Chapter 16
Obstetric Fistula

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Abbreviations

CT	Computerized tomography
EUM	External urethral meatus
IVU	Intravenous urography
LHRH analogues	Luteinizing Hormone Releasing Hormone
LSCS	Lower segment Caesarean section
MRI	Magnetic resonance imaging
TB	Tuberculosis
UGF	Urogenital fistula
UTI	Urinary tract infection
UTVF	Ureterovaginal fistula
VVF	Vesicovaginal fistula
WHO	World Health Organisation

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Introduction

Obstetric urogenital fistulae are a major health issue in resource limited countries consequent to prolonged, obstructed second stage of labour [1]. In well-resourced countries obstetric urogenital fistulae are a rarity and mostly Caesarean section related [2]. The World health Organization (WHO) estimates that 50,000–100,000 women develop obstetric fistula worldwide each year [3], mainly in sub-Saharan Africa or south Asia. This is likely to be a significant underestimate as reported data is scanty and often inaccurate. Many women in resource limited settings live with their fistulae for decades without surgical repair with untreated obstetric fistulae estimated to affect approximately 3.5 million women worldwide [4].

The consequences of developing an obstetric fistula in a resource limited country include not only urinary and/or fecal incontinence but also fetal death, lower limb and pelvic girdle injuries alongside significant psychological, social, and financial adverse effects [5]. These women are often outcasts. They are considered unclean because they are soiled, stinking and continually wet. They are stigmatized by their family and communities, often divorced by their husbands, and relegated to precarious lives on the margins of society [6].

Incidence

The 2006 WHO estimated that two million women worldwide were living with VVF. This estimate was made from a countries' rapid needs assessments and physicians' reports rather than robust epidemiological studies [7]. The current figure is likely to be much higher, up to 3.5 million women worldwide [4], with high fistula prevalence rates reported in Nigeria, Kenya, Ethiopia and Bangladesh [8]. It is estimated that there are one million women living with VVF in Nigeria alone [9] and that 1/1000 deliveries in Nigeria and Kenya are complicated by obstetric fistula [9, 10] The World Health Organization estimates that 50,000–100,000 women develop obstetric fistula worldwide each year [3].

In contrast to this VVF, in particular obstetric VVF, are vanishingly rare in well-resourced settings—with a total of 74 VVF (none of which were obstetric VVF) recorded in England (population 55 million) in 2018–2019 [11].

There continues to be a paucity of accurate data regarding obstetric VVF. Most data is from relatively few countries on each continent. Studies deriving data from demographic and health surveys and questionnaires are likely to overestimate incidence [12]. Studies deriving data from local hospital and community records are likely to underestimate both incidence and prevalence of the condition by neglecting to include women living in hard to reach, rural areas [13] who are the most likely to be affected by the condition.

Types of Obstetric Urinary Tract Fistula

Whilst obstetric fistulae are primarily vesico-vaginal, obstructed second stage of labour can also result in uretero-vaginal, utero-vaginal, urethrovaginal and recto-vaginal fistula.

Uretero-Vaginal Fistulae (UTVF)

A uretero-vaginal fistula is defined as an abnormal communication between the ureter and the vagina (or the uterus or cervix). Full assessment to exclude a simultaneous VVF is essential as UTVF are associated with VVF in up to 25% of cases [14–17]. Up to 9% of women with UTVF present with acute renal failure (ARF) due to delayed presentation and diagnosis [15].

Aetiology of UTVF

The commonest cause of UTVF worldwide is injury by incision, division, crush, tie, or diathermy at time of hysterectomy [15, 18]. UTVF may also arise because of pressure from an obstructed second stage of labour [19].

Presenting Symptoms of UTVF

Most data on UTVF are on post-surgical UTVF with minimal data available on obstetric UTVF. UTVF are generally asymptomatic until the affected woman experiences sudden onset of urinary leakage from the vagina, at around 1–4 weeks post-delivery [15, 20, 21]. If symptomatic, it is generally with back or loin pain [15, 22] due to partial or complete ureteric obstruction (present in over 2/3) causing hydronephrosis. Over 10% of UTVF patients have a non-functioning kidney at time of diagnosis due to delayed presentation and diagnosis in the majority [15, 23].

Diagnosis of UTVF

CT Urogram with delayed urogram images (Fig. 16.1) provides the most accurate and rapid diagnosis along with identification of level of ureteric injury. IVU or retrograde urography can be utilized instead of CT Urogram if it is not available [15]. Ultrasound is often performed as a primary investigation, demonstrating upper tract dilatation in the majority, and should lead to further imaging as delineated above. Cystoscopy to exclude a simultaneous VVF is mandatory following the diagnosis of UTVF [20, 21].

Fig. 16.1 CTU showing right uretero-vaginal fistula

Treatment Options for UTVF and Outcomes

Immediate renal drainage, either by insertion of a ureteric stent, nephrostomy tube or formation of cutaneous ureterostomy should be performed to preserve renal function [24, 25] whilst awaiting resolution of inflammatory changes and definitive surgical repair, if required. Ureteric stent insertion may not be straight forward, and rendezvous (antegrade-retrograde) access or "cut-to-the-light" endoscopic techniques may be required to allow placement [26]. Complete healing of UTVF has been reported in 5–15% following stent placement alone [24, 25].

Classification of ureteric fistula is by:

1. Cause of the injury (cut, tie, diathermy, avulsion, ischemic (obstetric))
2. Complete or incomplete division of the ureter
3. Size of the ureteric defect.

This classification allows categorization and thence comparison of UTVF treatments and outcomes, and the prediction of the odds of success from minimally invasive management techniques. If minimally invasive management treatment fails or is not available, then open or laparoscopic/robotic options should be utilised.

Surgical treatment consists of open or laparoscopic/robotic uretero-vesical reconstruction ± VVF repair. Direct reimplantation is possible in up to 80% of cases, whilst psoas hitch, Boari flap, transureteroureterostomy and ileal chute interposition are required in up to 20% (Table 16.1, Fig. 16.2). Complete renal loss occurs in around 2% of cases. In cases having successful direct reimplantation, stabilization of the repair with a psoas hitch to prevent ureteric kinking yields best results [28].

Vesico-Vaginal Fistulae (VVF)

A vesicovaginal fistula (VVF) is defined as an abnormal communication between the vagina and the urinary bladder. It is a devastating complication of poorly managed (second stage) labour and, far less commonly, pelvic surgery and/or radiotherapy [29, 30].

Aetiology of VVF (Table 16.1)

The majority (>90%) of low resource setting VVF arise due to neglected, prolonged, obstructed labour [29, 31]. Whilst 6–13% are caused by Gishiri cutting, sexual assault, post-coital injuries, and infections such as tuberculosis (TB) [32–35].

In contrast in high resource settings the majority (>90%) of VVF are iatrogenic, following pelvic surgery for benign and malignant conditions [36, 37] or radiotherapy to treat malignancy [38]. An increase in lower segment Caesarean sections (LSCS) in both elective and emergency obstetrics has resulted in an increasing number of iatrogenic urogenital fistula (UGF), accounting for up to 12% of cases in some series [39, 40].

