.32) It may be necessary to press gently on the urethral meatus with a swab to prevent dye leaking out of the urethra and spilling into the vagina, making interpretation of the test difficult. This is especially common if there are ureteric catheters in the urethra in addition to the Foley catheter, because the dye tracks around, through the spaces between the catheters. If the dye test is satisfactory, pressure over the urethra can be released to look for a urethral leak around the catheter. Whether this predicts stress incontinence remains to be determined.

If a leak is detected in the suture line, an additional suture is required, but, if the leak is not controlled by one or two additional sutures, it is better to take at least part of the repair down and begin again rather than inserting more and more sutures that will only strangulate the tissue, causing ischemia and a breakdown of the repair.

Figure 6.32
In this case the fistula repair is sound but the dye test has revealed another previously unnoticed fistula high in the vagina adjacent to the cervix.

Vaginal Closure

Vaginal closure is performed with interrupted sutures. (Figure 6.33) Where possible it is best to close the vagina completely with everting vertical mattress sutures. Sometimes small gaps are left in the vagina as the edges are difficult to approximate. These gaps will generally heal by granulation and epithelisation, but it can lead to a tight, tethered anterior vagina which in turn can lead to urethral incontinence (see Chapter 6—Operative Steps to Reduce the Incidence of Stress Incontinence). If a large gap is left in the vagina, the bladder invariably breaks down. Kees Waaldijk has the saying 'A ceiling needs a roof to keep the rain out', meaning that the two layers of bladder and vagina keep the urine out of the vagina.

If there is bleeding between the vagina and bladder, an infected haematoma could burst into the bladder and/or the vagina, so make sure there are no active bleeders and use packing to deal with any residual ooze. Note that if the vagina is closed with tension, this often results in the urethral

Figure 6.33
This vaginal skin has been repaired with interrupted everting mattress sutures.

Figure 6.34
The vagina is packed for 24 hours. Protect your repair while you insert the pack by placing a Sims speculum over it.

meatus being pulled into the vagina. This will also pull the urethra open and the patient will almost always end up with stress or urethral incontinence. It may be necessary to close the defect in the vagina by using flaps.

Haemostasis

Actively bleeding vessels should always be secured by a figure eight suture, but sometimes a degree of continuous oozing has to be accepted. This may be reduced by greater head-down tilt or dilute adrenaline-soaked swabs, and finally controlled by packing.

Vaginal Packing

It is traditional to finish by packing the vagina with gauze soaked in antiseptic solution. Residual venous oozing is common at the end of large operations and this may increase after the adrenaline injection wears off and the patient is lying flat and no longer in a Trendelenburg position. A firm pack may stop this. It is important to realise, however, that a pack may prevent the recognition of serious bleeding for several hours and post-operatively the patient should be checked regularly. In most simple dry cases there is probably no need to pack, but, to simplify nursing, it is better to have an 'all-or-none' policy, and all patients will have their packs removed the next day except in special circumstances.

When packing, the site of the repair should always be protected with a Sims speculum. (Figure 6.34)

Securing the Indwelling Catheter

Some surgeons prefer to suture the indwelling catheter onto the labia whereas others just tape the catheter (see Chapter 11—Principles of Catheter Care). The aim is to ensure that the balloon of the catheter does not put pressure on or pull at the repair site, especially when the patient is walking. This should not be a problem for high vaginal fistulae, where the repair site is away from the bladder neck, where the balloon will sit, but it will be a problem for those fistulae involving the urethra or bladder neck. I prefer to secure the catheter in place to prevent any pressure or traction on the repair by the indwelling balloon. It is best to secure it to the abdomen rather than the leg. If it is taped to the leg, the Foley will be pulled when the patient walks, and the balloon will be pulled in the bladder against the repair, which is what we are trying to avoid. When trying to secure with tape, remember that many women in Africa like to use Vaseline on their skin which prevents the tape from sticking. You might need to clean the area where you will place the tape to help it stick better.

The important thing to remember is to keep the bladder empty with the catheter draining well during the 10 days to 2 weeks after the operation.

The next section describes the selection of cases for more advanced surgeons.

Juxta-Urethral and Circumferential Fistulae

The following are discussed in this section:

- Management of juxta-urethral and circumferential fistulae
- Management of ureteric involvement.

Fistulae in the bladder neck area are common. We term them juxta-urethral fistulae. They can be small, just involving the posterior aspect of the bladder neck area. They can be very large where the posterior, lateral and anterior bladder neck and adjacent bladder and urethra are all necrosed making the fistula circumferential. Then there is everything between.

Small juxta-urethral fistulae can be quite simple to repair, but large circumferential cases can be very challenging. Many a trainee fistula surgeon has examined a patient and diagnosed a small juxta-urethral fistula, taken her to theatre and only then realised that there is a circumferential defect that is beyond his or her skills.

Many of the larger circumferential defects have the ureter involved as well.

The key to repairing the more complex fistulae is first to understand the circumferential fistula.

Anyone reading standard textbook accounts of vesico-vaginal fistula repair may get the impression that the fistula is simply a hole in the base of the bladder that needs to be closed transversely in one layer to the bladder with repair of the vagina over the top. The concept of circumferential loss and the strategies for dealing with this are often glossed over.

In the majority of cases, the ischaemic injury occurs at the urethro-vesical junction (bladder neck). If the posterior part of the proximal urethra and bladder neck are affected and it sloughs away, it is called a juxta-urethral fistula. This is quite common. If the ischaemia is more severe and affects all the anterior, lateral and posterior urethra, and bladder neck, and it all sloughs away, the resultant injury is called circumferential. The whole circumference of the urethra/bladder neck sloughs away and the urethra ends up being completely detached from the bladder.

The degrees of circumferential loss are illustrated in Figure 6.35. It must be appreciated that in the larger defects the antero-lateral bladder wall is adherent to the pubic rami. The practical point is to make the distinction between fistulae without an anterior gap, fistulae with a small or negligible gap, and finally those with a significant gap. The management is different. Often the defect extends around just part of the circumference of the bladder neck region and appears as a simple hole on inspection in the clinic and when you start dissecting in theatre you sometimes find an anterior defect as well. The varying degrees of loss are shown in Figure 6.35.

There are several important things to consider:

- Is the fistula just in the posterior urethra/bladder? If so, it is managed as a juxta-urethral fistula.
- Is there also a gap in the anterior urethra and/or bladder? If so it is a circumferential fistula and will be managed differently.
- To what extent is there circumferential tissue loss (i.e. separation of bladder and urethra)?
- How much urethra has been destroyed?

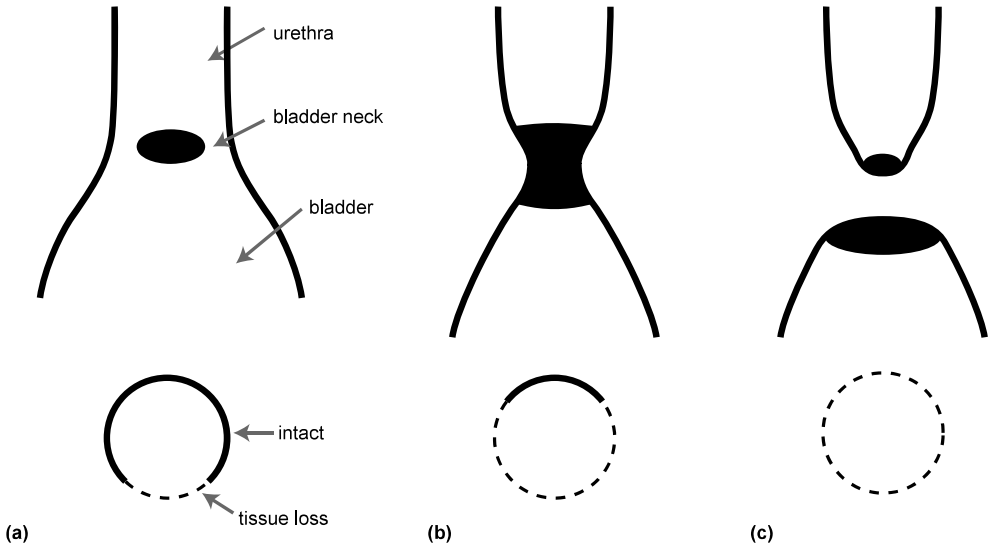


Figure 6.35
Different degrees of severity of a urethral fistula. a) Just the posterior urethra is involved, this is not circumferential. b) More of the circumference of the urethra is involved but the anterior part is still intact. We call this ¾ circumferential. c) The whole circumference of the urethra is involved and the distal and proximal segments of the urethra are completely separated. The defect is circumferential.

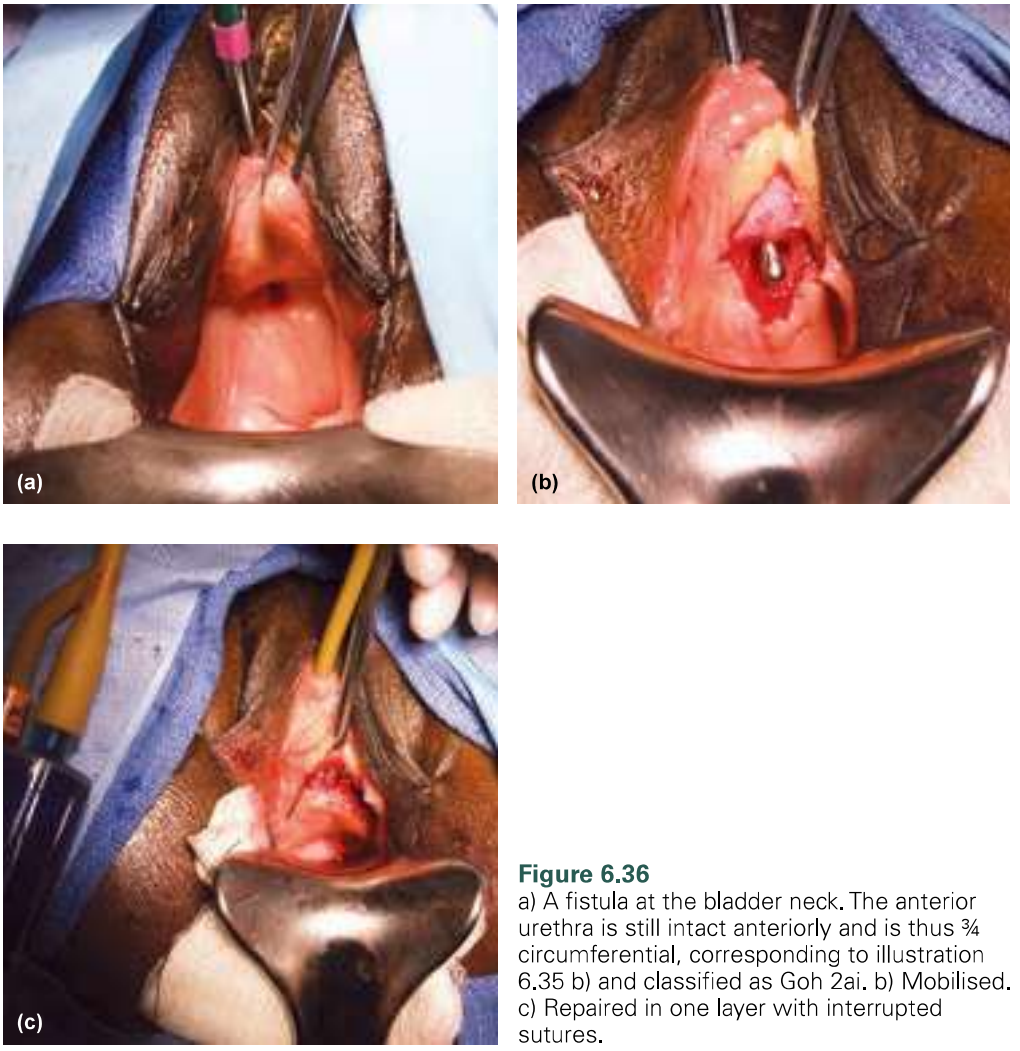


Figure 6.36
a) A fistula at the bladder neck. The anterior urethra is still intact anteriorly and is thus ¾ circumferential, corresponding to illustration 6.35 b) and classified as Goh 2ai. b) Mobilised. c) Repaired in one layer with interrupted sutures.

Extent of Circumferential Tissue Loss

There is of course a spectrum of conditions. There may be a small discrete defect in the posterior urethra/bladder, the defect may extend around laterally on both sides, but with the anterior urethra still just intact. There may be a small circumferential gap and then the gap between what is left of the urethra and the bladder may be large, even up to 5cm or more. When you examine these more extreme cases you can palpate a small fleshy area of the remaining urethra, then there is just a thin membrane of epithelia over the posterior pubic bone and then usually a larger hole entering into the bladder. Sometimes there is no distal urethra remaining at all and all you can palpate is the back of the symphysis pubis and then into the bladder deep in the vagina. Sometimes the hole into the bladder is difficult to feel as it can be just a tight slit entering the bladder on the top of the pubic bone. I've had a few patients with no urethra at all, with a tight slit into the bladder held with rigid scar on the back of the bone, and they were dry!

Extent of Urethral Destruction

The normal urethra is about 3.5cm long (range 3–5cm). Circumferential defects almost always affect the urethra, only rarely are they proximal to the urethra and in these cases they are usually stuck right to the top of the symphysis pubis and are very challenging to repair. Generally in circumferential cases the urethra is almost always damaged to some extent. There is frequently a block in the proximal urethra, which needs either to be excised or dilated. We think that it is better to excise the stenosis as the scarring formed after the dilation can lead to the stenosis reforming. Measuring or estimating the distance from the external urethral orifice to the distal fistula margin best records the status of the urethra. (Some people use a marked uterine sound or engrave centimetre markings on a metal catheter to measure the urethral length. If neither is available, it is helpful to know the length of one's own distal phalanx and length from nail tip to first knuckle and use it as a ruler!). Goh's classification from 1 to 4 may then be applied. Urethral length is the major prognostic factor for stress incontinence. When the urethra is short, we recommend a urethral support procedure that is described later in this chapter—Urethral Reconstruction.

Operative Steps for Non-Circumferential Juxta-Urethral Fistula

A Non-circumferential Fistula in the Region of the Bladder Neck

Figure 6.36 illustrates a common simple juxta-urethral fistula, with a ¾ circumferential defect. There is tissue loss on the posterior urethra and laterally on both sides, but the anterior urethra is still intact. In effect the urethra is just folded back together.

Another strategy for the non-circumferential bladder neck fistula is to consider vertical closure of the defect. (Figure 6.37) This is possible in about 50% of smaller urethral and bladder neck cases. The defect must be soft and mobile, and there must be no tension. Vertical closure will effectively maintain or even increase urethral length, and improves the prospect of continence.

A slightly larger juxta-urethral fistula that is just circumferential is shown in Figure 6.38.

Operative Steps for Circumferential Fistulae

Where there is a clear separation of urethra and bladder, there are two options for repair:

- Incomplete mobilisation and suture of the bladder to the pubic rami and urethra, leaving a gap on the anterior aspect.
- Complete mobilisation of the bladder front, back and sides, followed by circumferential anastomosis to the urethra using a variety of methods. This is to accommodate any discrepancy of size of the two ends, namely a larger diameter on the proximal or bladder end and a small diameter on the distal or urethral end.

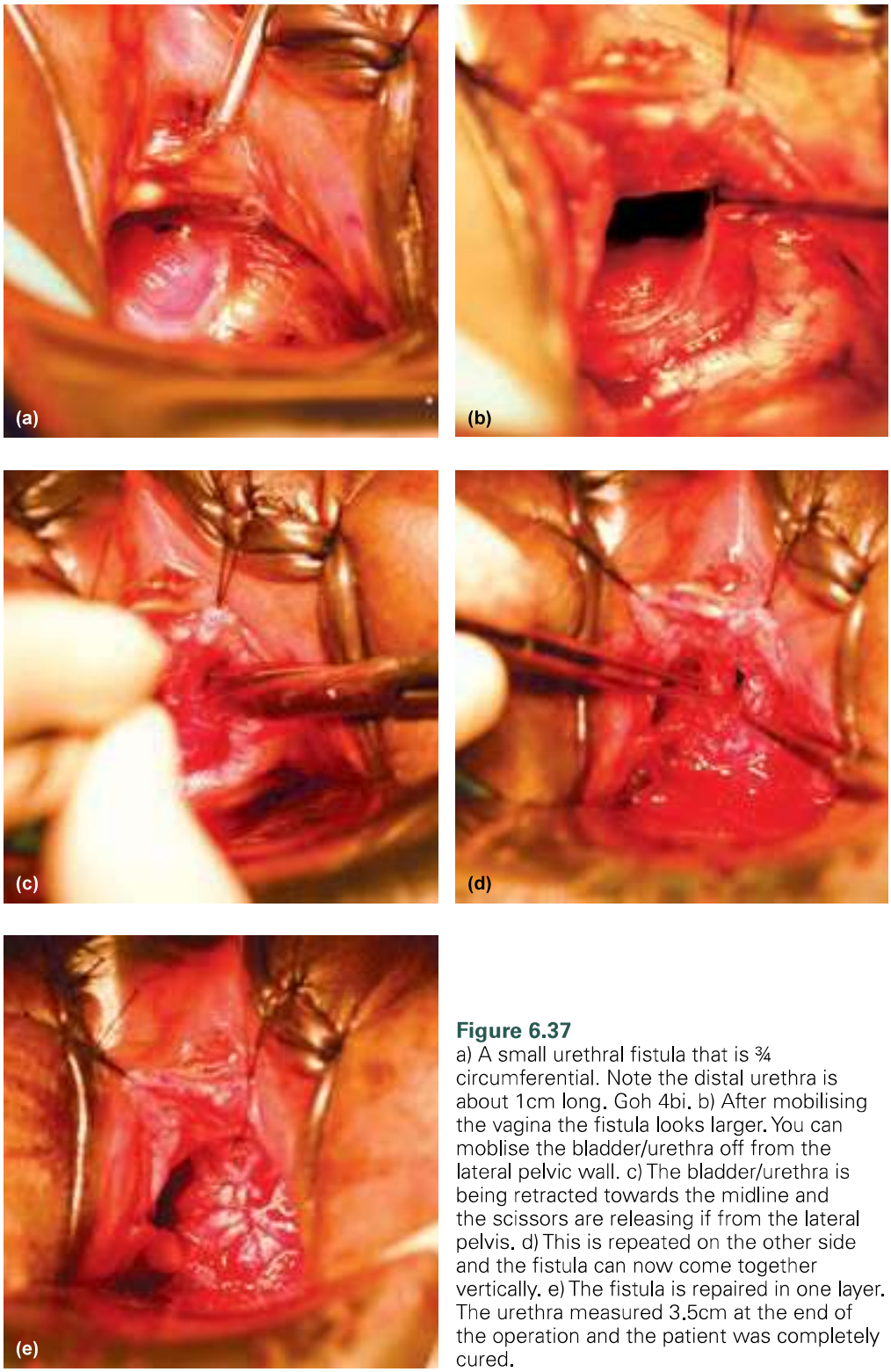


Figure 6.37
a) A small urethral fistula that is ¾ circumferential. Note the distal urethra is about 1cm long. Goh 4bi. b) After mobilising the vagina the fistula looks larger. You can moblise the bladder/urethra off from the lateral pelvic wall. c) The bladder/urethra is being retracted towards the midline and the scissors are releasing if from the lateral pelvis. d) This is repeated on the other side and the fistula can now come together vertically. e) The fistula is repaired in one layer. The urethra measured 3.5cm at the end of the operation and the patient was completely cured.