Table 16.1 Aetiology of fistulae in the developing and developed world. Table uses data presented in Hillary CJ Osman NI, Hilton P, Chapple CR. The aetiology, treatment, and outcome of urogenital fistulae managed in well- and low-resourced countries: a systematic review. Eur Urol. 2016 Sep;70(3):478–92 [27]

Aetiology	Low-resource settings	High-resource settings
Obstetric causes	95.2%	3.5%
Prolonged, obstructed labour	44.9%	0.1%
Surgical causes	4.4%	83.2%
Abdominal hysterectomy	1.2%	46.2%
Radical hysterectomy	0%	4.2%
Vaginal hysterectomy	0.4%	1.9%
Other pelvic surgery	1.6%	12.7%
Radiotherapy	0.2%	13%

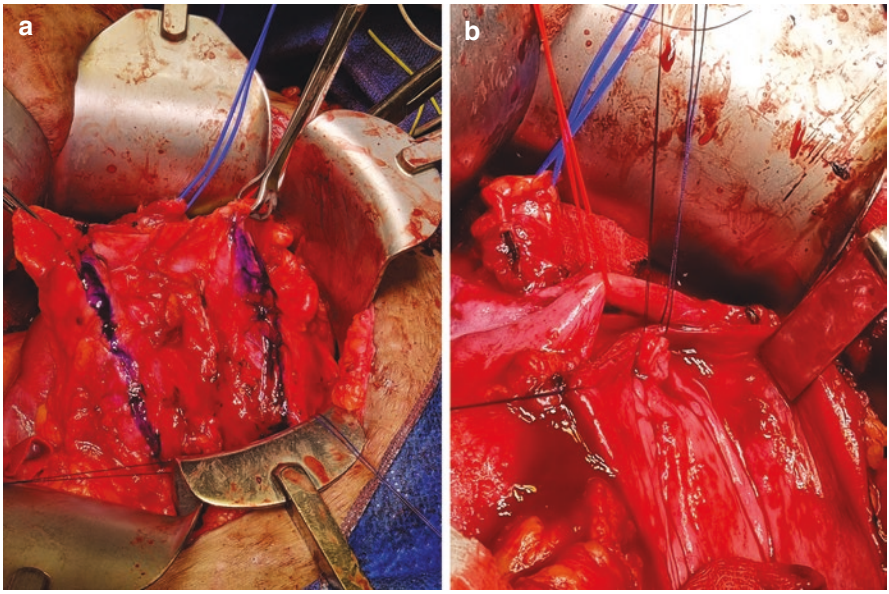

Fig. 16.2 Open abdominal ureteric reimplantation for obstetric ureterovaginal fistula. (**a**) Outline of left Boari flap on anterior bladder wall. (**b**) Left Boari flap with psoas hitch and Leadbetter-Politana tunnel for ureteric reimplant

Classification of Obstetric VVF

There have been many classification systems for obstetric VVF described over the years however none have attained universal acceptance. The two most widely used classifications are those of Goh [41] and Waaldijk [42].

The Goh Classification [41]

- Type 1—Vesico-Cervico-Vaginal Fistula
- The distal edge of the fistula is >3.5 cm from the external urethral meatus (EUM)
- Type 2
- The distal edge of fistula is between 2.5 and 3.5 cm from EUM
- Type 3
- The distal edge of the VVF is 1.5–2.5 from the EUM
- Type 4
- The distal edge of the VVF is <1.5 cm from the EUM

The Waaldijk Classification [42]

- Type I—Vesico-Cervico-Vaginal Fistula
- Does not involve the urethral closure mechanism
- Type II
- Involves the urethral closing mechanism
- Type III
- The ureteric orifices are involved

The prognosis in terms of likelihood of anatomical closure and restoration of continence worsens with grade in both classifications.

Although VVF classification offers a useful framework for describing fistulae and has some prognostic value, it has not been proven to be useful in all settings [43]. Most VVF in high resource settings are type 1/1 and neither the Goh nor the Waaldijk classification systems appear to have practical relevance in terms of outcome prediction [43].

In low resource settings critical factors for VVF outcomes are the position and size of the fistula, in particular its' proximity to the ureters and whether the urethral closure mechanism is involved. A comparative study between the Goh and Waaldijk classification systems found that the Goh system was significantly better at predicting successful fistula closure [44, 45]. However, there is a large degree of subjectivity in the application of all available classifications, with accuracy dependent upon both surgical experience and individual interpretation [46]. The goal must be the development of a simple, simple, standardised, international system (similar to that used to stage cancers) [47] which accurately predicts surgical outcomes.

Predisposing Factors

The pre-eminent risk factor for obstetric VVF is poverty, not just of wealth, but also of education and environment. Women developing obstetric VVF are commonly poor, young, illiterate, and live in rural communities [48]. The average age at marriage for "women" developing obstetric VVF is 14.7–15.9 years and at first pregnancy and delivery is 16.9 years [48–50]. Women most commonly develop their fistula during their first delivery (43.5%), and 83% develop their obstetric VVF before the age of 20 [48–50].

These unfortunate young women are also likely to be malnourished, with stunting of their overall and pelvic growth [49–51]. This stunting exacerbates cephalopelvic disproportion related to their lack of physical maturity and in many cases their underlying anatomy (for example African women have naturally narrower pelvises) [51–53]. Cephalo-pelvic disproportion is a significant causative factor for

obstetric VVF—with larger male fetuses and/or malpresented fetuses of either sex more commonly involved in obstructed prolonged labour [54]. Women with obstetric VVF experience prolonged obstructed labor of on average duration of 2.3 days with fetal death from asphyxiation and subsequent still birth in 89–90% [4, 55].

The multi-level poverty that predisposes to obstetric VVF development is also associated with a reduction in the likelihood of/or ability to seek medical care. In Benin, Sierra Leone and Ghana obstetric complications are believed to be God's will, the consequence of evil spirits or inherited [49, 53, 56]. In some provinces of Nigeria woman need their husbands' permission to access emergency healthcare [53, 56] and birth injuries may be stigmatized as God's punishment for previous sexual misbehavior [4, 55]. There is also a lack of understanding in some communities that Caesarean section is life saving and a perception that failure to give birth vaginally is a form of reproductive failure [57]. The financial cost of obstetric care also presents a significant barrier for many [52, 53].

Prevention

Short-term preventative strategies for obstetric VVF are:

- Improved care during labor
- Increased access to emergency obstetric services (particularly Caesarean section)
- Improved medical care during and after obstructed labor

The long-term preventative strategies for obstetric VVF are:

- The development of specialist fistula centers to treat injured women
- Universal access to emergency obstetric care
- Universal access to family planning services
- Increased level of education for girls and women
- Community economic development
- Enhanced gender equality [58]

These are all the reasons that obstetric VVF have all but vanished from high resource settings.

Pathogenesis

When the second stage of labour is obstructed, the fetal head is compressed against the tissues of the birth canal for a prolonged period. This causes local tissue ischaemia which eventually results in necrosis [50, 52, 59, 60] and destruction of the vesicovaginal septum with consequent fistula formation. Further local tissue damage occurs secondary to the irritation and infection caused by the subsequent continuous urinary incontinence which in turn increases inflammation and scarring [49, 50]. The level at which obstruction occurs during labor determines the site at which the fistula will subsequently develop [59, 61]. For example, if labor becomes

obstructed at the pelvic brim, the resulting VVF will be high in the pelvis whilst if labor becomes obstructed at the pelvic outlet, the VVF will be closer to the urethra.

VVF is only 1 part of the "Obstetric Injury Complex" formed from a combination of any or all the following: urethral damage, renal failure, vaginal stenosis, rectovaginal fistula, pubic symphysis damage and foot-drop due to compression injuries of the local nerves [49–52].

Presenting Symptoms

Up to 80% of women with obstetric VVF may never seek treatment [51, 52, 55] secondary to lack of knowledge, infrastructure, and resource ± shame [53]. Many live with their VVF for years before presenting with persistent urinary (and/or faecal) incontinence, urinary tract infection and ammoniacal dermatitis [62]. The volume of urine voided per urethra and the volume of urinary incontinence vary significantly depending upon the site and size of the VVF. Urinary incontinence can range from continuous (large and low fistulae) to intermittent and postural (small and high fistulae). Other symptoms include pelvic pain, dyspareunia due vaginal stenosis and/or incontinence and infertility [63]. Women with obstetric VVF suffer from significant depression, post-traumatic stress disorder and mental health dysfunction [51, 53], the end result of which is sadly suicide for some [64].

Diagnosis

Examination of the vagina utilizing a Sims speculum and Rampley sponge holding forceps may show pooling of urine in the vagina ± the fistula itself (Fig. 16.3) [62]. Pre-existing pelvic organ prolapse and urgency and/or stress urinary incontinence should be also noted. Cystography or methylene blue installation ± the "3 swab test" (the placement of 3 white swabs in the vagina followed by intravesical instillation of 100 mL methylene blue dye diluted 50:50 with normal saline) may allow visualisation of more subtle fistulae directly by visualisation of blue tracking into the vagina or indirectly by observation of blue staining on the innermost swab (Fig. 16.4) [52, 65, 66].

Simultaneous cystoscopy and vaginal examination remain the gold standard for diagnosis and allow classification of the fistula by determining size, location, and tissue quality (Fig. 16.5) [61, 65]. Associated inflammation, infection and tissue friability should also be recorded and may prompt postponement of fistula repair to allow them to settle. Vaginal length, mobility, vascularity and tissue quality along with width of the genital hiatus and vaginal introitus are important factors to record for classification and to determine the route of repair—vaginal or abdominal.

Up to 20% of women with VVF will have concomitant ureteral injuries (obstruction ± UTVF) [62] and all women with VVF should have a CT Urogram, IVU, retrograde ureterography or very rarely MRI to exclude this (Figs. 16.6 and 16.7) [59, 66].

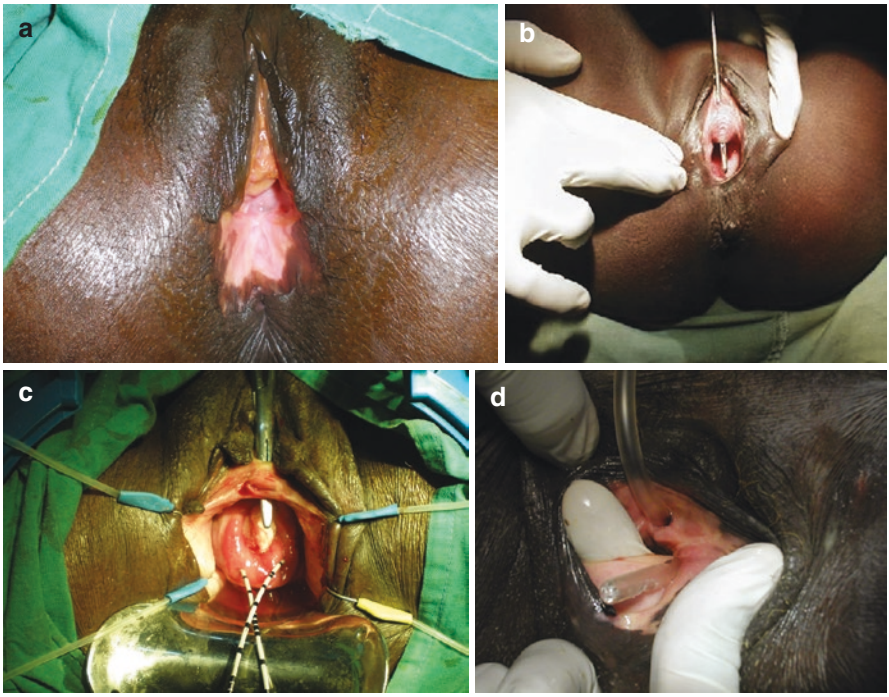

Fig. 16.3 Obstetric VVF on examination. (**a**) Perineal loss. (**b**) Proximal urethrovesicovaginal fistula. (**c**) Complete loss of urethra and bladder neck. Stents in the ureteric orifices. (**d**) Rectovaginal fistula

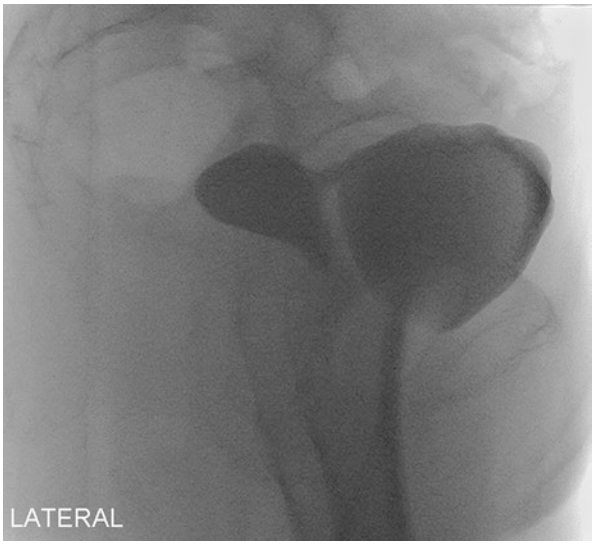

Fig. 16.4 Cystogram to diagnose VVF

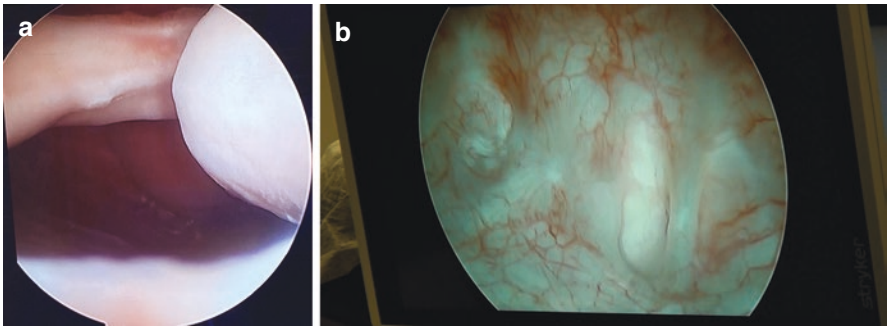

Fig. 16.5 Cystoscopic diagnosis of VVF. (**a**) Large VVF—view into bladder from the vagina. (**b**) Small VVF—at 6 O'clock in bladder