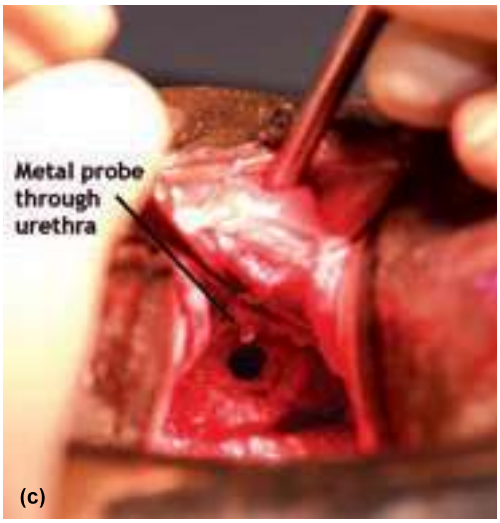


Figure 6.38
a) A larger juxta-urethral fistula that is circumferential. b) As is common here, the proximal side of the fistula is stuck high on the posterior symphysis pubic making retraction and access difficult. You can see how tight the proximal attachment is on the public bone when the metal catheter is inserted and trying to retract the fistula. c) Both distal and proximal ends have been mobilised. You can see the tip of the metal catheter just poking through the urethra. The proximal bladder is now fully mobilised off the bone. d) You now need to anastomose the bladder back to the urethra. e) The first sutures go anteriorly through the distal urethra and periosteum then to the proximal anterior bladder at 12 o'clock. It's hard to see here. f) The next two sutures go to 3 and 9 o'clock around the urethra. The urethra is nearly closed (see diagrams k) and m) from Figure 6.40 p93–94 to help). g) The final sutures go around the posterior urethra in evenly spaced placement.

Incomplete Mobilisation and Repair of a Circumferential Fistula

Incomplete mobilisation has, historically, been the method used to repair circumferential fistulae, and is still practised by a few surgeons. The bladder is mobilised from the vagina and cervix only over its posterior and lateral aspects and not anteriorly. Sufficient mobility needs to be obtained to bring the posterior bladder directly to the postero-lateral boundaries of the defect. This is, in effect, the undersurface of the pubic rami lateral to the urethra. Before this is done, a distal flap of vaginal epithelium will have been reflected off the urethra. Strong, small half-circle needles are needed to fix the bladder to the periosteum laterally on both sides. The urethra is incorporated into this repair in the midline as the last step.

Advantages of incomplete mobilisation

- The operation may be easier to perform than a complete detachment and anastomosis. This will appeal to the novice surgeon or one working in difficult circumstances.
- A reasonably high rate of closure can be obtained.

Disadvantages of incomplete mobilisation

- Post-repair incontinence may be unacceptably high, up to 100% in some unpublished series. The patient may be improved, for example she might be dry at night but wet on walking, or she might not be improved at all despite a closed fistula.
- There is no muscle between the urethra and bladder on the anterior aspect and the urethra remains short (resulting in varying degrees of ongoing urethral incontinence).
- If the fistula breaks down in the corners (the most common place), the margin of the defect will be bone—a very difficult situation to re-repair, sometimes needing the initial repair to be completely taken down and a formal circumferential repair done.
- Secondary operations for the ongoing incontinence are often needed, and may be hazardous. The bladder immediately proximal to the urethra will have its anterior wall as a thin membrane of epithelia directly over the posterior symphysis. There is a risk of producing another fistula with a urethral and bladder base plication or with a rectus fascial sling operation. Opening the para-vesical space is a step used in many operations for stress. I have done many operations for ongoing incontinence for patients like this which failed. When I re-operated, I opened the urethra and found the gap in the anterior urethra. Hence I took the first repair down, redid the fistula repair in the more formal circumferential manner, and which the patient was dry.

Complete Mobilisation of the Circumferential Fistula

Complete mobilisation and circumferential anastomosis of a circumferential fistula is recommended by most fistula experts.

A small circumferential urethral fistula repair is illustrated in Figure 6.39. Note this fistula is in the urethra (Goh 3aiii) and far from the ureters. There was no need to identify and catheterise them here. Both the proximal and distal defects that need to be joined are of similar size so you

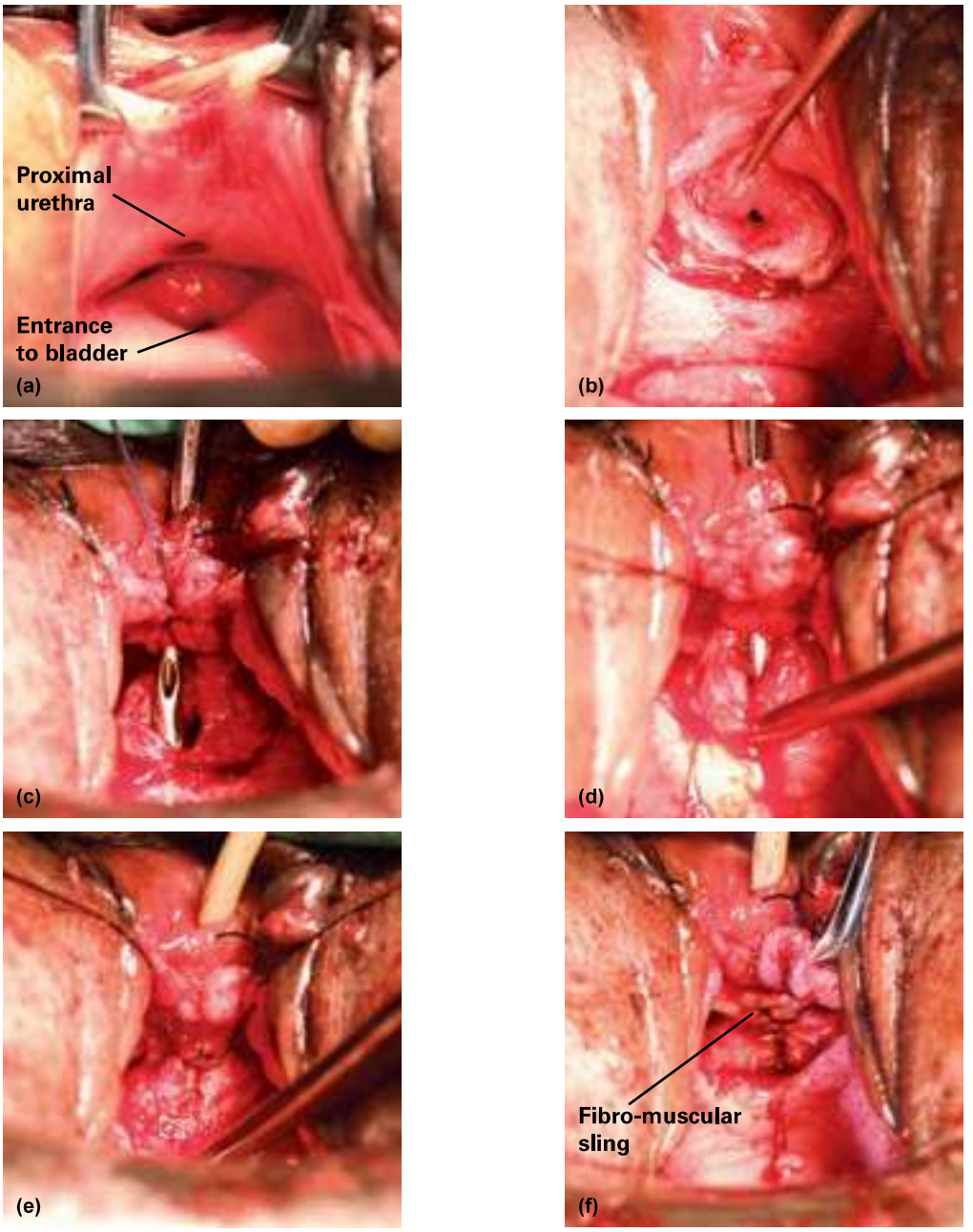


Figure 6.39
a) A small circumferential fistula in the urethra, Goh 3aiii with a 1.5cm gap along the pubic bone between the distal and proximal urethra. b) The proximal urethra has been mobilised circumferentially and advanced down with sufficient mobility to anastomose it to the distal urethra. c) The first stitch is placed at 12 o'clock, joining the two ends against the pubic bone. d) The side stiches are placed at 3 and 9 o'clock as you work your way around the anastomosis (see Figure 6.40 for helpful diagrams). e) Anastomosis complete. f) a fibro-muscular sling has been developed to support the urethra. This helps reduce the rate of ongoing incontinence that is common in all urethral injuries. (See section on 'Operative Steps to Reduce the Incidence of Stress Incontinence'.)

can do a direct anastomosis. Many circumferential injuries are much larger and there is a small defect in the urethral or distal side and a large hole or defect in the bladder (proximal side). A direct anastomosis in these cases won't work. We will describe and illustrate the steps for this repair. (Figure 6.40)

For the larger circumferential defects you will need to catheterise the ureters first. The proximal vagina is reflected off the bladder.

The initial incisions are around the fistula, distal and proximal edges and then extending the incisions onto the lateral vaginal walls, more or less parallel to the floor.

The vagina is now reflected off the proximal side but the lateral and anterior bladder is still attached to the bones. The anterior aspect of the urethra will be adherent under the symphysis. Scar in this region is excised, but no attempt is made to mobilise the urethra.

So far the mobilisation has been the same as the steps above, but the difference now is that you need to mobilise the bladder laterally and anteriorly to free the bladder from all bony attachments and advance the bladder forward to anastomose it to the urethra.

I find it easier to start the mobilisation from the patient's left (if you are right handed), using the curve of the scissor to dissect under the symphysis pubis. Once you are through the scar attachment of the bladder to the bone you will enter the Cave of Retzius anteriorly, a loose connective tissue layer where you can get a lot of good mobility.

Keep in the same plane as you come anteriorly and then to the patient's right. Now the bladder should be completely free and mobile off posteriorly, laterally and anteriorly.

After mobilising the vagina off the urethra you will need to anastomose the bladder back onto the urethra.

The mismatch between the diameter of the bladder opening and that of the urethra makes a straight end-to-end anastomosis impossible. The underlying principle in closure is to use the anterior and lateral bladder to wrap around the urethra and then to close the excess posterior bladder vertically. This has the effect of making the bladder lumen into a tube as you join it to the urethra. Often in these cases the remaining urethra is short, say less than 2cm. In such cases, unless you attempt to make the urethra longer, the patient will never have a chance of continence, because the short urethra will leak.

To perform this anastomosis, first take a bite at 12 o'clock to the proximal urethra, the same as above, picking up some periosteum. Suture this bite to the anterior bladder in the midline and tie it.

The next suture is taken at 3 o'clock through the urethra/periosteum and to the corresponding bladder, just a few millimetres lateral to the first suture.

Now take a 9 o'clock suture, again through the urethra/periosteum and to the bladder a

few millimetres away from the 12 o'clock suture. The anterior anastomosis is now complete. Pass a Foley or metal catheter to ensure you have patency of the urethra.

There should now be a large mismatch between the size of the posterior urethra and remaining defect in the bladder. Take a small 3–0 Vicryl suture through the proximal urethra at 6 o'clock and to the bladder both left and right side, again close to the previous sutures. This will be a three way suture and it will in effect be bringing what was anterior bladder around posteriorly, tubularising it thus making the urethra longer. This is a weak point and we usually place another suture over the top in a second layer. Fill in the anastomosis with two further sutures at 5 and 7 o'clock as there are sometimes small defects remaining.

You will now have a defect in the bladder in the midline. In the smaller defects a vertical closure of the remaining bladder is possible, which can be done in a few routine sutures. In larger defects the vertical closure will not be possible, because the postero-lateral margin containing the ureteric orifices cannot be mobilised enough to meet in the midline. The finished repair will then resemble an inverted 'V' or inverted 'Y'. (Figure 6.36) Repair proximal to the urethral anastomosis with a few vertical sutures, then advance the bladder flap in the midline to complete the closure with two 'arms' either side. This also has the advantage of keeping the ureteric orifices in a more physiological position in relation to the new urethro-vesical junction.

Always remember one of the first principles to protect the ureter—make sure they are identified, catheterised and safe).

Advantages of complete mobilisation

- The urethro-vesical junction is now completely surrounded by muscle, and in many cases the bladder defect will have been converted to a tube, thus effectively lengthening the urethra. The incidence of post-operative stress incontinence may be reduced by over 50%.
- A secondary stress operation can be more safely performed if required.

Disadvantages of complete mobilisation

- The anastomosis is technically more demanding, and if not well done may be more prone to break down, especially at the three way stitch. Kees Waaldijk has termed this 'the crying corner'.
- 8% of patients will develop a urethral stricture at the site of the anastomosis which can be very difficult to treat.

Incomplete Versus Complete Mobilisation

Unfortunately, there are no hard data to allow a comparison of closure and incontinence rates between the two methods, but the consensus of opinion among the most experienced fistula surgeons is that a complete detachment and anastomosis does give better results. It makes sense to restore muscular continuity between bladder and urethra front and back. There are unpublished data and opinion to the effect that the rate of ongoing urethral incontinence after complete mobilisation is less than half the rate following incomplete mobilisation.

It must be appreciated that, although the anastomosis can easily be performed in some cases as shown in our illustrations, in many others (which are almost impossible to photograph) the operation is quite demanding and requires a high degree of skill and judgment. It is probably only full-time fistula surgeons who have the experience to achieve good results with this group. The problem of ongoing incontinence has improved after applying a sling to support the urethra and flaps to reconstruct the vagina, but results are still not perfect.

For those with less experience, we believe that there is still a place for incomplete detachment, provided that the gap is not too large and there is no expert available to take on the case.

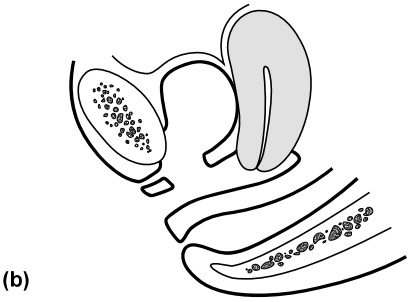
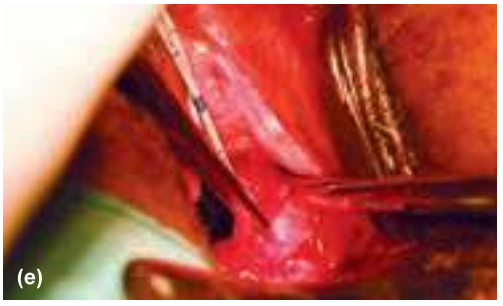


Figure 6.40
a) A large circumferential defect with 2cm of urethra remaining. Goh 3ciii.

b) Diagrammatically you can see the large gap on the anterior bladder against the bone, about 4cm in this case.

c) You must protect the ureters in these cases. It would be very easy to cut and/or tie it if you didn't.

d) The proximal dissection is being done here, the assistant is using Allis forceps to create traction upwards on the bladder bringing the plane into view.



e) Mobilise the bladder off the lateral pelvic either side.

f) The distal vaginal mobilisation. I start laterally and work my way around using the curve of the scissors.

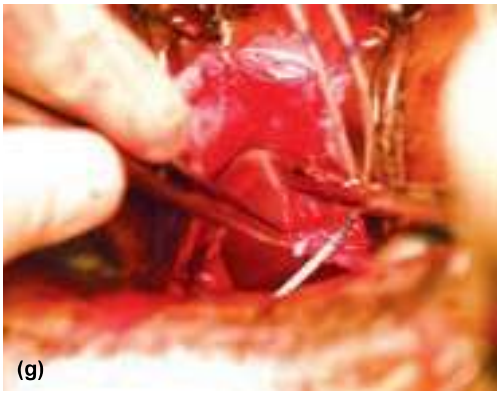
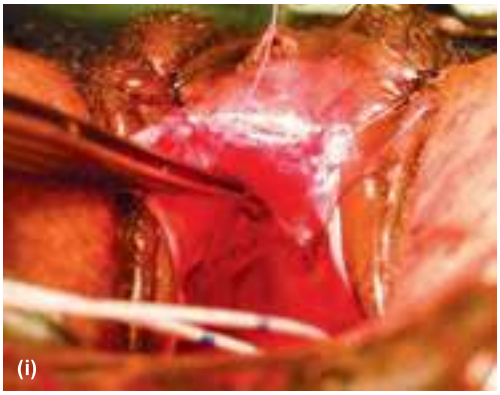
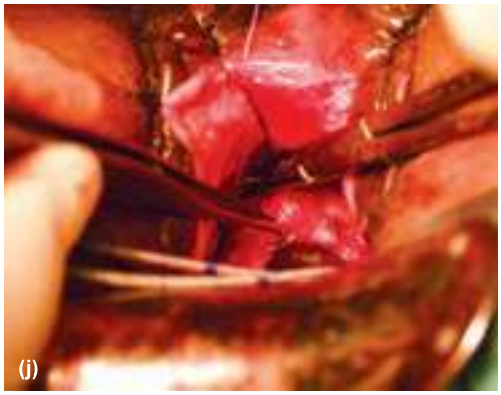


Figure 6.40 *(continued)*
g) I'm now releasing the bladder off the pubic bone anteriorly, entering the Cave of Retzius.

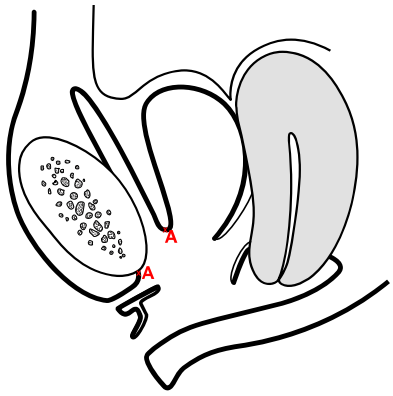
h) Further into the Cave of Retzuis. The anterior bladder is coming well forward.





i) The first stitch is placed at 12 o'clock around the anastomosis. The stitch just picks up the periosteum of the posterior symphysis.

j) Through 12 o'clock on the anterior bladder in the midline (the proximal defect).



k) Joining 'A' as marked in the diagram. The 12 o'clock stitch securely in place.

l) You now place the sutures at 3 and 9 o'clock making sure not to occlude the urethral lumen, using the metal catheter as a guide.

Continued

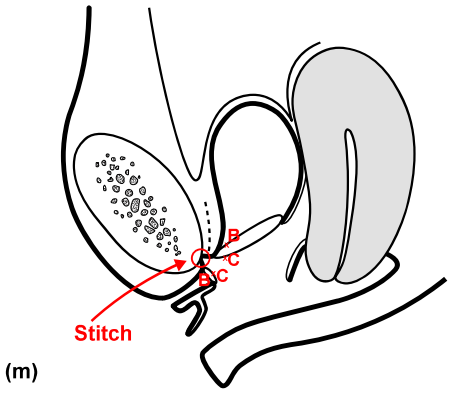
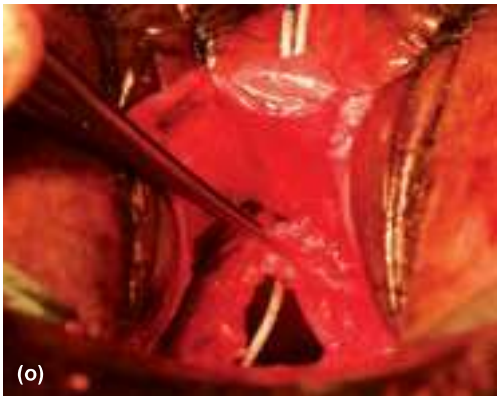
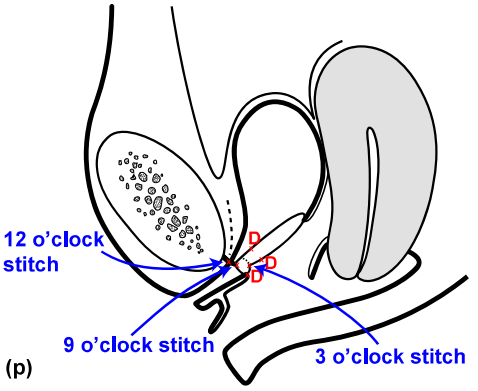


Figure 6.40 *(continued)*
m) This is joining B to B and C to C on the diagram.