Fig. 16.6 CTU of VVF—to left of midline

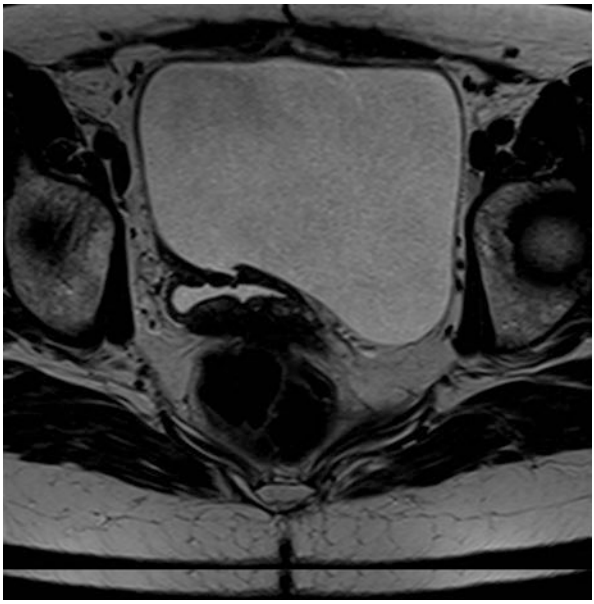

Fig. 16.7 MRI of VVF—to right of midline

It is also important to exclude other causes of urinary incontinence such as stress, urgency, mixed and overflow incontinence and vice versa. Rarely patients with long standing refractory urinary incontinence have been found to have VVF as the cause of their problems [50].

Management Options For VVF

The aims of VVF management are:

1. Anatomical closure of the VVF
2. Restoration of complete urinary continence
3. Restoration of volitional voiding
4. Diagnosis of malignancy (if indicated)

Conservative Management

Spontaneous closure occurs in up to 12% of women managed with indwelling catheters and anti-cholinergic medication for the first 3–6 weeks following the precipitating injury [67–69]. Excellent nutrition, infection control and urinary drainage (using indwelling catheters or nephrostomy tubes) are first line primary management. If this fails to result in spontaneous closure of the within primary closure of the fistula within 6 weeks, the VVF is unlikely to close with continued conservative management and surgical management will be necessary. Any indwelling urethral catheters can be removed at this stage unless they significantly reduce the volume of urinary leakage experienced. All urethral/suprapubic catheters should be removed at least 6 weeks before definitive repair to eliminate catheter related irritation and inflammation of the bladder mucosa, which may reduce the ability to visualise the fistula at the time of the repair, and to allow definitive treatment of any catheter related urinary tract infection (UTI). Incontinence pads, skin care and regular perineal review with continence nurse specialists (if available) greatly improve patient comfort and reduce distress.

Endoscopic Management

The use of diathermy fulguration or of fibrin glue has been described for small fistulae (<5 mm) [70, 71]. It would be reasonable to offer a trial of these techniques the patient presenting with a small VVF whilst awaiting the optimal time for delayed repair however there is no data for this in the setting of obstetric VVF.

Definitive Repair

The key surgical principles include [49, 50, 60, 61, 72]:

1. Incision and delineation of the fistula margins
2. Wide separation of the vaginal wall from the vesical wall (generally without debridement of the fistula margins and the tract) with sufficient mobilization of both to allow tension free closure.
3. Removal of any foreign bodies
4. Watertight closure of both bladder and vaginal side of fistula
5. Multi-layer, tension free closure without overlapping suture lines utilizing peri-vesical, paravaginal or interposition flap as a third layer
6. Excellent haemostasis
7. Appropriate anti-microbial cover as per institutional policy
8. Drainage of the urinary tract with an indwelling catheter for a minimum of 2 weeks (until healing is presumed or confirmed by leak test, dye test or cystourethrogram).
9. If healing has not occurred by 6 weeks, then the procedure is deemed to have failed [50, 67].

There are very few other areas of consensus regarding best management of VVF [49, 50]. Areas of divergence are:

Timing of Repair

Surgical repair is indicated if spontaneous healing has not occurred following 6 weeks of urinary catheter drainage. Traditionally obstetric VVF repair has been delayed for 6–12 months from the time of the precipitating delivery, to allow resolution of tissue inflammation and infection [4, 12, 73, 74]. This has been challenged recently and, with careful patient selection, it has been proven possible to achieve successful repair within 12 weeks of the precipitating delivery [75] with one Nigerian series reporting success in 87.8% of VVF repaired within 12 weeks of injury versus 87.2% in those having delayed repair. Early repair if successful benefits the patient's physical, psychological and social wellbeing [61]. It should be noted that the most likely chance of successful VVF closure is following the first repair attempt [50] and shortening the waiting period must not compromise overall surgical success [59]. Taking this into account, most experts continue to recommend a period of delay to treat infection, let inflammation settle and allow the fistula margins to mature before attempting definitive repair [8, 10, 27, 45].

Antibiotic Usage

The use of antibiotics is a further area of controversy [8, 10, 49, 50]. Some centres give all patients a course of peri-operative antibiotic therapy [60], some use only one prophylactic dose [8, 10, 76] whilst others do not use any [59, 77, 78]. One randomized controlled trial in West Africa found no benefit at all from antimicrobial therapy [8]. In view of the lack of evidence antibiotic use remains an individual and institutional decision.

Route of Repair

There continues to be a debate about the best surgical approach to VVF repair. It should be possible to close VVF vaginally at least 70% of the time [8, 79] and this is the route of choice for the majority of obstetric VVF repairs. The chosen route of repair is mainly dependent upon the training and surgical preference of the operating surgeon—with a tendency for gynecologists to perform transvaginal repairs, and for urologists to perform transabdominal repairs [27, 37] in well-resourced settings. This is not however always the case with 85% of VVF repairs performed transvaginally by urologists in my institution [43]. Anatomical closure rates are similar for both routes of repair however the open abdominal route has significantly higher morbidity [77, 80–82]. In the case of fistulae that are particularly large, complex, or high in the vagina, a transabdominal approach may offer the best chance of success [6, 9].

Trans-Vaginal VVF Repair (Fig. 16.8)

Transvaginal VVF repair was first reported by Sims in 1838 [78].

Absolute Indications

1. The VVF is physically accessible via the vagina—the VVF is low enough, the vagina mobile enough and vaginal width versus depth ratio sufficient to allow visualisation and instrumentation
2. There is no absolute indication for abdominal repair (ureteric injury ± small capacity bladder requiring clam cystoplasty)

Relative Indications

1. Previous failed abdominal repair

Advantages

Vaginal repair avoids a laparotomy and its associated morbidities and the need to bivalve the bladder with its associated longer-term functional morbidities. Vaginal repair is also associated with reduced post-operative pain, more rapid recovery, a

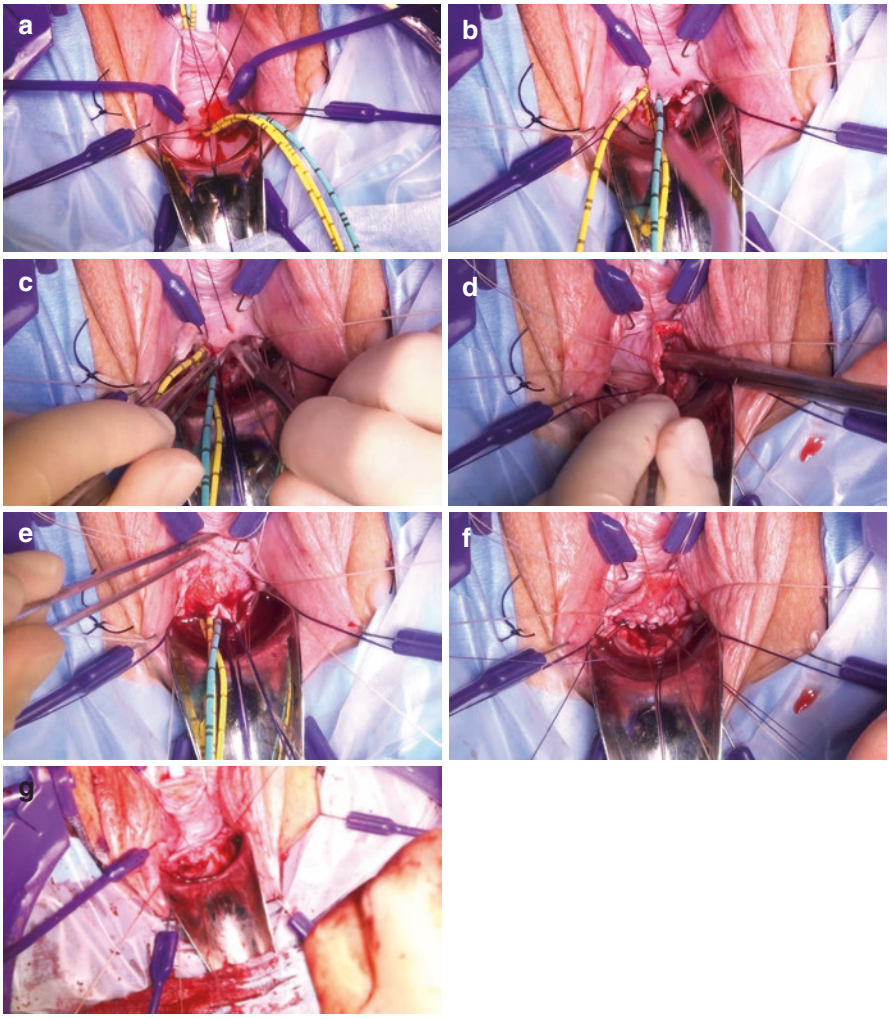

Fig. 16.8 Vaginal repair of VVF. (**a**) Stay sutures to pull fistula into operative field. (**b**) Fistula is circumscribed and white monocryl stays on vaginal free edges. (**c**) Fistula circumscription is completed and purple Vicryl stay sutures are places on vesical free edges. (**d**) The plane between the vagina and bladder is widely mobilized. (**e**) The wide mobilisation of the vagina off the underlying bladder is completed to allow a tension free closure. (**f**) The bladder aspect of the fistula is closed with continuous Vicryl. (**g**) The vaginal aspect of the fistula is closed with continuous Monocryl

shorter hospital stay and an earlier return to normal activities [77, 80–83]. Local paravaginal interposition flaps (e.g., Martius fat pad) are immediately adjacent and readily available and it is relatively simple to perform simultaneous anti-incontinence or prolapse surgery if indicated. There may also be a putative reduction in medico-legal litigation costs in high resource settings because of these advantages.

The complications associated with the transvaginal approach include a longer operative time, vaginal shortening and potential dyspareunia [77, 80–83].

Trans-Abdominal VVF Repair

The O'Connor technique is considered the gold standard for transabdominal VVF repair [84] and follows the principle of omental flap interposition as described by Turner-Warwick in 1967 [85, 86]. The fistula is approached via a long anterior wall and bladder dome cystostomy. Fistula can also be repaired extra peritoneally with dissection along the back wall of the bladder minimizing bladder trauma and allowing easy access for omental interposition through a small peritoneal window [87].

Indications for Trans Abdominal VVF Repair (Fig. 16.9)

Absolute Indications

1. Ureteric involvement requiring concomitant ureteric reimplantation
2. Small capacity bladder requiring augmentation cystoplasty,

Relative Indications

1. high fistula in a deep narrow or a floppy capacious vagina making surgical access impossible
2. previously irradiated tissues
3. complex fistulae (commonly fistulae over >2 cm)
4. previous failed transvaginal approach [85, 87].

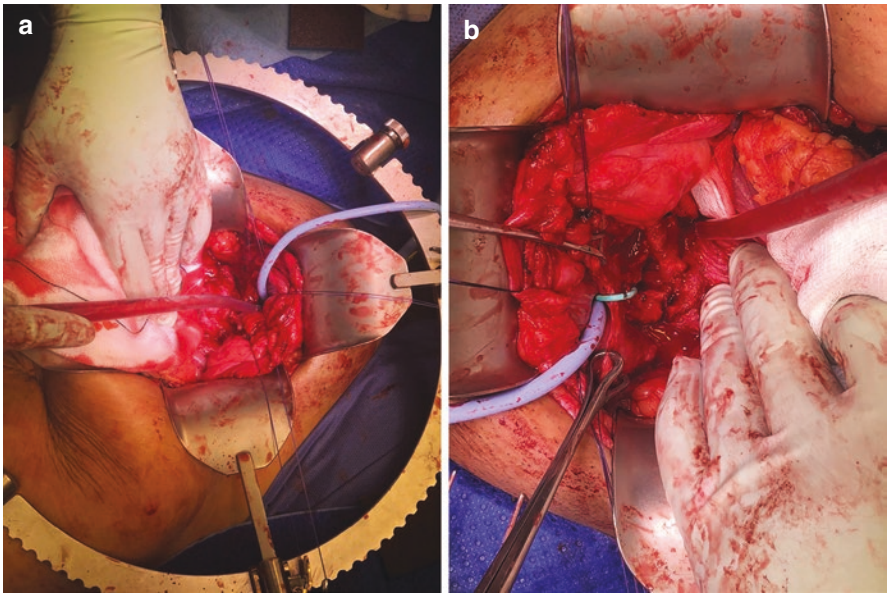

Fig. 16.9 Abdominal repair of vesico-utero-cervico fistula. (**a**) Pfannenstiel incision, dome and posterior wall of bladder opened to level of fistula. (**b**) Plane between posterior aspect of bladder and cervico-uterine fistula developed with stent traversing fistula

Advantages

Abdominal repair of VVF allows for simultaneous reimplantation of ureter(s) and/or clam cystoplasty if required. Omentum can also be easily harvested in most patients without additional morbidity or incision.