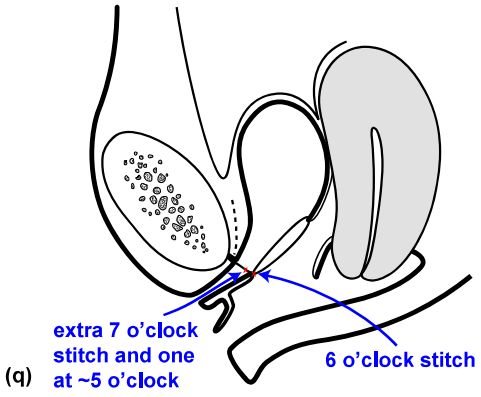
n) Now is the time to thread the ureteric catheters through the urethra and secure them to the mons pubis.



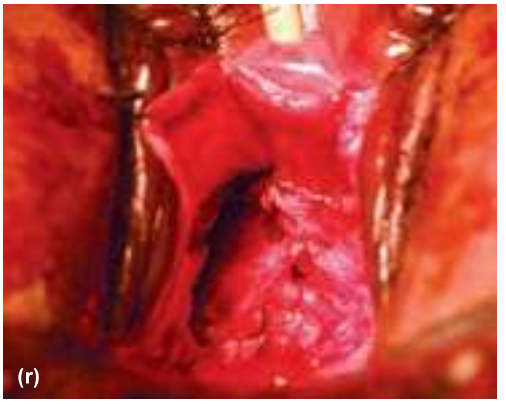
o) You now need to elongate the urethra by pulling what was the anterior bladder around to the posterior urethra and doing a three way stitch.



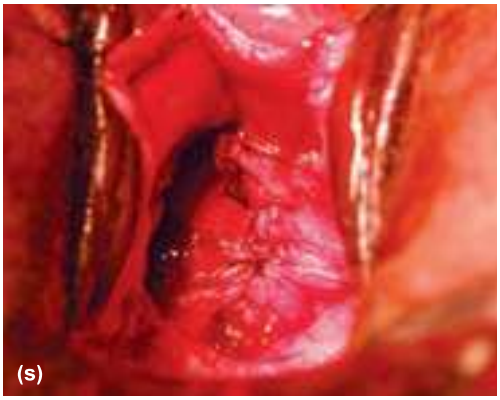
p) and q) The three way stitch but connecting the 'D's.



p) and q) The three way stitch but connecting the 'D's.



r) Then repair vertically to elongate the urethra. You also need to place small sutures at 5 and 7 o'clock around the anastomosis.



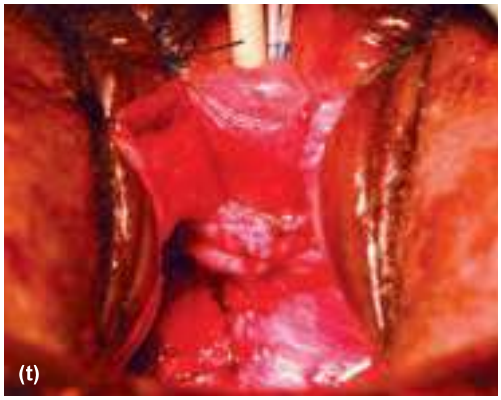
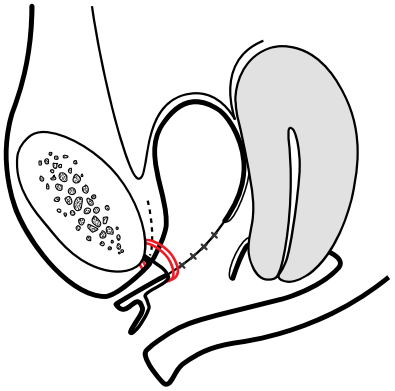
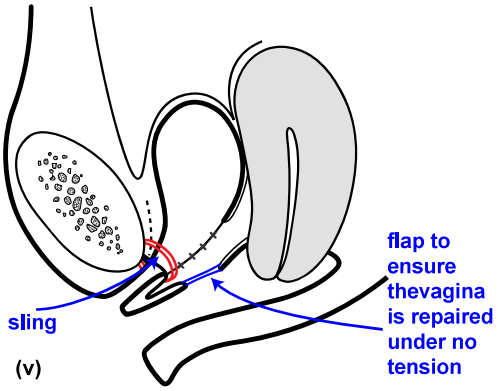


Figure 6.40 *(continued)*
s) The rest of the bladder is repaired, however it comes together under the least tension. In this case it was vertical, in other cases it can be horizontal or even in an inverted 'V' or inverted 'Y' shape.

t) and u) Make a sling to support the urethra (see section on 'Operative Steps to Reduce the Incidence of Stress Incontinence').



t) and u) Make a sling to support the urethra (see section on 'Operative Steps to Reduce the Incidence of Stress Incontinence').



v) There's usually a deficit in the vaginal skin in these larger cases needing some sort of flap (see section on 'Attending to Vaginal Skin Defects').

Ureteric Involvement

The larger the fistula and the closer it is to the cervix, the greater is the chance of ureteric involvement. (Figure 6.41) During every fistula repair, one must keep in mind the position of the ureteric orifices. For small fistulae at the bladder neck or urethra, the orifices should not be close, but it must be borne in mind that what was once a large defect involving most of the anterior vaginal wall and bladder base will have contracted in the first 3 months. Thus, the anterior vaginal wall will be short and the ureteric orifices may be close to the fistula edge, as the defect starts at the urethro-vesical junction and thus involves the trigone. Likewise, a small defect in the region of the cervix may have been much larger at first, subsequent contraction having brought the ureters close to the edge of the defect.

Figure 6.41
A fistula with its proximal margin right on the cervix. The anterior cervix is missing in this case so you can just see the posterior cervix and the cervical os is between the bladder and cervix. Note how close the ureter is to the edge of the fistula.

There may be complex ureteric involvement in large circumferential fistulae. The distal end of the ureter may be involved in the ischaemic process and the uretero-vesical junction may have sloughed away as a result, leaving the ureter draining directly into the vagina rather than into the bladder. In this case, there are four options for repair:

- If the ureter is just on or outside the edge of the bladder mucosa then, after catheterisation of the ureter and sufficient mobilisation of the tissues, it is possible merely to fold the ureter (containing a ureteric catheter) into the bladder as part of the repair. The ureteric catheter needs to remain in place to splint open the healing tissues for about 7 days.
- If the ureter is further outside the bladder, then the bladder can be cut down to the ureter and the edges of the bladder wrapped around the ureter to invert it into the bladder.
- Occasionally the ureter is too far from the edge to be merely 'folded' in. In this case, it can be catheterised and then mobilised a little off the pelvic side wall. It can then be brought into the bladder at a higher level than the repair through a separate stab incision with curved artery forceps. (Fig 6.42) The ureteric catheter and distal ureter can then be introduced into the bladder and repaired. The ureter is secured in place by 3/0 sutures through its muscularis and the bladder wall. The ureteric catheter should stay in for 10 to 12 days.
- Exceptionally, the ureter is too far from the bladder to be re-implanted. The options are to implant the ureter into the bladder by an abdominal approach at the same operation, or to catheterise it for 2 weeks and defer the re-implantation. Although it's not unreasonable to implant the ureter abdominally at the same sitting, I prefer to reimplant after a few weeks, because you do mobilise and pull on the bladder from above during the operation, which may interfere with your fistula repair. (Figure 6.43)

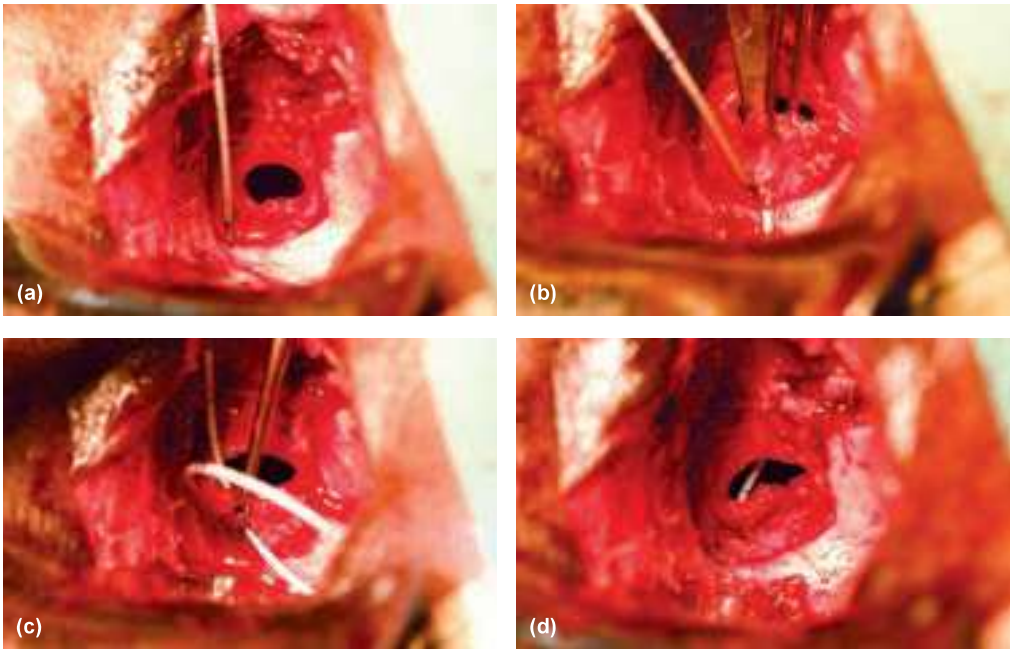


Figure 6.42
a) The ureter was found about 2cm from the edge of the fistula draining straight into the vagina. The vagina has now been mobilised off from the bladder and the right ureter catheterised. b) A curved artery is passed through the bladder wall. c) The ureteric catheter is introduced into the bladder which in turn will pull the ureter into the bladder. d) The bladder is closed over the ureteric implant site. The fistula and vagina are repaired routinely.

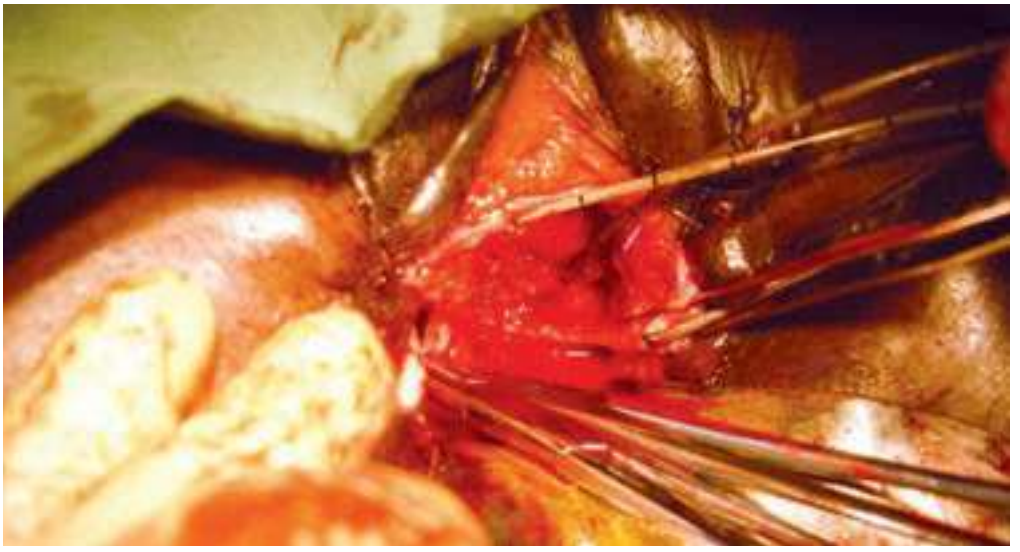


Figure 6.43
Look carefully and see the left ureteric catheter in the shadows entering the ureter on the left pelvic side wall. It's stuck in scar and too far from the bladder to be implanted safely from below. We left the ureter draining into the vagina with the catheter in place, repaired the fistula and reimplanted the ureter abdominally at a later date.

If the last three steps are required, there is usually such severe damage that the outcomes are poor. In 1993 when John Kelly studied factors leading to a failure of fistula repair, one factor he found was involvement of the ureters.

Other strategies for dealing with the ureters will be described in the section on juxta- and intra-cervical fistulae below.

As stress incontinence is such a problem after repair of juxta-urethral and circumferential fistulae, some measures that can be taken to reduce its incidence are described later in this chapter (Operative Steps to Reduce the Incidence of Stress Incontinence).

Juxta- and Intra-Cervical Fistulae

A fistula in the region of the cervix is often called a juxta-cervical fistula. Fistulae in this region can be divided into three main types:

1. The fistula is just distal to the cervix, and both distal and proximal margins are visible. (Figure 1.7)
2. The distal margin can be visualised, but the proximal margin is out of sight in the cervical canal (the anterior lip of which is often split open). (Figure 1.8)
3. The fistula cannot be seen at all, i.e. it is entirely intra-cervical. (Figure 1.9 and Figure 1.3d)

Beginners should attempt only small juxta-cervical fistulae that can be exposed easily. The proximal margin between the fistula and the cervix must be seen clearly. Those that extend into the cervical canal can be challenging to close.

The general principle in repairing fistulae close to the cervix is to begin the dissection on the distal margin. (Figure 6.44a–e) This is exposed by upward traction with two Allis forceps applied close to the distal fistula margin. The bladder wall can be supported by a metal catheter through the urethra and fistula and thus be used as a retractor. A small vertical incision is made through the vagina down to the fistula margin and then taken round the distal margins to the sides, where a small lateral extension may be made. The antero-lateral flaps are developed, keeping just under the vaginal mucosa. It is easy to stray into the bladder wall. These flaps are then sutured up to the labia. This should retract the distal margin of the fistula bringing the proximal margin more into view.

The postero-lateral dissection towards the cervix must be carried out with extreme caution, staying just under the vagina. The ureter is very much at risk where it runs in the wall of the bladder. It should, if possible, already have been catheterised. Sometimes the proximal bladder/fistula can be viewed more easily by inserting a Sims speculum into the bladder and pulling it anteriorly Figure 6.45. Often the ureters come into view with this method as well. At other times the ureters are on the distal margin of the fistula under where the blade of the speculum is lying.

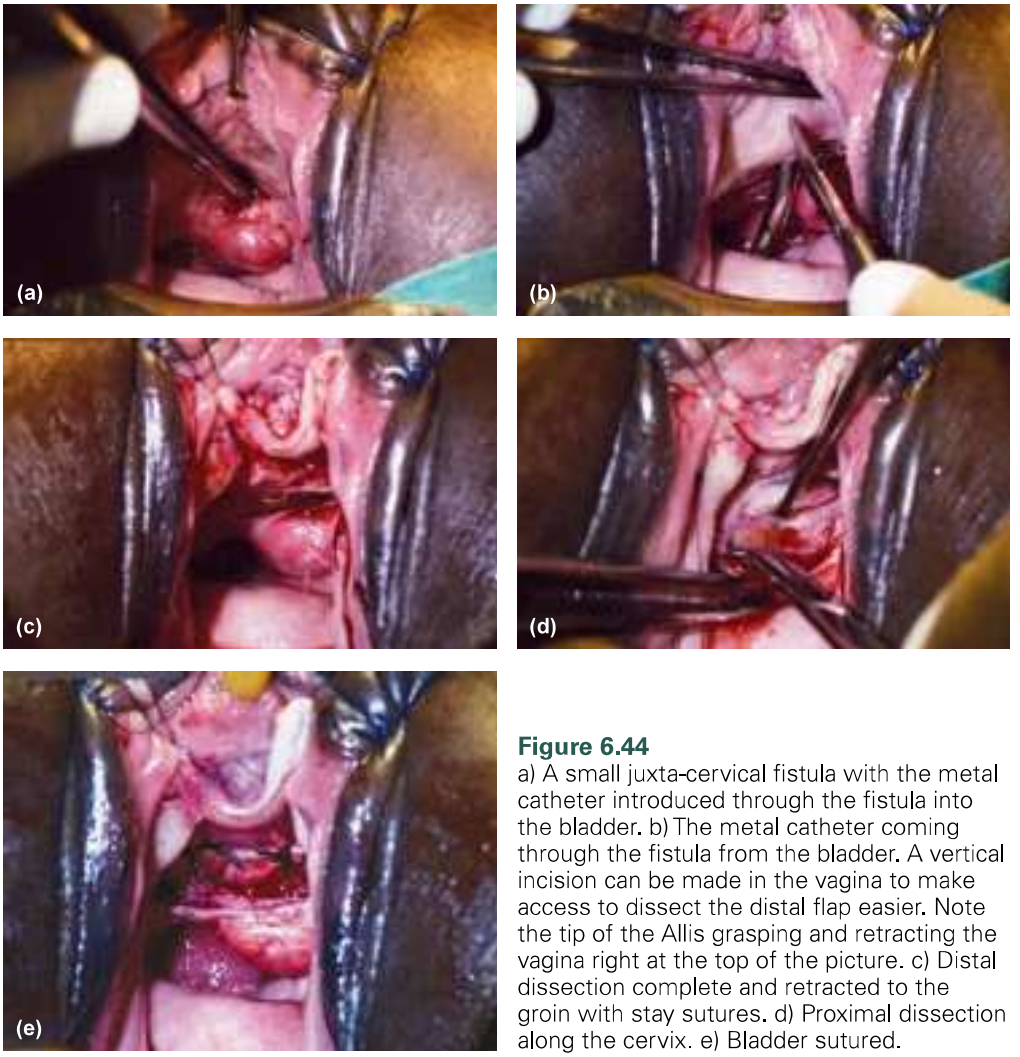


Figure 6.44
a) A small juxta-cervical fistula with the metal catheter introduced through the fistula into the bladder. b) The metal catheter coming through the fistula from the bladder. A vertical incision can be made in the vagina to make access to dissect the distal flap easier. Note the tip of the Allis grasping and retracting the vagina right at the top of the picture. c) Distal dissection complete and retracted to the groin with stay sutures. d) Proximal dissection along the cervix. e) Bladder sutured.

It is always best to err on the side of caution and you should always give 10mg intravenous frusemide to all fistula occurring in this area after a caesarean. Ureteric fistulae are quite common in such cases and it is easy to miss if you don't go looking for them. If you miss one, the patient will be wet in her bed despite you having closed the fistula and got a negative dye test. This is the same for all vault fistulae after a hysterectomy—always check for a concurrent ureteric fistula.

An Easy Case

A type 1 case is shown in Figure 6.46. As a general rule if the fistula is very small (<0.5cm) and in the midline then the ureters should not be at risk. However, if one can see into the bladder then they should always be identified. Babcock forceps should be used to evert the bladder—toothed forceps cause bleeding. Intravenous furosemide 10mg should be administered if there is still difficulty.

Figure 6.45
An intra-cervical fistula. The Sims speculum is in the bladder retracting the anterior wall to be able to see the posterior wall.

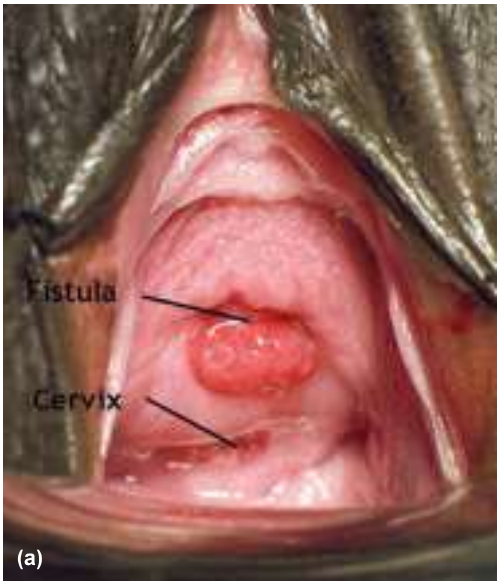


Figure 6.46
a). A small midline juxta-cervical fistula. There is a small gap between it and the cervix.
b) Be wary of the ureter. Note here how close this one is to the edge of the fistula.

Intermediate Examples

Figures 6.47 and 6.48 show two examples of cases that are intermediate in difficulty.

Combined Juxta-/Intra-Cervical Fistulae

An example of a combined juxta-/intra-cervical fistula is shown in Figure 6.49. If the ureters are not easily found in this sort of case, a Langenbeck or Sims speculum should be used to expose the interior of the bladder.