The complications associated with the transabdominal approach include the morbidity associated with a laparotomy, greater post-operative pain, longer recovery time and hospital stay and a marginally higher risk of failure.

Excision of the Fistula Tract

Complete excision of the fistula tract can compromise the outcome of the repair [88–91] by creating a much larger tissue defect and may convert a simple fistula suitable for transvaginal repair to a more complex fistula requiring a transabdominal approach, especially if the VVF is adjacent to a ureteric orifice. The exception to this edict is for post radiotherapy fistulae when the fistula margins need to be debrided back to healthy bleeding tissue (if possible). This often creates a large fistula as the area of non-viable tissue requiring debridement is often substantially larger than suggested on preoperative radiological or examination appearances.

Tissue Interposition

The reason for tissue interposition is to promote healing (via improved blood supply and, venous and lymphatic drainage) and avoid overlapping suture lines [8, 91–93]. Those most used during transvaginal repair are paravaginal fascia, peritoneal flaps (for proximal fistulae) and Martius (labial) fat pad flaps [10, 30, 92]. A recent single centre study indicated excellent success rates over 10 years in a cohort of 83 patients with tissue flap interposition regardless of flap type [90]. Many surgeons regard the use of interposition tissue flaps as another core principle of vesicovaginal fistula repair whilst others feel they are not indicated for all VVF repair [90, 91, 93, 94]. Most authors whether proponents of routine interposition flap usage or not would agree that they are indicated in (1) irradiated tissue, (2) previous failed repairs, (3) large fistulae >3 cm.

Omentum is widely regarded as the interposition flap tissue of choice for transabdominal repair (open, laparoscopic, or robotic). Evans et al. found a higher success rate (100% for both benign and malignant aetiology) for transabdominal repairs performed using an omental flap than without (63% for benign aetiology and 67% for malignant aetiology) [94].

There is, however, more ambiguity with regards the use of tissue flaps for transvaginal repair, particularly Martius labial fat pad flaps. Success rates over 95% have been reported with Martius interposition compared to 75–80% rates with simple repair alone [95–98]. Tissue interposition flaps appear to make a significant difference in salvage repair outcomes [98], although good results from simple transvaginal repair have been reported in single series [43, 83]. The arguments against Martius fat pad flap interposition are related to the purported difficulty and morbidity of its harvest. Reported complications include bleeding and haematoma from the

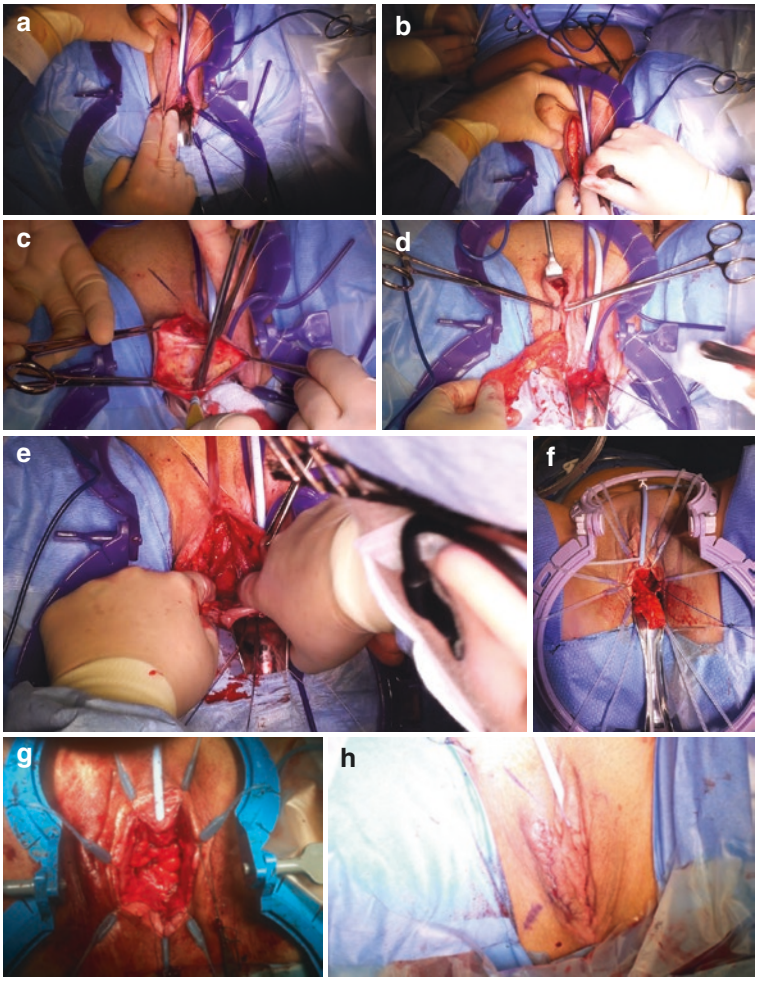

Fig. 16.10 Martius fat pad flap harvest and interposition. (**a**) Skin incision marked on right labium majora. (**b**) Skin and superficial fascia excised to deep fasia. (**c**) Lateral aspect of fat pad is mobilized. (**d**) Superior pedicle is divided and fat pad is completely mobilized on all aspects apart from inferolateral pedicle. (**e**) Tunnel is made along lateral wall of vagina. (**f**) Fat pad flap is transposed into vagina. (**g**) Fat pad flap is sutured to vaginal fascia to reinforce the underlying bladder repair. (**h**) Final appearance

harvest site, labial wound infections, altered and distorted labial cosmesis, reduced and absent labial sensation and labial pain [97, 99, 100], although most complications are mild and self-limiting. Cosmetic disfigurement and reduced sexual function do not seem to be significant factors, although protracted paresthesia and pain [97, 100] may occur in <10%. An alternative technique utilised in the resource limited setting is excision of the fistula tract and vaginal cuff scar with layered tissue closure [101]. We have used a modified fibroadipose Martius flap with minimal cosmetic or functional morbidity in all transvaginal repairs since 2002 (Fig. 16.10).

Other surgeons reserve the use of tissue interposition only for complex (urethral and bladder neck fistulae) and have found that there was no significant difference in success rates between those cases where a graft had been used and those where it had not [102]. We are currently reliant on evidence primarily from cases studies and this is inevitably subject to the bias of individual surgeons. Randomized trials are needed to standardize practice and establish when and which tissue interposition is most appropriate.

Who Should Repair VVV and UVF?

Overall, there is 10–30% of failure to close obstetric VVF and a 30–55% failure to achieve urinary continence [8, 10, 32, 33, 41]. Successful fistula closure is significantly more likely in women who had not had previous failed attempts at closure [8, 95] in other words the best opportunity to repair a VVF is at the first operation. Failed attempts at repair create further inflammation, scarring, anatomical distortion, and compromise potential reconstructive flaps. Whilst it is possible to achieve repair after several failed operations, each failed repair adversely effects the likelihood of success of the subsequent repair [103, 104]. Surgeons involved in fistula repair should be skilled in both abdominal and vaginal approaches and should have experience and versatility to decide the most appropriate procedure for each individual patient including urinary diversion and continence procedures. Repair by experts in centres of significant experience is the best option for all patients [105] and produces the best results.

Techniques for Complex Fistulae

Complex fistulae are defined as those that are greater than 2 cm in diameter, radiation induced (rare in low resource settings), involving the trigone or involving the urethrovesical junction [89, 106]. Although vaginal repair is possible in most of such cases [106], a modified approach may be required [107].

When repairing vault or juxta-cervical fistulae it is advisable to perform this transversely [8] to reconstruct the underlying trigone. When there has been substantial urethral loss, a flap of anterior vaginal wall can be used to form a neourethral tube over a catheter [8]. Tissue interposition is almost always required to provide additional bladder neck and/or neourethral support [8, 79]. Because of the severity of injury these fistulae have a poorer prognosis both in terms of anatomical closure and urinary continence [8].

Some complex fistulae will necessitate a transabdominal approach, particularly those that are extensive and/or close to the ureteric orifices. Preliminary catheterisation of the ureters to prevent ureteric injury [8, 10, 92] is essential when repairing such fistulae.

Outcomes

Anatomical Closure

Successful anatomical fistula closure has been reported in 58–98% have been reported [32, 73, 75, 108–111] depending on whether the fistula is simple or complex, obstetric or iatrogenic and whether the procedure a primary or secondary (or more) procedure. Obstetric VVF primary anatomical closure rates vary from 72.9% in Zambia [109] to 91.8% in Nigeria [111].

Anatomical closure of a simple VVF has been reported in more than 85% with either the transvaginal or transabdominal approach in many series. VVF that are complex, secondary to obstetric causes, large or those associated with radiation therapy, generally have lower success rates of between 60% and 70% [8, 38, 108–111]. At our institution we have found that up to 85% can be performed transvaginally, with a 95% first time repair success rate, and 100% success rate overall. Modified Martius fat pad flap interpositions are used for all transvaginal repairs.

Although there are no randomized controlled trials to compare outcomes of vaginal and abdominal repair, series have consistently reported lower primary closure rates for abdominal repair [14, 43]. A recent systematic review of VVF repair cites a success rate for a vaginal closure of 91% versus 84% for abdominal repairs [112].

Continence Rates

Stress urinary incontinence in up to 55% of women following successful anatomical closure of their obstetric VVF [113–115]. Continence rates are higher after primary successful anatomical VVF closure compared with after successful anatomical closure of persistent VVF (previous failed anatomical closure). Continence rates are also higher following successful anatomical closure of simple VVF compared with successful anatomical closure of complex VVF. The Danja centre in Nigeria reported closure and continence in 80% of all women after primary fistula closure; when subgroups were analysed 92% of women with primary simple VVF had closure and continence compared with only 57% of women with complex and/or recurrent VVF cases [32]. Success decreased with increasing numbers of previous attempts at surgical repair [32]. Stress incontinence following successful closure of obstetric VVF may be secondary to "tethered vagina syndrome" and the use of a Singapore skin flap may prevent this [116]. Many try to prevent the development of post closure stress urinary incontinence by performing a bulbocavernosus muscle sling at time of VVF repair [117].

Other Complications

Acute Complications

Peri operatively women are at risk of wound and urinary tract infection [8, 12], blood loss and pain. In low resource settings access to blood products and analgesia is often limited. Many VVF repairs are performed under spinal anaesthetic alone

and in some cases local anaesthetic alone [75]. Despite this, most studies report a very low short-term complication rate especially for the transvaginal route [12, 75, 108–111].

Long Term Complications

Long term complications are much more prevalent and can have a profound effect on quality of life. The most common long-term complications include frequency, urgency, urge incontinence, stress incontinence (detailed above), vaginal stenosis, recurrence, ureteric obstruction and bowel obstruction [79]. Voiding dysfunction either preexistent or as a consequence of VVF and its repair is found in up to 83% [72, 118–120]. Types of voiding dysfunction include detrusor overactivity, loss of compliance and detrusor hypocontractility in order of frequency. USUI and IDO are most commonly associated with bladder neck VVF [121]. Urethral stricture causing bladder outflow obstruction occurs in 4–6% of those with urethral involvement and has generally been managed by urethral dilation or urethrotomy ± ISC [122] although urethroplasty can be considered in recurrent cases.

Female sexual function is barely reported. No difference in sexual function has been reported in 1/3 of women having their VVF repaired by transabdominal or transvaginal approach with or without a modified Martius fat pad flap interposition [99]. Sexual function was significantly improved in 64% patients and overall sexual function was significantly improved following both operative approaches. Neither surgical intervention was superior to the other regarding sexual function or quality of life scale [72].

Irreparable Fistula

There is no universal agreement on what constitutes an "irreparable" fistula [123]. Typically, they are defined by multiple failed repair attempts or such significant obstetric injury that the tissue defects are simply too large to close (complete destruction of the urethra or bladder, defects involving the ureters or severe vaginal scarring) [7, 10, 12, 123]. Urinary diversion, most commonly by ileal conduit [124] but also ureterosigmoidostomy [125] and neobladder and Mitrofanoff [126], may be offered to women with irreparable fistulae. These represent a small proportion of the total number of women with obstetric VVF—<1% in most series [7, 32, 123]. However, they are both a technical and ethical challenge.

Urinary diversion surgery requires extensive pre-operative counseling, a reliable supply of stoma equipment and long-term follow up [123, 124]. Unfortunately, this is not often available low resource settings. It is imperative that the pros and cons of diversion are carefully considered in light of the above in low resource settings [123].

Ureterosigmoidostomy is an alternative form of urinary diversion [123, 125] which eliminates the need for stoma equipment. It requires a well vascularised portion of sigmoid colon and an intact anal continence mechanism for success whilst neobladder and Mitrofanoff channel necessitates ISC [126]. Long term follow up is still requires due to risks of acute and chronic pyelonephritis, hyperchloraemic metabolic acidosis and colonic cancer [123–126].

Vesico-Uterine Fistula

A vesicouterine fistula (VUF) is defined as an abnormal communication between the uterus and the urinary bladder. It most commonly occurs following difficult Caesarean section and rarely following obstructed vaginal delivery, pelvic surgery and/or radiotherapy. There is an increasing in incidence in VUF consequent to increasing Caesarean section rates in both high and low resource settings [127–131].

Presentation

VUF presents with cyclical haematuria (menouria), amenorrhea, infertility or first trimester spontaneous abortion [127–132]. Rarely it presents with haematuria, urinary incontinence (in the presence of cervical incompetence), dysfunctional voiding, and urosepsis [128–133]. Bladder injury during Caesarean section should be repaired immediately with tissue interposition to prevent fistula development [134].

Treatment

Spontaneous closure of small VUF occurs in up to 5% and is more likely if menstruation is prevented by hormonal manipulation with LHRH (Luteinizing Hormone Releasing Hormone) analogues [127, 132, 135].

Those failing conservative management require surgical repair. If access is amenable, vaginal repair may be possible [127]. Alternatively, an open, laparoscopic, or robotic repair using omentum as an interposition is employed [127–133]. Hysterectomy may be necessary to ensure cure however uterine preservation is preferred if possible.