Figure 6.49e shows a juxta-cervical fistula that extends high up into an open cervical canal. If the cervix does not come down well, cases like this can be very challenging to close and impossible to photograph. They should be left for experienced surgeons.

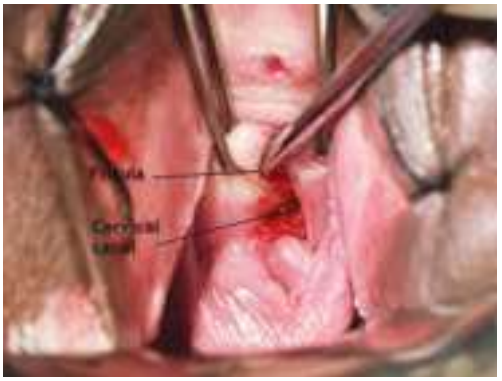


Figure 6.47
The metal catheter is in the fistula. The anterior cervix is split which will also need repairing.

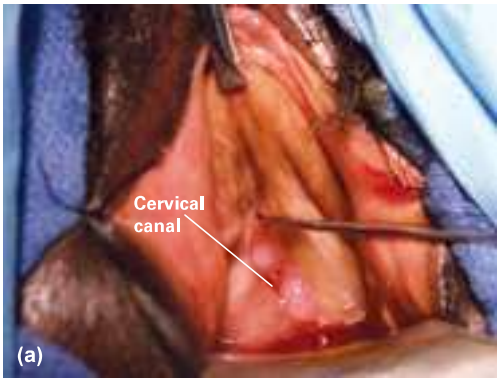


Figure 6.48
a) A tiny juxta-cervical fistula. Notice that the anterior cervix is split. b) It's reflected off from the cervix and note again that the anterior cervix is split and will need repairing. The fistula is so small that it would be impossible to identify the ureters formally. Check that the ureters are not on or outside the edge of the fistula before repairing it. The repair only needs two or three sutures.

The incidence of this combined juxta-/intra-cervical fistula varies from place to place. In one hospital in Uganda, 75% of fistula patients have been delivered by caesarean section, so this injury is seen quite often. In Ethiopia, where only 15% have had a caesarean section, it is uncommon.

Usually the anterior cervix is damaged in these cases and at times completely splayed open. After repair of the fistula you should try to approximate the edges of the torn cervix and then repair the vagina to it.

Intra-Cervical Fistulae

A case of intra-cervical fistulae is shown in Figures 6.50. In such cases a fistula will not be seen in the vagina, and a dye test shows a leak coming through the cervix. These fistulae always result from a caesarean section; most are iatrogenic due to accidental incorporation of some bladder when closing the lower segment. Unfortunately many doctors neglect to reflect the bladder inferiorly when doing a caesarean so incorporation of the bladder into the lower segment repair can happen very easily.

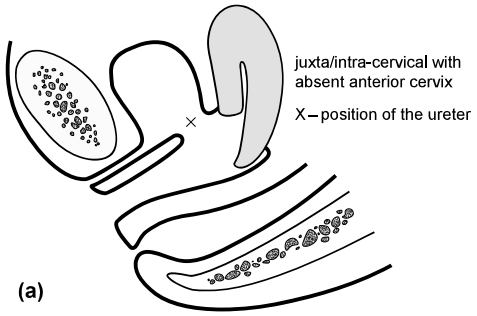


Figure 6.49
a) Diagrammatically you can see that the anterior cervix is missing and the bladder split up along the uterus. This is very hard to photograph. b) Identify the ureters. You may need to retract the bladder with a Langenbeck or Sims speculum to be able to visualise it c) although sometimes it is under the distal margin of the fistula. d) A different fistula, but you can see the split cervix clearly here and the proximity of the ureters to the edge. e) It can be very hard to visualise the tear in the bladder going up the cervix. Having a Sims in the bladder can help you see it and you will need to dissect along each side of the bladder/cervix junction, from the right and left side of the torn cervix to meet it at the apex. It's easiest to repair the bladder longitudinally and don't forget to repair the split in the uterus and the cervix.

Provided that the cervix comes down well, they are not difficult to repair from below (as in the case shown in Figure 6.50). Begin the operation by making a horizontal incision over the top of the cervix, reflect the distal vagina as above and then reflect the bladder off the cervix as you would for a vaginal hysterectomy. You will come across the fistula within 1–2cm of the external os and almost always in the midline.

Make sure after repairing the fistula in the bladder, to repair the fistula in the cervix.

I repair all intra-cervical fistulae from below, but my colleague Brian Hancock elects to repair about one-third via an abdominal trans-vesical approach. Those with less experience of vaginal surgery may find it easier to repair all true intra-cervical fistulae from above, although we advise them to learn the vaginal approach as soon as possible. The abdominal approach is described in the next section.

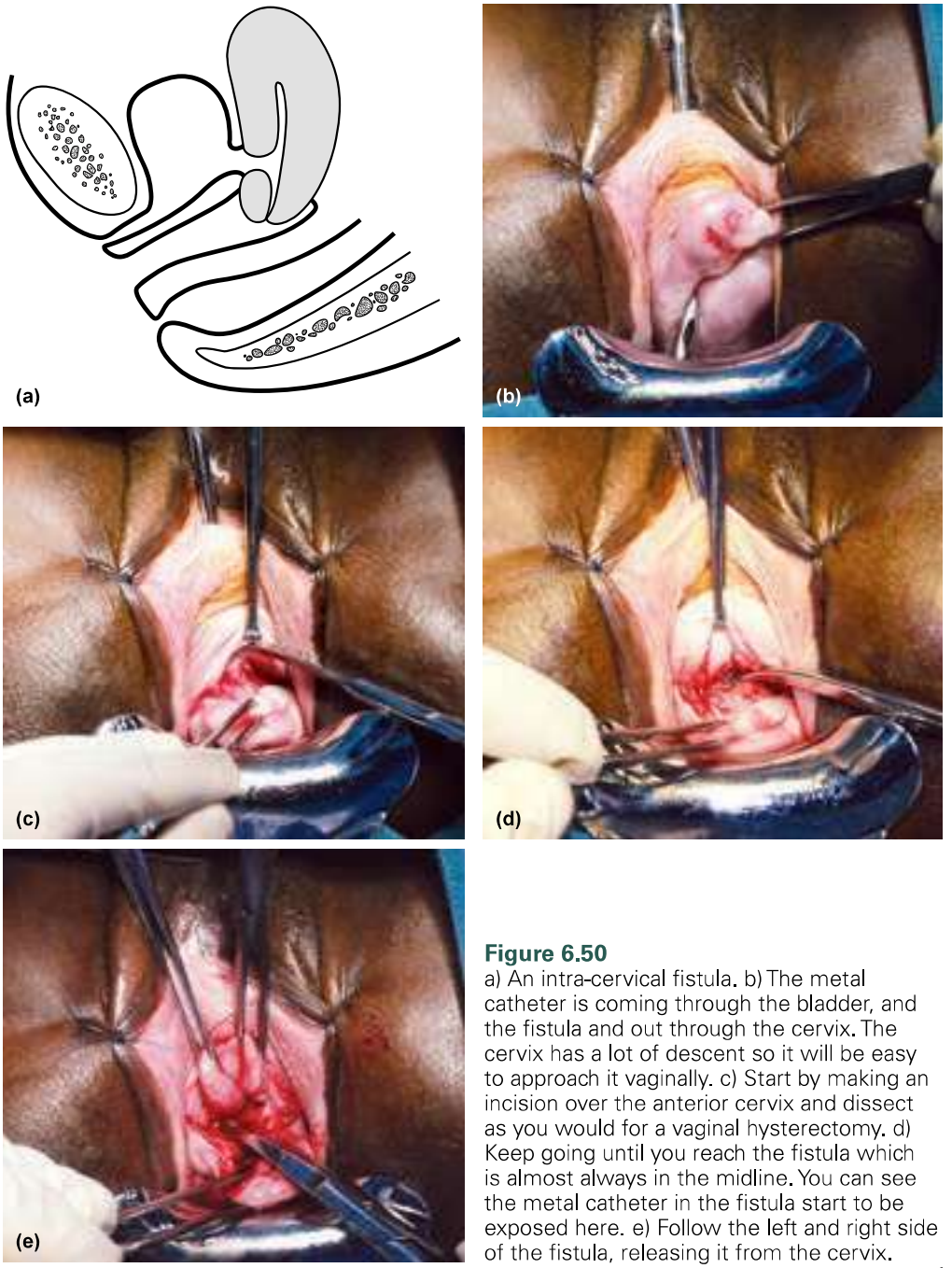


Figure 6.50
a) An intra-cervical fistula. b) The metal catheter is coming through the bladder, and the fistula and out through the cervix. The cervix has a lot of descent so it will be easy to approach it vaginally. c) Start by making an incision over the anterior cervix and dissect as you would for a vaginal hysterectomy. d) Keep going until you reach the fistula which is almost always in the midline. You can see the metal catheter in the fistula start to be exposed here. e) Follow the left and right side of the fistula, releasing it from the cervix.

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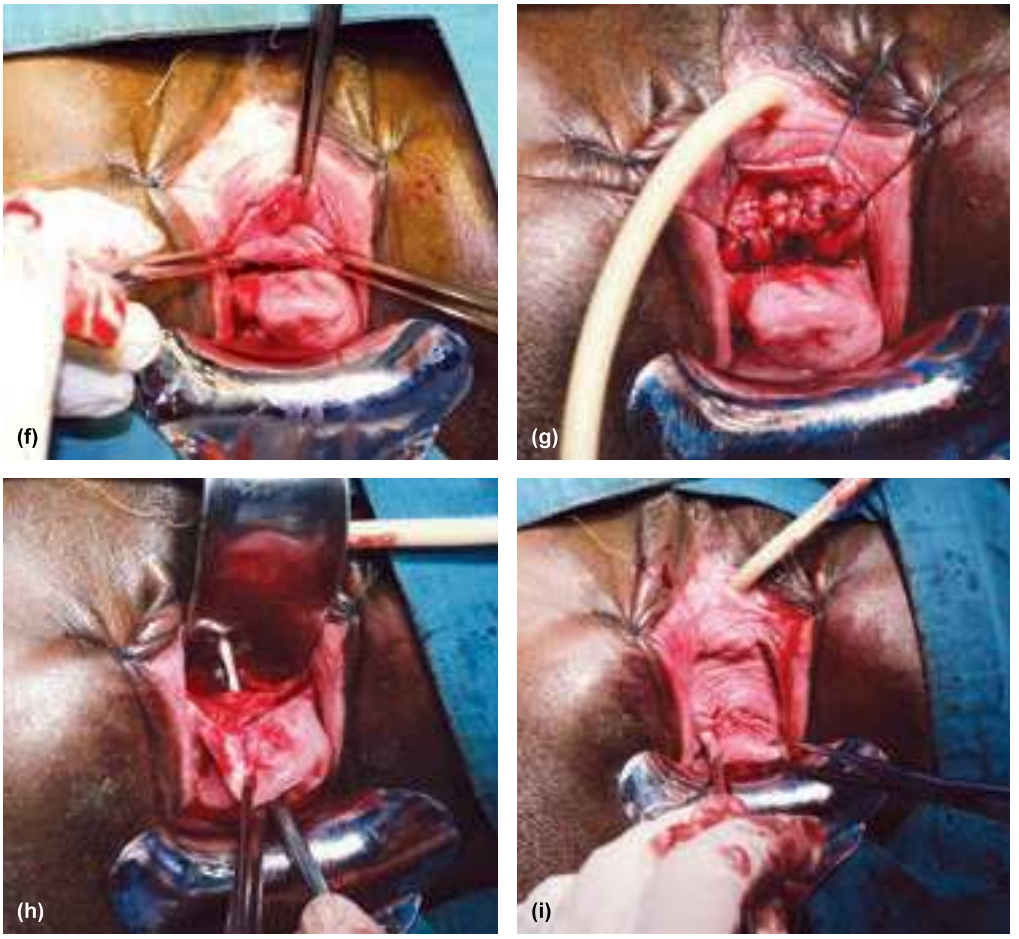


Figure 6.50 *(continued)*
f) Release the apex and the bladder will be free. It usually springs apart and becomes large. g) Bladder repaired. h) Don't forget the hole in the cervix or uterus. This should be repaired too. i) Vagina repaired.

Vault Fistulae

Vault fistulae occur after a hysterectomy. There may be some remnant cervical tissue incorporated into the vault especially when the operation has been a caesarean hysterectomy. (Figure 6.51)

The principles of all fistula operations still apply. I always give Lasix to exclude a ureteric fistula. The ureter easily could have been incorporated into the vault at the time of operation and it should never be neglected. The ureter can also be found on the edge of a fistula and you should make sure there are no spurts of urine from the edge before you start to repair the bladder.

It is very easy to enter the peritoneal cavity on mobilising, which, is not a major problem. However if it occurs all the blood and urine present during the operation will drain into the abdominal cavity with the patient in steep Trendelenburg, which can lead to an ileus in the post-operative period. To prevent this from happening I close the peritoneum if I have opened it.

Some surgeons also prefer to repair these abdominally although they can readily be repaired vaginally with practice

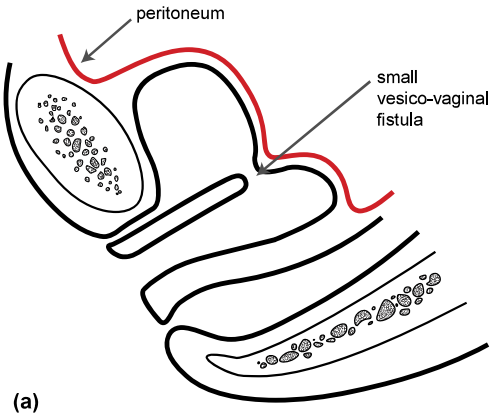


Figure 6.51
a) Diagram of a vault fistula. Note how close the peritoneal cavity is to the fistula.
b) A vault fistula after an elective hysterectomy.

The Abdominal Approach

When is an Abdominal Repair Appropriate?

Several full-time fistula surgeons claim that they can repair all fistulae by the vaginal route, however high the fistulae might be. With increasing experience, most find that they can close the majority of high juxta-cervical, intra-cervical or vault fistulae from below.

You may find some cases extremely difficult to close from below and several surgeons strongly believe that some cases are much more easily closed electively by the abdominal route. These are always patients who have sustained their fistula after a caesarean delivery.

An abdominal trans-vesical approach is not an easy opt-out for a fistula that an inexperienced surgeon might find difficult from below. No fistula that is below or likely to be close to the ureteric orifices should be attempted from above, except by a very experienced surgeon. This approach needs good abdominal relaxation, proper retractors, good light, an ability to catheterise the ureters from inside the bladder and, above all, good suction—ideal circumstances that may not be met in many resource-poor hospitals.

The final decision on approach is usually made on the operating table, with or without an anaesthetic. The factors to consider are the visibility of the fistula and the mobility of the uterus and cervix as assessed on bi-manual examination.

Post-Caesarean Iatrogenic Intra-Cervical Fistulae

A post-caesarean iatrogenic intra-cervical fistula can be suspected when the patient gives the story that she was delivered of a live baby, and yet is shown to have a leak through the cervix. The fistula is almost always caused by accidental suture of the bladder into the lower uterine segment.

Brian Hancock chooses an abdominal approach in the following cases:

(a) those that are intra-cervical with a cervix that cannot be pulled down easily (this is more likely in primipara than multipara)

(b) post-hysterectomy vault fistulae that will not come down easily.

Before selecting an abdominal repair for any patient, it is essential to be absolutely certain by dye test and vaginal inspection under anaesthesia that the leak is coming through the cervix and not through a hole in the vagina. It is quite possible for a small vaginal fistula to coexist with an intra-cervical or post-ruptured uterus vault fistula.

A Trans-Vesical Repair Illustrated: The O'Connor Technique of Bladder Bisection

Most urologists would prefer an extra-peritoneal approach to the bladder. While this has the advantage of minimal disturbance to the abdominal contents, most general/fistula surgeons, myself included, prefer a general laparotomy. This allows much better exposure. A helpful trick from Brian Hancock is to put a large suture through the fundus of the uterus to use as a retractor. (Figure 6.52) Strong traction on this towards the head end greatly helps to bring the adherent bladder and cervix into view.

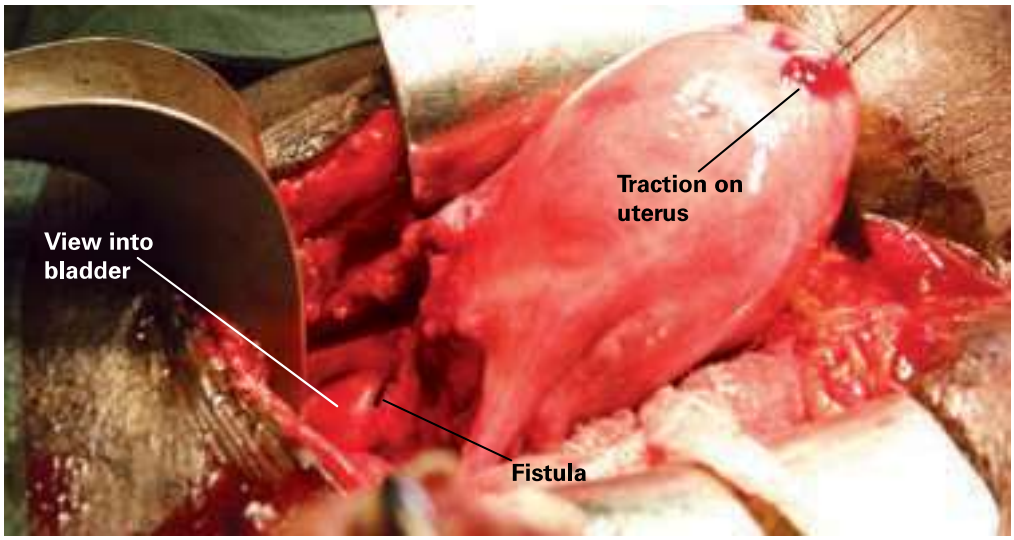


Figure 6.52
To aid exposure, a strong suture is placed through the uterine fundus. Using this to retract it towards the patient's head helps to access the bladder and fistula.

The adhesions between the bladder and lower segment are dissected a short distance. If the fistula is not soon found, there should be no hesitation about opening the fundus of the bladder, inspecting the interior and splitting the bladder vertically downwards until the fistula is reached and circumscribed (the O'Connor technique). (Figure 6.53) This, of course, has the added advantage of allowing identification and, if necessary, catheterisation of the ureteric orifices. As mentioned previously, always be alert for a ureteric fistula in such cases. If you can't see a ureter spurting into the bladder, check and see if it is dilated. If it is both dilated and not draining into the bladder, then it must have been ligated. It should be reimplanted.