Urethro-Vaginal Fistula (UVF)

An urethrovaginal fistula (UVF) is as an abnormal communication between the urethra and the vagina. In low resource settings, UVF primarily occurs because of obstructed second stage of labour and is a consequence of pressure necrosis of the pelvic floor including the bladder base, bladder neck and proximal urethra, often with loss of the sphincter control mechanism [136]. Catastrophic loss such as this is rarely seen in well-resourced settings with only 3–6 UVF repairs are performed annually in England [11]. UVF are mostly iatrogenic in well-resourced settings, occurring as a consequence of stress urinary incontinence surgery, anterior prolapse surgery and urethral surgery in particular diverticulectomy [122, 137, 138]. Other reported causes have included severe trauma [139], forgotten foreign bodies [140], catheterisation during labour [141] and rare inflammatory conditions such as Bechet's disease and Churg Strauss disease [142].

Signs and Symptoms

Size and location of the fistula with respect to the urethral sphincter determine symptoms. Proximal urethral fistula present with continuous or stress incontinence (70%). Distal urethral fistula (beyond the sphincter) may be asymptomatic or may present with a urinary divergence or vaginal voiding [143] Frequency, urgency, nocturia, pelvic pain and obstructive or painful voiding symptoms have been reported in 20–40% of cases [143, 144].

Diagnosis

The diagnosis of UVF is mainly made on clinical examination—with voiding cystogram and cysto-urethroscopy required in a small number. As a significant number of patients with a UVF also have a VVF, examination or imaging to exclude VVF is essential [144, 145].

Classification

There is no current classification system for isolated UVF, but position relative to the urethral sphincter (proximal/through or distal), size of defect in relation to urethral length and circumference, the presence of obstruction distal to the fistula, local infection, fibrosis, degree of tissue vascularization, malignancy, or dermatological pathology should be documented.

Management

UVF Repair

There is no conservative management for UVF. Surgical repair can be technically challenging if there is an extensive tissue loss and or a lack of local viable tissue for a multi-layered repair [136].

Distal fistulae that are asymptomatic may be observed or managed via an external meatotomy [122, 143, 144, 146], although the patient must be warned about divergent urinary stream. Most fistulae can then be repaired by direct suture and tissue interposition using similar principles described for VVF repair. In UVF where there is significant urethral loss urethral reconstruction may be required. Rotational vaginal flaps [147] and buccal mucosa inlay grafts [148–152] have been utilized in this situation. In very severe cases, urethral substitution using ileum also has been described [153].

Anatomical closure rates for simple UVF after one surgery are 90% and up to 99% after a second or more operations [154–156]. For complex UVF anatomical

closure rates vary between 25% and 80% depending on aetiology of the UVF and the complexity of the reconstruction required [122, 136, 143, 148–153, 155, 156].

Bladder neck and proximal urethra involvement with consequent sphincter incompetence in the UVF result in high rates of stress urinary incontinence—(up to 50% in some series) following successful anatomical closure [122, 143, 154]. In obstetric UVF, the bulbocavernosus muscles have been utilized as an anti-incontinence flap/wrap in these situations with reasonable success [117, 157].

Rectovaginal Fistula

Given the obstetric aetiology of most fistulae in resource limited countries, it is likely that a fistula surgeon operating in this setting will encounter more extensive fistulae involving the urethra and quite possibly the rectum. Rectovaginal fistulae can be repaired via a transanal, transvaginal or transabdominal approach—the latter being reserved for high recto-vaginal fistula. A diverting colostomy may be needed in extreme cases, and this should ideally be done in conjunction with a colorectal surgical team.

Future Surgical Developments

There is an increasing interest in laparoscopic/robotics in VVF repair and there have been recent studies showing an overall high success rate comparable with open abdominal repair [158] in experienced hands. However, the current data is derived largely from case reports and small series with generally short term follow up, thus more extensive trials are needed in this area. Laparoscopic/robotic repair if found to be equivalent to open abdominal repair should remain second line to vaginal repair whenever vaginal repair is possible—as this will remain the most cost effective [83] and patient friendly mode of repair especially within the financial constraints of a resource poor setting.

Additionally, the advent of bioglues may presented new options for the minimally invasive management of small fistulae [159]. However, their use at present must be considered experimental and they are highly unlikely to be of great utility in the management of the average obstetric fistula.

Holistic Care

It is also important to consider the setting in which surgical repair of obstetric VVF takes place. Most women will have travelled a significant distance and may have been ostracised from their families and communities. In addition to closing their fistula and rendering them continent again, rehabilitation must occur to ensure

sufficient education, economic skills and social support to function independently [123]. These women have been born into a society where their worth is all too often determined by their ability to bear children and have sex with their husband. It is therefore unsurprising that many have been divorced or abandoned by their husbands [4, 29, 30, 160] by the time of their fistula repair. In Niger, fistula accounts for 63% of all divorces [30, 161] whilst in Ethiopia 100% of women having fistula repair had been abandoned by their husbands [30, 55]. In the long term a shift in mindset and culture is required at both a community and national level.

There is little evidence available on the success and best mode of delivery for pregnancy following successful VVF repair. Much of the literature on successful outcomes focuses on the technicalities of anatomical closure, and there is little on woman's quality of life post repair. This is no doubt a consequence of the difficulties in long term follow-up of patients living in remote, rural areas who do not have easy access to transport, telephone or postal services [111]. Many women are left childless following the development of an obstetric fistula—their first baby is stillborn following their fistula inducing delivery [9] and they subsequently become amenorrhoeic secondary to dysfunction of the gonadotrophin hormonal axis although the reasons behind this are undefined [9, 12]. This compounds their cultural worthlessness [64].

For those women who recover their fertility the socioeconomic and healthcare factors that predisposed these women to developing obstetric fistulae initially are still in place and family planning is of paramount importance following fistula repair. In Burundi, a comprehensive programme of fistula care is offered, and all women are discharged with family planning advice and a contraceptive method [108]. This should be an integral part of any fistula repair centre. However, contraception is often limited to condoms or the rhythm method, both of which rely on male compliance and consequently many women are simply advised to remain abstinent for at least 6 months following their VVF repair [9, 75]. They are also informed to attend the nearest healthcare facility once labour commence for any subsequent pregnancy for delivery by Caesarean section [9, 12, 162]. There have been reports of successful vaginal deliveries under medical supervision without incurring damage to the repair in women whose initial fistula was the result of a non-recurring cause (malpresentation rather than pelvic disproportion) and where tissue interposition had been used in the repair [12].

Conclusion

Obstetric fistulae affect more than 3.5 million women worldwide. These women are all too often left wet, childless, poor and alone. There must be a concerted and coordinated effort at national and international level to prevent VVF or, treat all VVF in a timely and effective manner. To do this, it is necessary to obtain accurate data on incidence and prevalence of obstetric VVF from a wide range of settings. Funding must be diverted to antenatal and obstetric care and fistula centres. Governments

and academics must strive to improve the status of women in the most affected countries. A widely recognised and utilised classification of obstetric fistulae needs to be developed to determine best practice for anatomical closure with urinary continence,

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