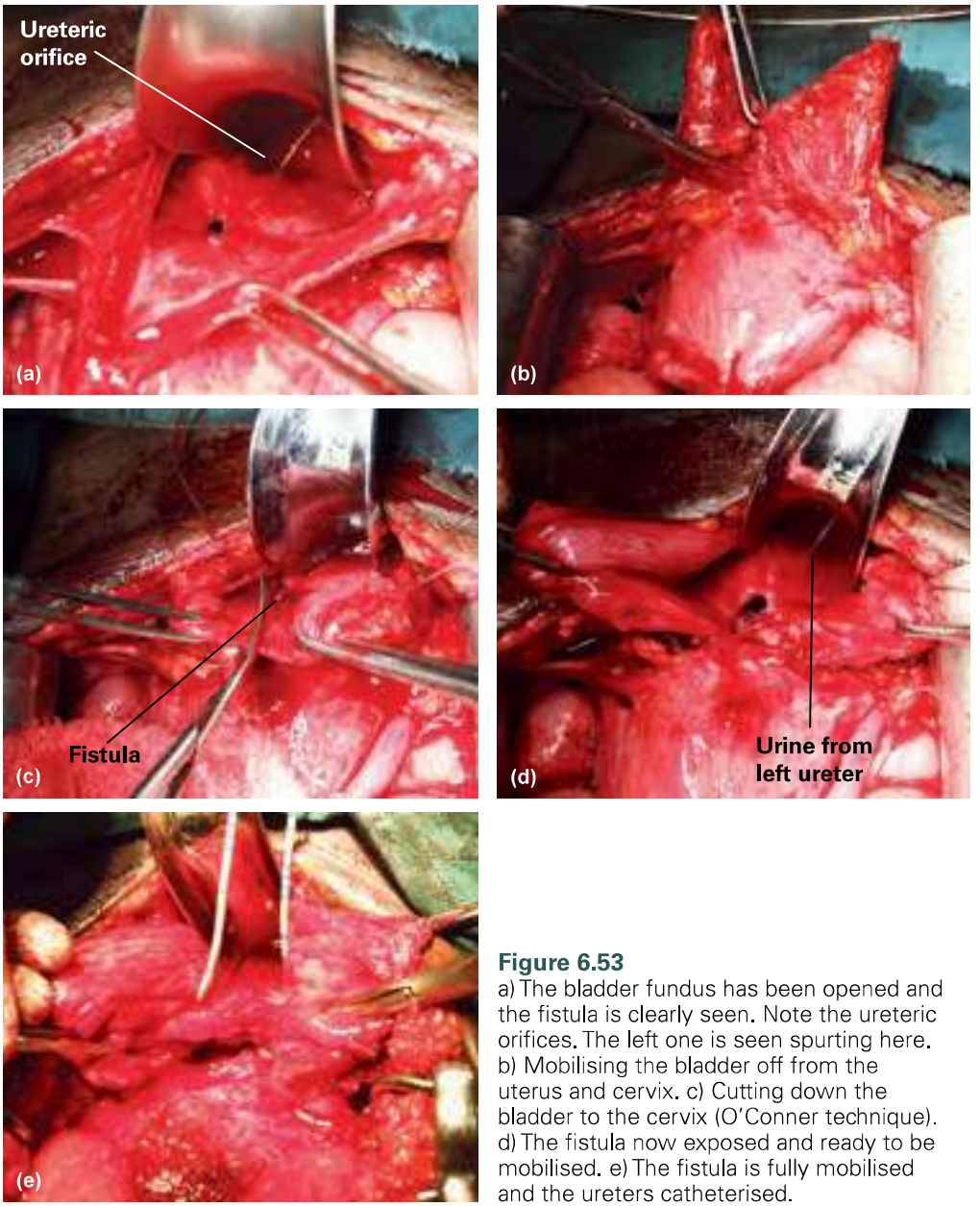


Figure 6.53
a) The bladder fundus has been opened and the fistula is clearly seen. Note the ureteric orifices. The left one is seen spurting here. b) Mobilising the bladder off from the uterus and cervix. c) Cutting down the bladder to the cervix (O'Conner technique). d) The fistula now exposed and ready to be mobilised. e) The fistula is fully mobilised and the ureters catheterised.

Urethral Reconstruction

About 2% of cases present with complete loss of the urethra. This results from very low obstructed labour in which all the urethra is crushed and sloughs away. It may be a localised injury with a normal-sized bladder, but more commonly occurs with a vesico-vaginal component to the fistula as well which may result in some bladder loss and end up with a small bladder. These defects can be repaired anatomically, but it is difficult to achieve a satisfactory functional result. Currently, two methods are available to help restore these patients:

- creation of a new urethra from existing tissue—vaginal tissue or any remaining urethra tissue
- construction of a new urethra from the anterior wall of the bladder.

Creation of a New Urethra from Existing Tissue

A new urethra is made from remaining urethral and vaginal tissue. If all urethral tissue has gone and there is little normal vaginal tissue, the prospect is more or less hopeless (Figure 6.54) as the only remaining tissue is a thin veil of epithelia over the posterior symphysis bone which is too fragile to work with and provides no substance to create anything functional.

Figure 6.54
The urethra has been completely destroyed. The patient had very little bladder tissue remaining, making it impossible to create a new urethra from anterior bladder. She ended up having a diversion procedure.

If a strip of normal urethral tissue remains, there is a chance of making a reasonable tube. The repair is done by making a U-shaped incision, with the arms of the U extending to where the external urethral meatus should be and about 3cm apart. (Figure 6.55) It is better to make the arms wider than appears necessary, as it is easy to end up with too little tissue to make a tube. The base of the U lies over the entrance to the bladder. The sides of the U are undermined a little from either side towards the midline. This raises up the flaps of tissue from which you will create the new urethra. Care has to be taken, as the tissue is often fragile. The vagina lateral to the U-shaped incision is also dissected to create flaps to cover the new urethra, and the bladder is mobilised as much as necessary to enable it to be attached to the new urethra.

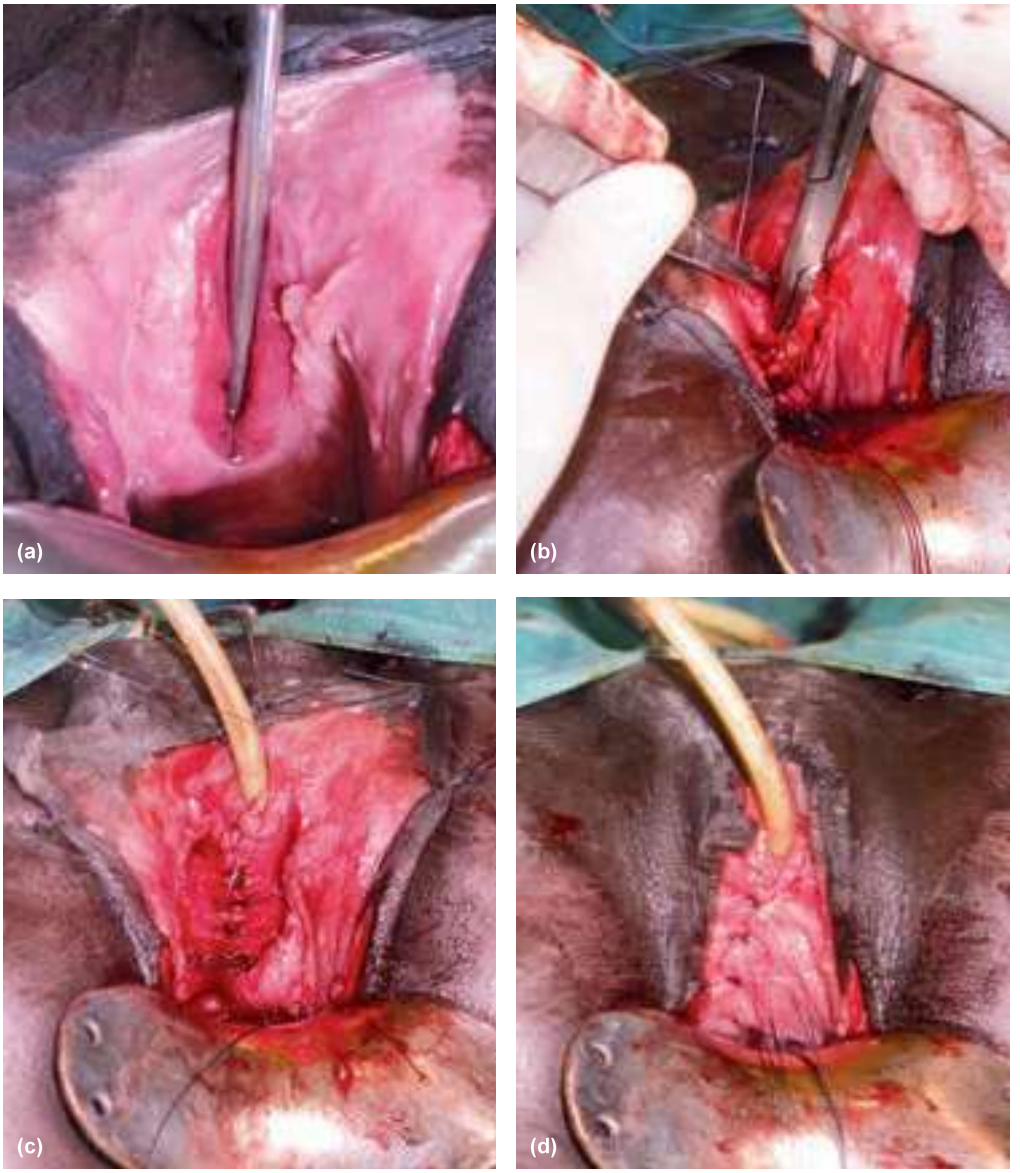


Figure 6.55
a) A urethra that has been cut. There is good tissue remaining and this shows the principles of repair. b) Mobilisation of the urethra has been done and the urethra is being sutured. Remember not to make it too tight, or too loose. c) Urethra reconstructed. d) Vagina repaired.

The tissues of the new urethra are sewn over a Foley catheter. An alternative is to suture the urethral tissues without an indwelling catheter and instead to check the diameter of the new urethra after each stitch with a medium Hegar dilator, Foley or metal catheter. Once the construction is complete, a 14 or 16 FG Foley catheter can be passed. The catheter must not be tight within the new urethra. Support the structure with a sling of fibro-muscular tissue from the lateral pelvis (see section on Urethral Support with a Fibro-Muscular Sling). It is good to use a Martius graft also as an extra support if the repair is very fragile.

Occasionally there is insufficient vagina either side of the new urethra to cover it. An alternative is to extend two incisions down the vaginal wall in the direction of the cervix and, having mobilised a flap off the bladder, advance it distally to cover the new urethra. The trouble with this is that it will lead to a short and tight anterior vaginal wall, which when healed will tether the vagina so it is not loose and elastic. This tethering pulls the urethra open and the patient will be wet. A better option to cover the new urethra is to use flaps of tissue from the labia or groin crease. This will maintain the vagina's elasticity and length, and not pull the urethra open (see section on Vaginal Skin Defects).

The case illustrated in Figure 6.55 shows the principle of repair, and has an excellent prognosis as it is not a childbirth injury and there has been little tissue loss. It is a case of traumatic urethral injury from a *Gishiri* cutting (a form of genital mutilation sometimes practised in Northern Nigeria as a traditional treatment for a variety of gynaecological ills). The superficial urethra has been cut as far as the bladder neck. As there is no ischaemic tissue loss this is the most favourable type to repair. Figure 6.56 illustrates a case where there is a small bridge of urethra superficially but good urethra on the deep aspect. The defect in the urethra can be repaired longitudinally to maintain the length of the urethra.

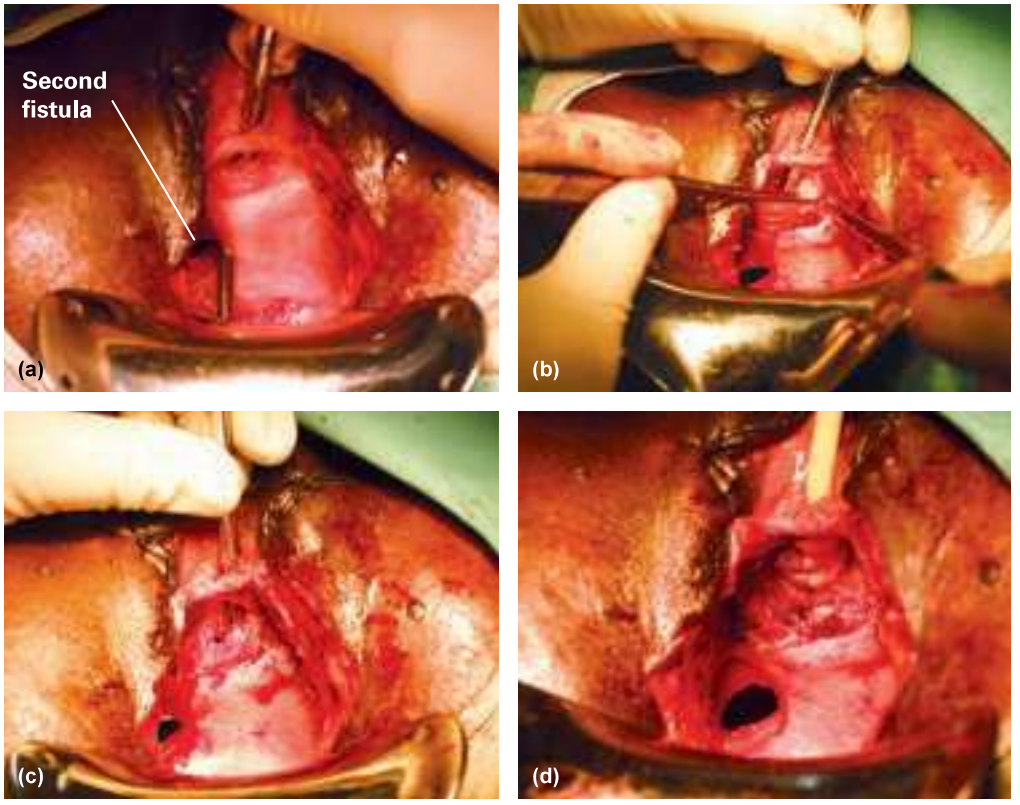


Figure 6.56
a) Two fistulae, one proximal and one in the urethra. A tiny bridge of distal urethra remains. b) Mobilise the urethral tissues off laterally from the bones. c) The urethral tissues are now fully mobilised and d) can be repaired longitudinally over a Foley catheter to create a new urethra (the proximal fistula can now be closed).

Construction of a New Urethra from the Anterior Wall of the Bladder

An alternative operation when there is little remaining urethral tissue is to make a new urethra from a flap of anterior bladder wall. (Figure 6.57) The results aren't great, the procedure is technically difficult and the bladder must be of almost normal size for it to be feasible. This approach is recommended only for advanced fistula surgeons.

For this operation, the bladder has to be mobilised circumferentially and quite widely to bring the anterior wall of the bladder down to where the external urethral meatus should be. When this has been achieved, two incisions are made in the anterior bladder about 3–4cm apart and about 2–3cm long. This flap will become the new urethra. First, the bed of the old urethra over the symphysis pubis needs to have the epithelia removed to create a raw area where the new urethra will lie. The vagina needs to be reflected laterally from where the urethra will lie to cover it later.

The flap is attached in the midline where the external urinary meatus should lie, and is then sewn from side to side over a Foley catheter. A size 12 may be needed if the flap is small. It is sometime easier to attach the anterior bladder to the site of the external meatus before cutting the flap, and then to start to sew the bladder from side to side over the catheter, making the incisions in the bladder after each suture, proceeding down the length of the urethra. This prevents the serious error of cutting the flap short or narrow. I certainly prefer this method. If you make a mistake in the initial incision of the flap then the operation is ruined, but if you do it step by step as you sew it over a catheter, the risk of error is greatly reduced.

When the urethra is made over the catheter, the remaining defect in the bladder is repaired either vertically or horizontally, a dye test is performed and a fibro-muscular or fascial sling is placed beneath the urethra. A Martius graft is optional and is useful to fill any dead space.

Of a small series of ten operations carried out by the author some years ago, two were completely cured and voiding normally and three had urinary retention but were dry self-catheterising. The remaining five were still incontinent to varying degrees but they were able to hold some urine. They had to have a second operation to try and make the urethra wider and support it better.

This tube of anterior bladder wall can also be used to lengthen a short urethra. This is technically demanding, and is occasionally not possible because the patient has a small bladder, effectively ruling out the procedure. I use this technique routinely in patients with short urethras and a circumferential defect, and it gives better results in my experience. The principle of fistula surgery is to restore normal anatomy—that is to make the urethra a normal length and width (and then support it with a sling to replicate the pubo-urethral ligament).

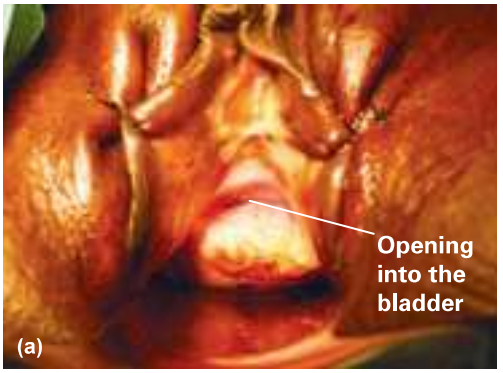
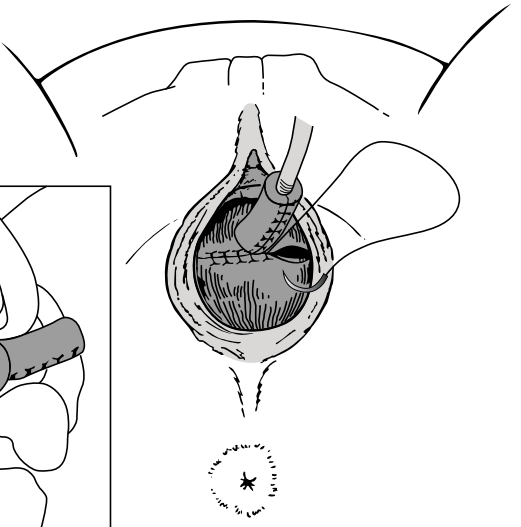


Figure 6.57
a) There is no urethra or remaining urethral tissues. There is a tight opening stuck under the pubic bone into a good sized bladder. b) The bladder has been mobilised circumferentially and advanced down. c) An incision was made on the posterior bladder and a strip created to suture over a Foley catheter.



d) The remaining bladder was repaired as shown in diagrammatic fashion here.

e) The new urethra was supported with a fibro-muscular sling.

Operative Steps to Reduce the Incidence of Stress Incontinence

The steps that that we have described so far concentrate on closing the fistula. Remember the Basic Principles. The more Advanced Principles are directed at preventing ongoing incontinence. We touched on those briefly in the preceding sections when we talked about making the urethra longer during the repair. We'll discuss more techniques in detail now.

From a multivariant analysis of patients in Ethiopia we know the factors that predispose to ongoing incontinence despite a closed fistula. These are:

- Involvement of the urethra (types 2–4 in Goh's classification) the shorter the urethra, the greater the ongoing incontinence with Goh type 4 having the worst outcomes. This corresponds to Waaldijk type II fistula, or those involving the closing mechanism.
- Larger fistulae.
- Vaginal scarring sufficient to prevent insertion of a speculum without vaginotomy.
- Small bladder volume after repair ($<150cm^3$).

Most important is loss of length and quality of urethral tissue, so any measures that can be taken to improve this should be taken. These measures fall into three groups:

– Lengthening procedures to ensure an adequate urethral length. Lengthen the urethra from bladder tissue.
– Urethral support with a fibro-muscular or fascial sling or including repair of the pubo-cervical fascia.
– Attending to vaginal skin defects to ensure there is no tension on the vagina pulling the urethra open.

Lengthening Procedures

In a series of patients with severe post-repair stress incontinence, the average urethral length was 1.4cm, which is less than half the normal length of 3–4cm. Anything that can be done to lengthen the urethra should help. Although there is no formal proof, Kees Waaldijk and others have the impression that a urethra less than 2cm in length is very unlikely ever to be continent.

As mentioned in the section above on juxta-urethral and circumferential fistulae, it is possible in some cases to fashion the bladder side of the anastomosis into a tube with a diameter approaching that of the urethra. (Figure 6.40) This is done by joining the anterior wall of the bladder to the urethral remnant, wrapping the anterior bladder around to anastomose to the urethra and closing the remaining defect in a vertical direction.

As also mentioned in the previous section, vertical closure of the urethral defect is possible in a few cases.

Urethral Support

Repair of the Pubo-Cervical Fascia

The pubo-cervical fascia is a sheet that originates from the arcus tendinus on the pelvic side wall. It is a fascial support for the urethra, the urethro-vesical junction and bladder base. It is disrupted by the ischaemic process, and attempts to repair this damage are worthwhile, even though it may appear insubstantial. Some surgeons make a quite extensive dissection over the bladder base to identify the fascia and pull it together in the midline, thus supporting and elevating the new urethro-vesical junction. This is really just a radical plication of the distal bladder.

Another method is to attach the pubo-cervical fascia to the arcus tendinous if it has been detached during the ischaemic loss.

Fibro-Muscular Sling (Pubo-Coccygeal Sling)

A review by the author of 318 consecutive patients successfully repaired at the Addis Ababa Fistula Hospital in the year 2002 showed an immediate post-operative incontinence rate of 33% and an independent review examining the patients put the rate at 45%. Repair was by simple closure, with a Martius fat graft added in most cases. This was a much higher figure for incontinence than had previously been recognised, and I started to use a fibro-muscular sling in high-risk cases, i.e. those with a shortened urethra (that is fistula edge <2.5cm from the external urethral orifice, Goh's type 3 and 4). This was an attempt to reconstruct the pubo-urethral ligament. Since this was adopted in routine practice, the rate of post-operative stress incontinence has been reduced to 18%.

The exact nature of the tissues to be used to make the sling is open to debate, but pubo-coccygeal muscle is generally preferred. Sometimes it is just scar tissue, because the muscle having necrosed and sloughed away, scar tissue is all that remains in its place.

The procedure is best understood by referring to the diagram and photographs shown in Figure 6.58. The lateral ends of the vaginal incision that was made around the fistula are extended a little more laterally onto the lateral vaginal walls each side. The vaginal skin is elevated so as to expose some fibro-muscular tissue under the pubic rami. The belly of fibro-muscular tissue that can be felt in this area is grasped with Allis forceps. A cut is made below with scissors so as to elevate a strip block of tissue still attached anteriorly under the pubic arch. The same procedure is performed on the other side, and then the two sides are sutured together in the midline beneath the urethra with two interrupted sutures. If the dissection has been taken high enough under the pubis, the sling should wrap around the urethra in a gentle U shape. Inadequate mobilisation potentially leaves dead spaces behind which can scar the urethra open in time. (Figure 6.58)

Unfortunately, in many of the worst cases, the pubo-coccygeal muscle has been destroyed and replaced by fibrosis. The sling will then be mostly scar, but may still give some support.

I use this sling in most patients with fistulae that are less than 2.5cm from the external urethral orifice, although on occasion I do use it on adequate urethras that were clearly leaking urine before the operation, that is leaking from a fistula and through the urethra.

The sling also acts as a graft, increasing the closure rate in what is often a fragile repair.

When you repair the vagina over the repair, remember to suture the corners of the vagina to the pubic bones (arcus tendinous). This will close any dead space and also act to support the urethra. (Figure 6.58)

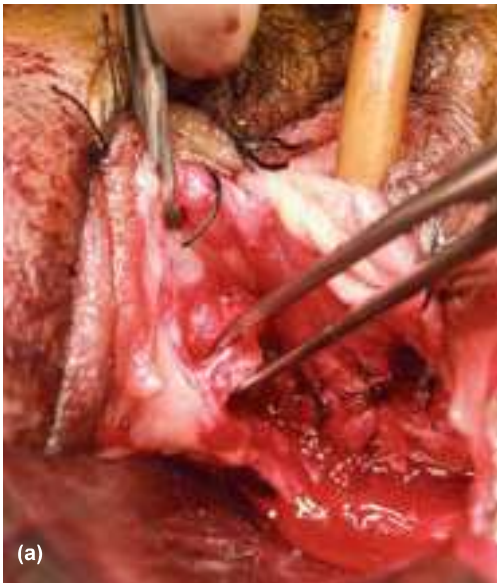


Figure 6.58
a) The Allis forceps are grasping the muscle under the pubic arch on the right side of the urethra.

b) Mobilising through the muscle. Don't cut right against the bone, take a strip from the body of the muscle.

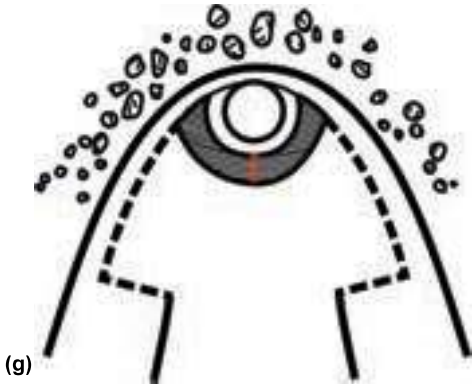
c) Right hand side of the sling being developed.

d) The same on the left.

Continued

Figure 6.58 *(continued)*
e) Dissecting the strip of muscle.

f) Left side of the sling fully developed and attached anteriorly.

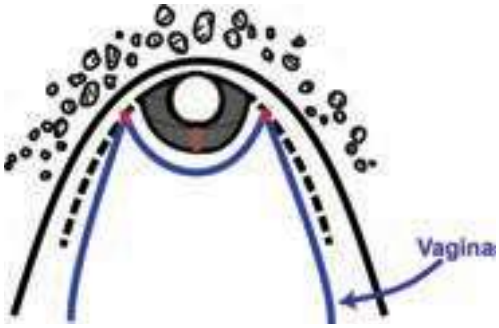


g) Make sure you mobilise high enough under the pubic arch so the sling sits nicely under the urethra.

h) If you don't, there will be a dead space between the sling and the urethra.

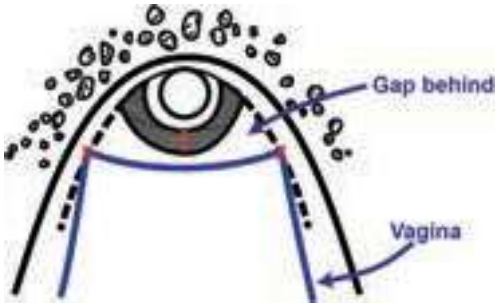
i) This sling is sewn in the midline but the dissection hasn't been far up under the pubic arch, so the sling is not forming a 'U' under the urethra.

j) This one has been dissected correctly and is a good sling under the urethra.



(k)

k) Likewise when you repair the vagina, make sure you repair the vagina against the pubic bones to the base of the sling to close any dead space.



(l)

l) If you don't you will get dead space between the vagina and urethra like this.

Fibrous Sling (Fascia Lata or Rectus Sheath)

Another option for urethral support is to use some fascial tissue. There is a randomised controlled trial underway comparing the use of the muscle or fibrous tissue described above and the fascial sling at primary repair. Preliminary results suggest that the muscle sling has fewer fistula recurrences but the fibrous sling *may* be better at maintaining long term continence.

I tend to use the fascial sling as a secondary procedure when the muscle sling has failed. As these patients generally have little to no physiological function to their urethra the sling acts more in an obstructive manner. You can get much more tension with the fascial sling which is of benefit at times and is perhaps the reason why a fascial sling created at the time of initial repair might be associated with more repair breakdowns. A tight sling under the urethra might put too much pressure on the healing tissues so the fistula breaks down.

The fascial sling is a fairly simple procedure. The first step is to harvest a 5cm by 1.5cm strip of fascia from either the tensor fascia lata or rectus sheath. The incision to harvest the tensor fascia lata is made about 10cm superior to the lateral femoral condyle. After harvesting, the fascial defect can be left open and the subcutaneous tissues and skin closed. If the rectus sheath is used it is done via a min-Pfannenstiel incision and a 5cm by 1.5cm strip is harvested centred on the linea alba. (Figure 6.59)

Tie some PDS or nylon to either end after making a Pfannenstiel incision (already done if you have harvested the rectus fascia sheath). The sling can be passed either side of the urethra from the vaginal side and into the cave of Retzius up to and through the rectus fascia. You use long curved artery forceps for this, holding the ends of the PDS or nylon. With the already attached nylon the sling is then sutured to the rectus sheath either side with a free needle, or if one is unavailable the curved artery forceps can puncture the sheath to thread the suture through. It is tied with mild tension.

This procedure is termed a 'sling on a string'. We have had some good short term results but the long term results are unknown.

Figure 6.59
A strip of rectus fascia can be harvested through a low mini-Pfannenstiel incision. It is used to create a sling going around the mid-urethra and sutured to the rectus sheath with nylon.

Attending to Vaginal Skin Defects

Sometimes, there is no vaginal skin to cover a successful bladder repair. More and more we are realising that it is just as important to close the vagina properly as it is to repair the bladder and the urethra. If the vagina is closed in such a way as to cause tension the patient will almost always have ongoing incontinence from her urethra. She may very well be suffering dyspareunia and even apareunia too from a short, scarred, rigid vagina. In the past surgeons have just pulled the cervix forward and sutured the vagina together under tension, but the tension pulls the urethra into the vagina and pulls the urethra open. So if after repairing the bladder and the urethra the vagina doesn't fall together easily, the gap in the vagina needs to be filled. In such cases, there are five options, the first three of which are simple:

1. Leave it as it is. (Figure 6.60)
2. Cover the bladder repair with a fat graft and leave a vaginal defect. (Figure 6.61)
3. Use a labial flap. (Figure 6.62)
4. Use more complicated flaps, e.g. medial thigh or buttock flaps.
5. Use a vascular island pedicle flap, namely the Singapore flap (and the alternative of the labia minora flap). (Figure (6.64)

The cases where this is necessary often have significant vaginal stenosis before the repair—the aim of the operation is to release and excise the scar that is causing the stenosis, open up a space to create a vagina and have a vascular flap to cover it. Non-vascular flaps and grafts are okay for small vaginal defects, but if used on larger defects tend to scar and retract in time and do not give good longer term results.

Options 1 and 2. My colleague Brian Hancock prefers options 1 and 2, but in my experience, unless the gap left in the vagina is very small there is a high chance of a breakdown of the bladder. I have seen cases where the whole repair had been left uncovered and the whole exposed area of the bladder necrosed and sloughed away, making the next repair even more difficult. It's best to repair the vagina completely and well. Kees Waaldijk has a saying 'to keep a house dry you need a roof and a ceiling', meaning it's best to have two layers; the bladder and the vagina.

Figure 6.60
A stenosed vagina. There wasn't enough vagina to cover the repair and the repair was left partially exposed.

Figure 6.61
The same as with Figure 6.60 but the repair was covered with a Martius fat flap which was partially left exposed as there wasn't enough vagina to cover the defect.

Option 3. Labial flaps can be used from labia minora and/or majora. The procedure is usually performed by extending the vaginal incision to the introitus and out onto the skin. (Figure 6.62) Then the incision is taken anteriorly between the labia minora and labia majora if the minora is to be used only, or more laterally to include the majora. If a relaxing episiotomy was made during the operation, this incision can just be extended up onto the labia. If a Martius graft has been used the incision can be extended to meet the incision created to harvest the graft (see the section in this chapter on the Martius Graft Procedure).

A flap is raised from posteriorly to anteriorly and rotated into the vagina. It is important to note the basic principle for flap surgery. This means the flap is still attached somewhere, the base of

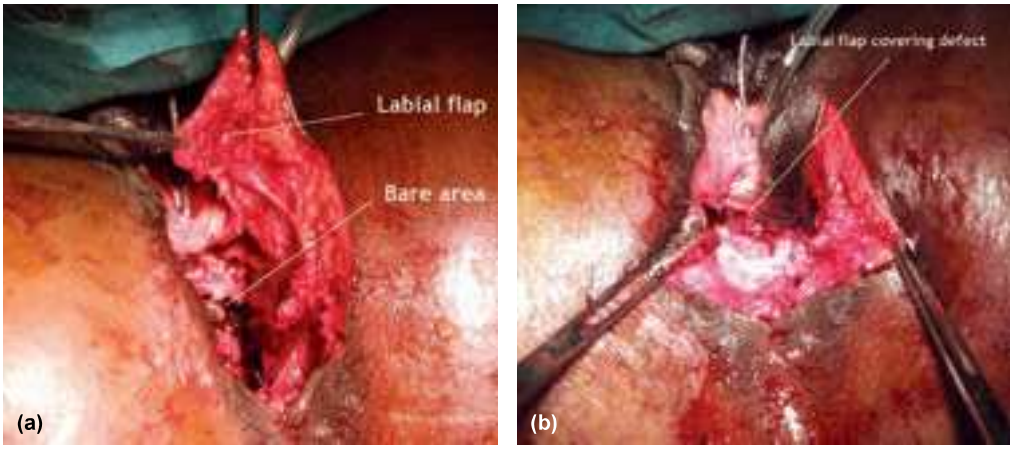


Figure 6.62
Labial rotational flaps. a) The labial flap has been developed on the left. Note the large bare area over the repair site and no vagina to cover it. b) The labial flap has been rotated in and there is enough tissue to cover the bare area. The incision sites will be repaired.

the flap. In this case it is the skin where it hasn't been cut. Unless the flap is based on an artery, it will not have its own blood supply. When the flap is raised and moved, the blood supply will be coming indirectly via diffusion from the base of the flap (the skin) and also from the tissues it will lie on, in this case the bladder. A general rule of thumb is that the base of the flap should be as wide as or wider than the length of the flap. If the flap is longer than it is wide, the blood supply to the distal part will be poor and it will probably die, so make sure the flap is wider than its length.

Small flaps work quite well but in my experience, larger ones end up being disfiguring and in time contract up, because they don't have their own blood supply. This slow contraction over time can end up pulling the urethra open with scar, making the patient incontinent. (Figure 6.63) I use this method if the gap in the vagina after repairing the bladder is only about 1–2cm.

Figure 6.63
This patient had bilateral labial rotational flap performed. It has scarred with time and there is tension pulling the urethra open. She was wet all the time, the same as when she had the fistula.

Option 4. Medial thigh and buttocks flaps are larger flaps based more laterally and distally, but the principles stated above still apply. Again, the flaps are not based on an artery and so should not be longer than they are wide. In my experience they tend to be disfiguring and scar up with time.

Option 5. Singapore Flap. In my opinion a vascular pedicle flap with an island of skin produces the best result. The method I use is a slight modification of the Singapore flap that was first developed in Singapore to create a new vagina. This flap is based on an artery, the terminal branch of the external pudendal artery. This comes towards the skin just medial to the ischial tuberosity and then runs up to the inguinal ligament slightly medially to the groin crease. So an island skin flap is created. First mark out your incision with the pedicle being based just medial to the ischial tuberosity. You can estimate the length of the flap that you need by approximating the distance from the tuberosity to the most distal part of the defect in the vagina using either your finger to measure or a piece of gauze. Then use this length to measure from the medial tuberosity along the groin crease. Mark this spot but then add another 2cm or so as you always end up needing more than you expect.

Make your initial incision just medial to the groin crease to your mark at the flaps base (pedicle). This will just include the lateral part of the labia majora. Then make an incision in an arc onto the thigh tapering down to base. (Figure 6.64) The length can be up to 15cm, right up onto the inguinal ligament, and about 6cm wide. Most of the time a smaller one is all that is needed.

Incise anteriorly down to the fascia over the muscle. Take the fascia off the muscle, this make sure the blood supply will be intact. The fascia may also add some strength to the vagina, replacing the defect in the pubo-cervical fascia. Put a small suture through the fascia and attach it to the skin. This will ensure the fascia doesn't shear off the subcutaneous tissue.

The flap is developed making sure you keep a nice wide pedicle inferiorly that includes the blood supply. Then mobilise the inferior part of the flap just under the skin to get more length from the pedicle. When it is nice and mobile (and hopefully still bleeding distally so you know the blood supply is still intact), make a tunnel just over the inferior ramus, under the bulbocavernosus and into the vagina. Use sharp scissors to do this and then push two fingers through to make sure the tunnel is wide enough not to strangulate the pedicle and thus its blood supply. The flap is passed through the tunnel and laid out in the vagina. Notice how the pedicle passes through the tunnel: there is skin on the flap through the tunnel that needs to be excised. Make a mark on the skin of the pedicle in the vagina to determine how much skin you want to keep then carefully excise the skin from within the tunnel but pulling the labia to the side and exposing the skin within the tunnel. Then repair the proximal end of the flap to the vagina/cervix and side wall, and then anteriorly. Secure the remainder of the flap within the vagina to the vaginal mucosa.

The groin crease defect then needs to be repaired. I repair this in two deep continuous layers in larger women with a lot of subcutaneous tissue or one deep layer to thin women. The deepest layer should aim to repair the fascia over the muscle. I then use interrupted sutures to the skin and tie a gauze as a dressing over the suture line and remove it after two days.

I have a small series of over 200 such grafts with extremely encouraging results. Almost all cases have been patients who have been operated on before—up to nine times—and lost all hope of a cure. Around 70% are now completely dry when the flap has been used to relax the vagina, with a sling to support the urethra. There have been several patients coming with closed vaginas and hopelessly incontinent after fistula surgery and I performed this operation just to make a new vagina. It also made them completely continent. The thought is that it works by taking the scarring and tension off the vagina—the scarring that was holding the urethra open.

The drawback of this is that it uses hair bearing tissue. Fortunately in my population the hair in the groin crease is small to non-existent. Some populations are more hirsuit. The longest follow up I have is on one patient in Uganda who was initially growing hair in the vagina, but after 2 years it had almost completely gone and the brown tissue was turning pink! She was completely dry and sexually active. At other times I have seen the patients at six months follow up with some hair in the vagina but interestingly few have complained about it. Whether this be out of politeness I can only imagine, but I usually take them back to theatre and diathermy the hair bearing areas in an attempt to destroy the follicles.

Other surgeons have been using a similar flap but taking skin from the labia majora with the Martius graft. This is far more hair bearing. The cases I have seen at follow up with this operation have worse results. The skin from the labia has started to raise in a mound in the vagina, just like the labia majora whereas the skin from the Singapore flap lies flatter and produces a more anatomical result.

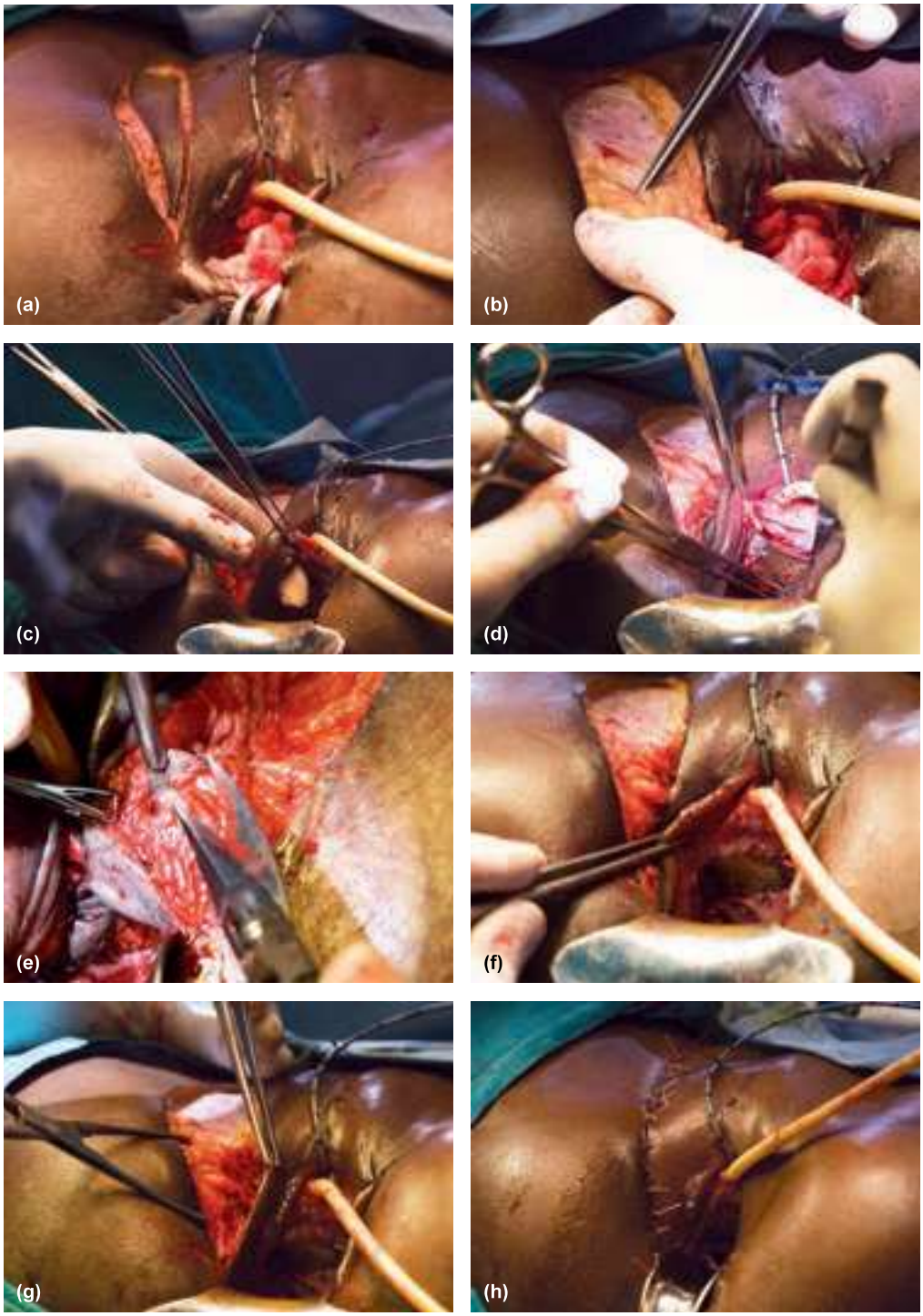


Figure 6.64
The Singapore flap. a) The initial incisions, extending from the inguinal ligament to the level of the posterior fourchette. The groin crease is included. b) The flap is developed with the pedicle over the ischial tuberosity. Note a perforating blood vessel which was preserved.

Figure 6.64 *(continued)*
c) The tunnel is developed into the vagina.
d) The flap is introduced through the tunnel.
e) Be careful to excise any skin that may lie in the tunnel before suturing the flap in place.
f) sutured in place
g) The skin has been excised from the pedicle.
h) Groin crease donor site repaired.
i) The vagina is packed and groin crease dressed.

Labia Minora Flap. The other option is the labia minora flap. Many fistula patients have been circumcised making this option impossible, while in other cultures such as in Uganda, the practice is to elongate the labia minora by pulling. If there is sufficient labia, it can be incised from anterior to posterior leaving the pedicle posteriorly. Be careful not to make your cut too close to the clitoris and thus cut the arteries in this area. Make a very superficial incision through the skin around the base of the pedicle. The skin is very thin here so be careful. Undermine the skin away from the pedicle to get some mobility, again be very careful here as the tissues are so thin. Open the two leaves of the labia minora to try and lay it flat. Sometimes you need to make a small incision through the skin at the distal end to be able to do this. Tunnel into the vagina beneath any vaginal skin remaining and suture the flap in place. Remember to remove any skin from within the tunnel. (Figure 6.65)

This has the advantage that the skin is soft and non-hair bearing. It is however smaller than a Singapore flap and doesn't have the fatty tissue underlying it which is useful for filling any surgical dead spaces.

Figure 6.65
Labia minora flap. a) The labia minora on the right is mobilised anteriorly to posteriorly. Keep a generous pedicle posteriorly. b) The flap is fully developed with the pedicle intact. c) Sutured in place.

The Martius Fat Graft

To Graft or Not to Graft?

For 30 years, a Martius fat graft (in reality a pedicle flap) had been the mainstay of completing a repair for all but the simplest fistulae at the Addis Ababa Fistula Hospital. When introduced, it appeared to produce significantly improved results. However over the last 15 years many experienced fistula surgeons have used it less and less, until it has been all but abandoned, without compromising results.

The idea of the Martius fat graft is to bring good tissue with its blood supply into the area of the repair. The graft appears quite vascular, as it is raised from its bed, but, when pulled into the vagina, there is rarely any sign of bleeding; if an old fat graft is found at a re-repair, it shows little sign of vascularity and resembles a lipoma.

Its proponents claimed that it improved closure rates, and that it filled dead space left on the sides of the bladder and urethra after the fistula repair. It has also been suggested that a pad of fat between the bladder and vagina may offer some protection should the patient be forced by circumstances beyond her control into a vaginal delivery again.

The downside of a fat graft is the extra time and extra use of sutures and slightly increased risk of a haematoma.

Most surgeons rarely use fat grafts. Our possible indications are:

- Some surgeons use it on the rare occasion to cover a repair where there is lack of vaginal skin. (See Vaginal Skin Defects—Options 1 and 2)
- As a last ditch attempt to close a defect that has failed several times. We know of several cases successfully closed at a fifth and greater attempt using a fat graft on the last repair. (Both repairs had been performed on the last occasion by a very experienced surgeon, which could be the reason for the success.)
- On those few occasions where it has been impossible to achieve a watertight closure.
- To support a fragile urethral repair or reconstruction.
- To fill dead space in the lateral spaces around the urethra and bladder after the fistula repair.

As there may still be a place for the use of the Martius fat graft in selected cases, a description will be given here. I currently use a graft in about 1 in 50 repairs.

The Martius Graft Procedure

After completing the bladder repair, five anchor sutures are placed:

- Two sutures above the fistula—one on each side, high and laterally, usually using the corner sutures, which have been left long.

- Three sutures proximal to the repair—two in the side wall of the vagina and one on the midline either into the cervix, if the dissection has extended this far, or at the top of the reflected vaginal wall.

The anchor sutures are not put in the bladder. The sutures are left long, and will be threaded onto eyed needles to pass through the graft.

The operating table is taken out of the Trendelenburg position to bring the labia into comfortable view. The right labia is traditionally used. The sutures that were used to retract the distal vaginal skin on this side are cut.

The labia majora is incised along its length from about the level of the base of the clitoris to the level of the anterior vagina and the fat pad beneath is exposed. (Figure 6.66) The fat pad is grasped with Allis forceps and reflected off the underlying skin laterally and medially. This is area is vascular, especially its medial edge, so attention must be paid to securing haemostasis.

The pedicle of fat is cut level with the top of the incision and dissected downwards off the underlying deep fascia. The dissection continues until the medial margin of the inferior pubic ramus is reached and a tunnel can be formed into the vagina. The raised pedicle is attached inferiorly to maintain its blood supply.

Haemostasis is obtained and then the graft is introduced into the vagina by making a tunnel with the dissecting scissors between the labia and the inferior pubic ramus. It may be necessary to extend the vaginal incision further distally. The vaginal flap is lifted up. The scissors are introduced and the blades are opened a little to enlarge the hole; they are then withdrawn and a finger is pushed through the tunnel. The tunnel must be large enough to accommodate the fat pedicle so that it will not strangulate.

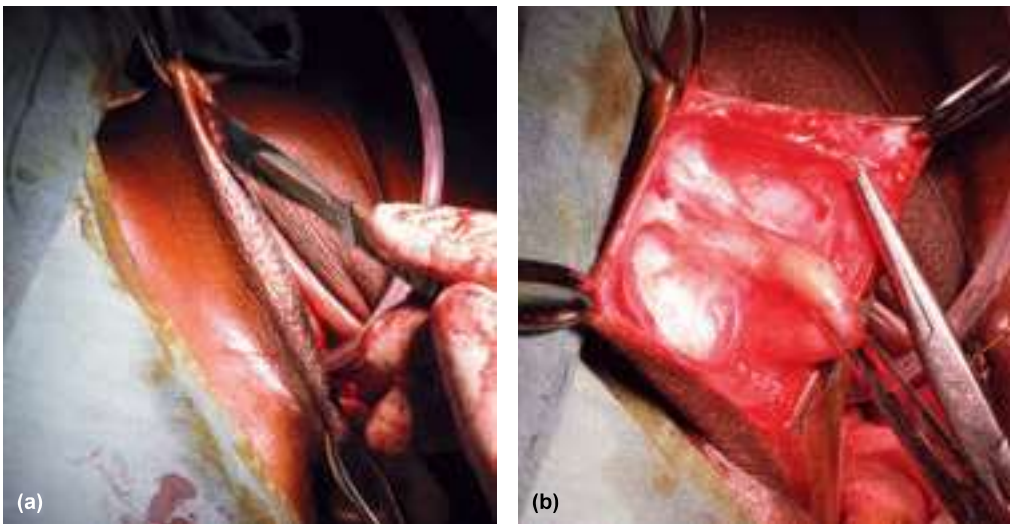
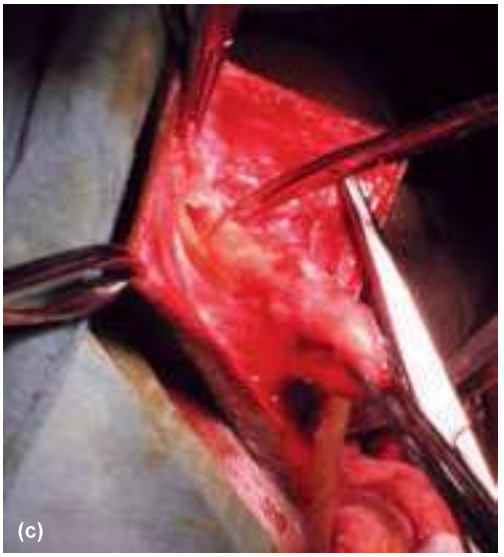


Figure 6.66
The Martius flap/Martius graft. a) The incision is made along the labia majora. b) The fat pad is exposed.

Continued



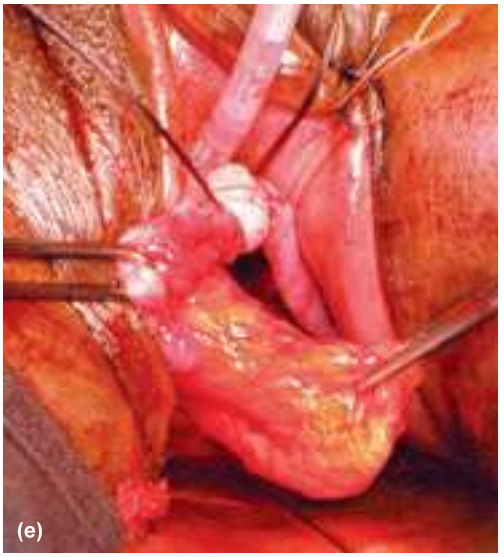


Figure 6.66 *(continued)*
c) and dissected from anterior to posterior, keeping a generous pedicle posteriorly. d) The flap attached by its pedicle. e) Introduced into the vagina. Note the anchor sutures in place. These can only be used like this if you have empty needles that you can use.

The fat pedicle is introduced into the vagina through this tunnel with the aid of Allis forceps and is sutured into place using the five anchor sutures placed previously. The free ends of the sutures are threaded onto a blank needle and both are brought through the fat and tied. The graft should be spread out and lie neatly over the whole of the repair.

The graft site on the labia must be repaired carefully. The area is prone to haematoma formation. The closure is done in three layers, beginning superiorly by taking a large bite with a 0 chromic or Vicryl suture through the previously cut labial fat. The suture is taken continuously down and then back up, closing all potential dead space. The final layer is of interrupted skin sutures.

Bladder Stones

Bladder calculi are found in about 2% of new cases. Their correct management is very important.

Causes

Bladder stones may be caused by:

- foreign material pushed up the vagina and sometimes through the fistula into the bladder in an attempt to stop the leak
- crystals forming in concentrated urine and growing over time
- non-absorbable sutures used in bladder repair (e.g. damage during caesarean section or previous attempt at fistula repair). This can sometimes cause stones to form in the vagina. (Figure 6.67)

Figure 6.67
This is a stone in the vagina that formed around a non-absorbable suture used to repair the vagina at fistula repair. The same can happen in the bladder.

Detection

Bladder calculi almost always occur with small fistulae, although exceptionally a large calculus may be found half in, half out of a large fistula.

Bladder calculi may cause an enormous amount of discomfort, and can often be suspected pre-operatively when there is tenderness on vaginal examination and an odour more severe than usual. A complaint or an observation of haematuria is another sign. The urine is usually infected and smelly.

A large stone can be felt on gentle bimanual examination, and any stone can be detected by sounding inside the bladder with a metal probe. (Figure 6.68) You can feel the probe hit against the stone.

Figure 6.68
Sounding/probing the bladder with a metal catheter for the presence of stones.

Small stones may be missed on clinical assessment. It is vital to detect and remove all stones before embarking on a repair. A missed stone is a disaster. We have seen patients return some time after a successful repair in great distress from a large stone. It is probable that a small one was missed at the repair. If you are in doubt, you can confirm the presence of stones with an ultrasound examination.

Management

Repair of a fistula should be delayed until after removal of a stone. In the presence of a stone, the bladder is thick-walled and hyperaemic, and there is almost certainly urinary infection. These conditions are not conducive for a successful repair, although one paper from West Africa showed that repair at the time of stone removal can be successful. At times I have removed a stone through the fistula and tacked the edges of the bladder together while I was there and patients were cured. But it is prudent to err on the side of caution and remove the stone first, treat any infection and then repair the fistula later. The interval between removal and safe repair may only be about 2 weeks, but each case should be assessed on its merits and local circumstances.

If a fistula is present it is preferable to remove the stone vaginally through the fistula. (Figure 6.69) Sometimes you need to crush the stone through the fistula with Allis and Wrampleys forceps, remove the large crushed segments and then flush out the remainder. If there is no fistula, remove stones by a supra-pubic extra-peritoneal approach. (Figure 6.70)

Infection is usual, and it is essential to give pre-operative and peri-operative antibiotic cover. Intravenous ampicillin 1gm and gentamicin 160mg for the operation, followed by gentamycin 80mg, 12-hourly for 48 hours along with ampicillin. Exceptionally, septicaemia has occurred after stone extraction.

The supra-pubic entry can be either via a low midline incision or small Pfannenstiel with a cut large enough into the bladder to extract the stone with sponge forceps. It is best to try not to enter the peritoneal cavity to reduce the chance of contamination from an infected stone and urine into the peritoneal cavity. Fortunately, most stones are solitary and firm, and do not

crumble on extraction. If the stone does break into fragments, it is vital that they all be washed out and removed. Even one small residue will lead to another stone. After removing the stone irrigate the bladder and the wound liberally to wash away any potential source of infection.

The bladder can be closed and drained through a urethral catheter for 10 days.

Figure 6.69
This stone was in the bladder and protruding through the fistula into the vagina. Note the central constriction on the stone which indicated the fistula margins. The fistula was successfully closed two weeks later.

Figure 6.70
A larger stone in a patient with a closed fistula. It was removed by a supra-pubic incision.

Failed Repair and Re-Operation

Everyone who operates on obstetric fistula patients regularly will get failures, where the repair breaks down. It is very discouraging for the surgeon and more importantly hugely disappointing for the patient who has her hopes on being cured.

There are many causes. It could be that the operation was not done well and there was too much tension on the suture line, the patient's tissues may have been poor, she could have undiagnosed diabetes causing poor tissue healing. Recently I've diagnosed schistosomiasis in patients who had unexpected failed repairs. After treating the schistosomiasis and waiting some months, I re-operated and they were cured. There could have been difficulties in the post-operative period with an infected haematoma, wound infection or a blocked catheter. The fistula that is more at risk of breakdown is the larger, more scarred, circumferential repair with little vaginal tissue left.

Breakdowns can be early, in the first couple of days after the operation, but most occur from day 7 to day 9 after the operation. It is general practice to leave the bladder on free drainage, thus relaxing the bladder and enabling the edges of the breakdown to oppose and hopefully heal. If the fistula breaks down I generally leave the catheter for another week. If the leakage through the vagina is decreasing I leave the catheter until it is completely dry from the vagina and add another week of catheterisation from the day that the patient becomes dry. If after a week to ten days it is obvious that the leakage is not decreasing, I remove the catheter and label it

a breakdown. Some people operate sooner rather than later, but for the best results it is best to wait 3 months so the tissues are completely recovered, and operate again.

In my personal practice I find that about 50–60% of patients I see for the first time have had a previous repair elsewhere, sometimes up to eight or nine repair attempts. This is mainly because people save these cases for me when I visit. Many of these cases are still quite easy to cure, as they were simple ones inexpertly done, but some are extremely challenging and have a very poor prognosis. Of course, I also have to operate on my own failures. The general rule is that the first operation is the patient's best chance of being cured and the more times you operate, the less chance she has of ever being cured.

Sometimes the patient is wet straight away after theatre. Most commonly this occurs when there is a Foley catheter and ureteric catheters in the urethra. This splints it open slightly and urine can leak around the catheters through the urethra. This calls for reassuring of the patient. It usually resolves when the ureteric catheters are removed. However there are more serious causes which need excluding.

The catheter could be blocked, making the bladder fill up and the urine leak around the catheter. You need to try and draw back with a syringe in the foley or gently flush it. You should also check with a gentle and careful dye test with good exposure and lights—ideally in theatre. The most likely explanation is the presence of an overlooked ureteric fistula or another vesico-vaginal fistula. If a ureteric fistula is confirmed, a ureteric implant can be performed electively at a later date. I prefer to do this after the fistula has healed so you don't risk pulling and pushing on your repair as you reimplant the ureter from above. If you are operating at a fistula camp and the patient won't have the chance to be reoperated on for some time, I would do it in the immediate post-operative period. If, however, the dye test is positive and the repair is thought to be sound, it is tempting to take the patient back to try and stop the leak with additional sutures.

Provided that the re-operation is performed within 48 hours, the bladder will hold additional sutures well, and, on the occasions when this has been tried, the leak was stopped at the repeat operation. I have done this about 20 times with a 70% success rate on discharge. After 48 hours, the tissues become oedematous and further suturing is unlikely to be successful as the sutures just tear through the tissues. Most breakdowns occur from day 7 to day 9. Their immediate conservative management is described above.

If you have tried all of those steps and the patient is diagnosed with a failed repair, then wait 3 months to try again or refer to a more experienced surgeon if there is one available.

The principles of a re-repair are no different to those for a new case. There will, however, be less healthy tissue available, more scar and distorted anatomy, so it will be harder to mobilise and get a tension free closure of healthy tissue. Clearly, the patient needs to be carefully assessed prior to the operation, noting the presence of any of the risk factors, and the surgeon needs to decide if he or she is confident enough to operate. We advise waiting at least 3 months before attempting a re-repair.

A few breakdowns will be in the middle of the old repair and therefore easily accessible,

but the majority are small and inaccessible at the lateral margins of the repair or at the corners of a circumferential anastomosis (Figure 6.71), the fistula being stuck right on the bone. These are challenging to repair. There are several tips for repairing these. First, exposure must be optimal, with episiotomies if necessary. Small corner defects that are high in the anterior vaginal fornix can often be approached directly, but better access may be obtained by mobilising the bladder off the cervix and advancing the sidewall of the bladder up to the defect and actually repairing bladder muscle to the pelvic side wall. You need very accurate suture placement as it is easy to leave a gap under where you have repaired the bladder to the side wall so that urine can still escape from the fistula and under here. Elevation of the vaginal skin off the defect is greatly helped by Thorek scissors. It is impossible to find the ureteric orifice through small holes, and we simply close the defect with two or three sutures—either directly if possible or to the sidewall. As the lateral margin is often close to bone, it is important to take strong bites and then insert all the sutures before tying them. A small J or 5/8-circle needle is a great help here. Wherever possible, swing a small flap of fibro-muscular tissue from under the pubic arch as a reinforcement and bring some healthier tissue to graft over the repair.

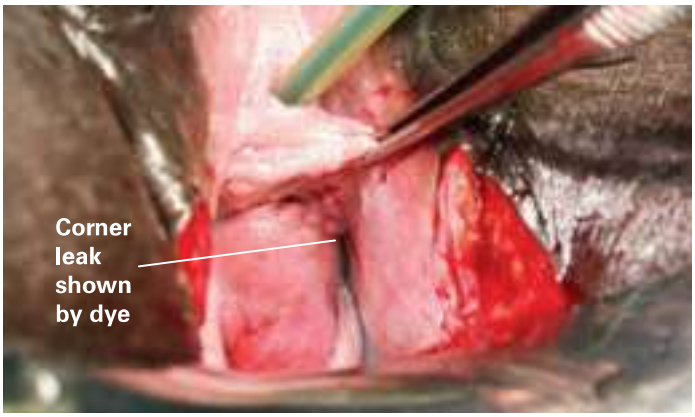


Figure 6.71
The dye test has revealed a small fistula in the corner of the vagina, right against the bone. The first operation was a circumferential fistula and it broke on the lateral anastomosis. Note a relatively short anterior vaginal wall, the cervix has been pulled towards the repair site.

Occasionally you will find two lateral fistulae, one on each side stuck firmly against the bone. This is always after a circumferential repair. After total reflection of the vagina I connect the two fistulae and invariably find that the anterior repair of a circumferential case has not been done, so I close the defect as a formal circumferential case. The results are good.

In the case of slightly larger defects from a breakdown, I occasionally enlarge them to see inside the bladder to check the ureters. More often I just check that the ureteric orifice it is not on the margin of the defect by probing, always with the help of 10mg intravenous furosemide. Using this minimalist approach, we have not knowingly had any problems with ligated ureters, but always beware as the ureter could be anywhere after a previous fistula repair.

Residual fistulae high in the region of the cervix following a failed intra-cervical repair provide a special challenge that depends largely on how much the cervix can be pulled down. Brian Hancock had two patients both of whom had two failures by the vaginal approach. They were quite easily cured on their third operation through an abdominal trans-vesical approach.

Figures 6.72–6.74 show some examples of re-repairs.

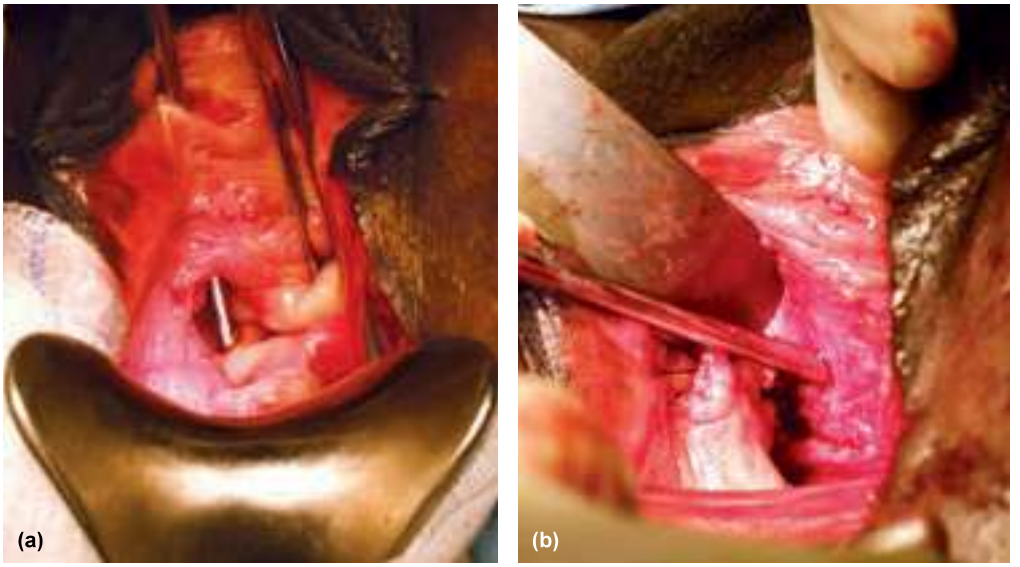


Figure 6.72
a) A small recurrent fistula at another common site, at the top of the vagina on the side, this time on the right hand side. Access to these can be difficult and an episiotomy might be helpful. b) The fistula has been mobilised and released off from the lateral pelvis and now repair is easy. Be careful of the ureter. I always give lasix to see if it is close to the margin or outside the bladder.

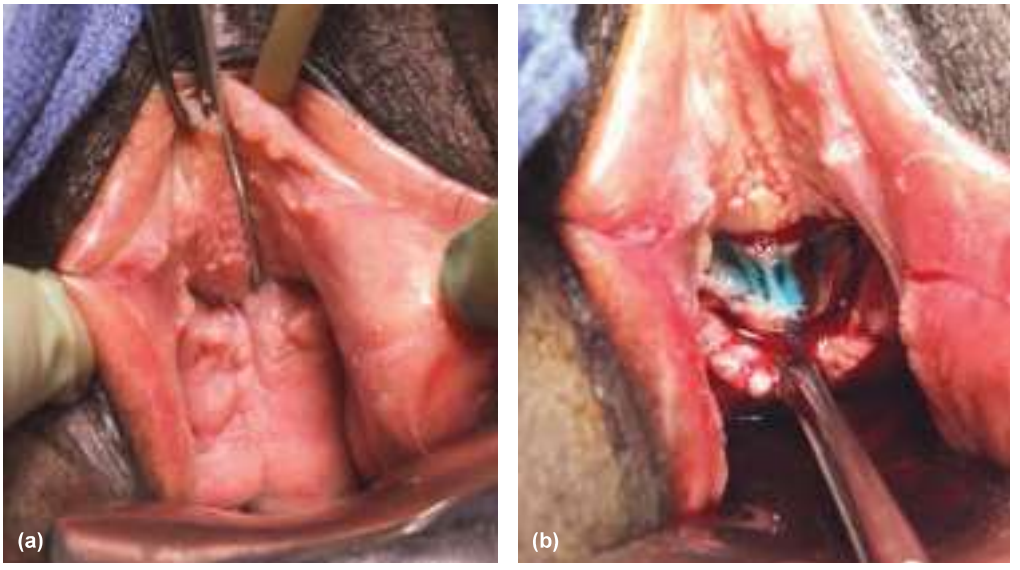


Figure 6.73
a) This appeared to be a small corner fistula at about the level of the bladder neck. b) However at the dye test there were multiple small fistulae. The whole area was excised to get back to good healthy tissue which was repaired under no tension. The patient was then cured.

How Many Times Can One Go on Attempting a Repair?

The chance of successful repair diminishes with each attempt, but, as long as there is some reasonable tissue and enough bladder and urethra to function, it is worth going on. I have seen a repair succeed and the patient cured after 12 attempts by various surgeons. In many patients, however, it will unfortunately be obvious from the degree of scarring, size of bladder and poor urethra that multiple attempts are not appropriate. I stop attempting to repair when the bladder is too small ever to be continent, although I must admit that I have had a handful of patients with tiny bladders who begged for another attempt and did get cured and became dry. Voiding small amounts frequently, they were happy.

Does HIV Status affect Success?

This is a big unanswered question. Clearly, it would not be sensible to operate on someone who is sick with AIDS, but one sometimes wonders if an unexpected breakdown might be due to a reduced immune status. Brian Hancock has had four patients who had repeated unexplained breakdowns after relatively simple repairs. Two were HIV positive and two were not. I've had a few simple recto-vaginal fistula cases break down unexpectedly and then tested them for HIV. They were all positive with a low CD4 count. It is now recommended that HIV be tested before every repair (depending on the government policy in your country). Test the CD4 counts if they are positive and operate when the CD4 is above 300. Occasionally I have operated with a low CD4 count, and the chance of breakdown is higher; more so with more difficult cases and rectal cases. The lowest CD4 count I have operated on is 70. The patient was cured, but it was a small, midline, non-scarred bladder fistula.

Other Infections?

Occasionally I see tuberculosis of the bladder causing a fistula. Patients usually give a history of spontaneous onset of continuous leakage of urine, not preceded by a long labour. On examination there is no cancer causing the fistula and the tissues feel supple. A biopsy reveals the granulomas of bladder tuberculosis. Sometimes we see breakdowns over multiple sites, usually clustered pin hole breakdowns making a watering can appearance of the old repair site. This is almost always a breakdown due to an infection such as tuberculosis.

More recently I have been screening patients for schistosomiasis. I have found several patients with unexplained breakdowns, that is patients with small midline fistulae, seemingly good tissues, HIV negative but who kept breaking. They tested positive for schistosomiasis and after treatment were cured with the next operation!

Results of Re-Repair

With repeat operations, results do decrease. In an unpublished series from Ethiopia I did in the early 2000s I found a 75% closure rate but a 52% ongoing incontinence rate at the second operation. If that failed, the closure rate reduced to 50% and ongoing incontinence rate to 75% with the third operation. However with the new surgical principles and the utilisation of flaps and slings the success rate has increased.

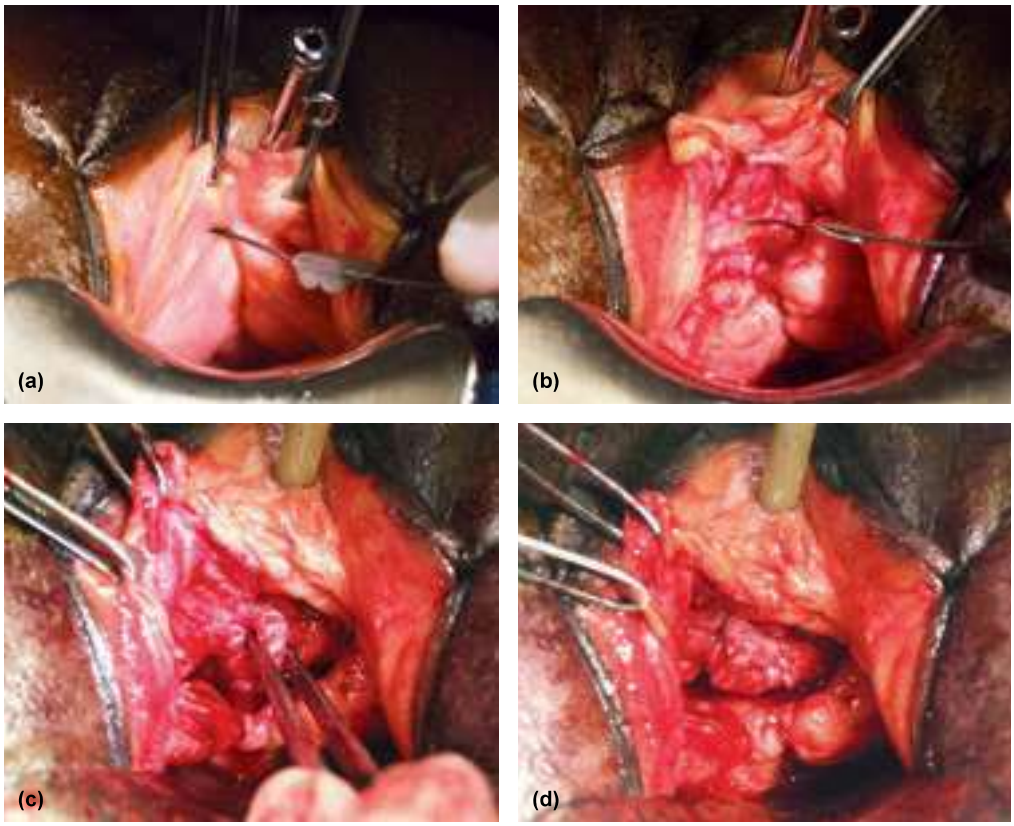


Figure 6.74
a) Another small corner fistula at the bladder neck, situated against the bone. b) It's now mobilised and released from its attachment to the pelvic bones. The margins were trimmed slightly and repaired. c) A fibro-muscular sling was placed over the repair to act as a graft and to help prevent post-repair incontinence. d) Fibro-muscular sling in place.

Ureteric Fistulae

Ureteric fistulae are increasingly common. In Brian Hancock's series from Uganda, about 5% of fistula patients had a ureteric fistula and correspondence with Addis Ababa Fistula Hospital indicates that they are seeing more and more. In my practice around East Africa I am certainly seeing more as the years pass.

Ureteric fistulae almost always follow a cesarean section. Fortunately more women are getting medical help in labour now compared to say 20 years ago, but unfortunately the doctors or health officers performing caesareans have not been trained adequately and many of these ureteric injuries could have been avoided. Many people doing a caesarean do not reflect the bladder at all or reflect it inadequately before incising the lower segment; when they repair the lower segment they incorporate the bladder and/or ureter in the suture line which results in a vesico-cervical fistula and/or a uretero-vaginal fistula. Sometimes this is hard to avoid with a difficult caesarean after a long obstructed labour, poor instruments, no assistant, no lighting and extension of the lower segment incision laterally to the blood vessels and ureter.

However you can reduce the risk by reflecting the bladder before incising the lower segment. It takes only a matter of seconds to do.

Other cases of ureteric fistula occur after emergency hysterectomy for a ruptured uterus. Considering the difficult conditions and the inexperience of many doctors called upon to treat ruptured uterus in rural areas, these injuries are understandable. Any urine leaking into the pelvis will soon find its way out between the sutured vaginal vault and the cervical remnant.

A ureteric fistula can similarly be caused at elective hysterectomy, usually for large fibroids where the normal anatomy is distorted and the ureters have been pushed into all sorts of unexpected positions. A hysterectomy for a large cervical cancer can cause similar problems and a ureteric fistula may occur.

The fourth cause of ureteric fistula is unrecognised injury to a ureter at the time of a vesico-vaginal fistula repair. In this situation, it may be possible at a later date to catheterise the ureter from the vagina and implant it into the bladder transvaginally. If you can't catheterise the ureter vaginally you will need to reimplant it abdominally as there will be a stricture in the ureter that needs to be relieved.

If the patient has several living children, and an abdominal operation is planned, the option of tubal ligation should be discussed. It is easy to do this at the same time as the ureteric implantation.

Diagnosis of ureteric fistulae is discussed at the end of Chapter 2. An ultrasound scan showing a distended ureter on one side is helpful confirmation. However, it is essential to confirm again on the table that the dye test is really negative and that clear urine appears in the vagina after giving furosemide. In partial injuries, the leak can be very small. If there is dye in the vagina then there is a fistula to the bladder, if the urine in the vagina is clear, it is from the ureter.

The affected ureter must be identified in the pelvic side wall and traced down to the point of injury. Four times out of five the affected ureter is found to be dilated, and thickening and can usually be felt at the site of injury. If the ureter is draining very freely into the vagina, it will not be dilated but this is more rare, there is usually some scar causing a stricture which in turns causes hydronephrosis. The most reliable method of confirming the site of injury is to open the bladder and look inside at the ureteric orifices. Intravenous furosemide 10mg should be given and the non-functioning side identified. Exceptionally, a partial ureteric injury (e.g. after a previous repair) may still produce urine into the bladder and leakage from a tract into the vagina—but it won't leak nearly so much as the uninjured side.

If the diagnosis and the side that the ureteric fistula is on are certain, some surgeons prefer an extraperitoneal approach, but I prefer a midline incision. The abdominal approach is usually quite easy, and the results are uniformly successful.

I sometimes have difficulty implanting the ureter into the bladder with no tension. This is because the ureter is stiff and scarred from the longstanding hydronephrosis and the bladder can be small and stuck due to adhesions. Twice I've had to call on a urologist friend to make

a new ureter out of small bowel to enable it to reach. On two other occasions we've tunnelled the ureter to the other side and implanted its end to the side of the contralateral ureter (end to side anastomosis). To reimplant it into the bladder without tension you can follow the following principles:

1. Fully mobilise the contralateral side of the bladder and support the anastomosis with a psoas hitch stitch.
2. Make a tube out of the dome of the bladder (Boari's flap) or incise the bladder transversely but repair it longitudinally.

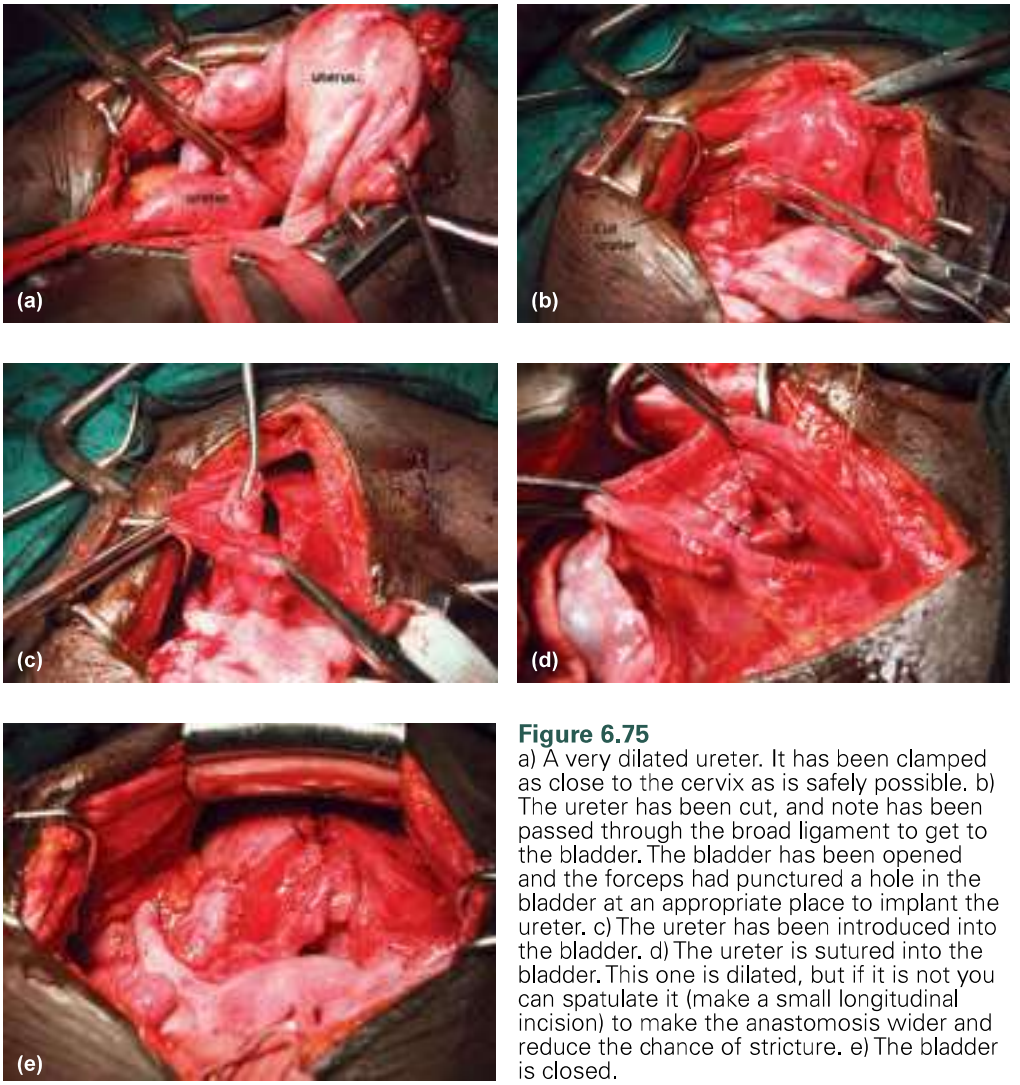


Figure 6.75
a) A very dilated ureter. It has been clamped as close to the cervix as is safely possible. b) The ureter has been cut, and note has been passed through the broad ligament to get to the bladder. The bladder has been opened and the forceps had punctured a hole in the bladder at an appropriate place to implant the ureter. c) The ureter has been introduced into the bladder. d) The ureter is sutured into the bladder. This one is dilated, but if it is not you can spatulate it (make a small longitudinal incision) to make the anastomosis wider and reduce the chance of stricture. e) The bladder is closed.

The steps of the operation are shown in Figure 6.75. I always stent the implanted ureter with a ureteric catheter, but some urologists don't, especially if the ureter is dilated and implanted with no tension. The distal end of the ureteric catheter can be brought out alongside a urethral catheter or through a separate stab incision in the anterior bladder wall. The ureteric catheter, if used, can be removed on days 7–10 and the urinary catheter removed on day 10–12.

Further Reading

Browning A. Prevention of residual urinary incontinence following successful repair of obstetric vesico vaginal fistula using a fibro-muscular sling. *Br J Obstet Gynaecol* 2004; **111**: 357–61.

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Elkins TE, Ghosh TS, Tagoe GA. Stocker R. Transvaginal mobilization and utilization of the anterior bladder wall to repair vesicovaginal fistulae involving the urethra. *Obstet Gynecol* 1992; **79**: 455–60.