Review Article

Vesicovaginal fistula: Review and recent trends

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ABSTRACT

Vesicovaginal fistula (VVF) is an abnormal communication between the bladder and the vagina. Prompt diagnosis and timely repair are essential for successful management of these cases. As the clinical scenario is variable, it is difficult to frame uniform guidelines for the management of VVF. Hence, the management protocol is dependent on the treating surgeon and the available resources. Conservative methods should be used in carefully selected patients. Delayed repair is better than the early repair of VVF. Transvaginal route for repair is preferred as it has low morbidity, higher success rates, and minimal complications. Anticholinergics should be used in the postoperative period for better chance of bladder healing. When facilities are available, all the patients may be referred to a tertiary care center where expertise and advanced resources are available. Trained surgeons adapting the new trends should refine the art of VVF repair.

INTRODUCTION

Vesicovaginal fistula (VVF) is an abnormal communication between the bladder and the vagina. It is a disastrous condition that affects the women physically, psychologically, emotionally, and economically. VVF has been known since antiquity, the earliest case of VVF dates back to 2050 BC.[1] Dr. James Marion Sims, the father of American Gynecology, succeeded in repairing VVF with silver wires after subjecting slaves to repeated experimental attempts.[2]

VVF creates a social stigma for the affected women and retards their overall development. Affected women, in their prime productive period of life, lose the potential for growth and excellence in the society.[3] Although it is a well-reported relatively common condition, not many established guidelines and well-conducted management trials are available in the literature. This review aims to address the current trends in the management of VVF and to give an overview of controversies involved.

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METHODS

We searched PubMed, Scopus, and Google Scholar for English language literature for the search terms including Vesicovaginal fistula, urinary tract fistula, lower urinary tract fistula, urogenital fistula, obstetric fistula, postpartum injury, sexual dysfunction, and stress urinary incontinence till March 2019.

EPIDEMIOLOGY AND ETIOLOGY

The true incidence of VVF is difficult to estimate as the affected women often suffer silently due to the social stigma. The reported incidence of VVF is different between the developing and the developed nations, similarly, the etiology also varies. The most common cause of VVF in developed countries is pelvic surgery. The incidence varies between 0.3% and 2.0%.[4,5] Less common causes are radiation-induced and advanced pelvic malignancies such as bladder, rectal, and cervical tumors[6] and their treatment.[3,4]

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In under developed nations, prolonged obstructed labor constitutes the most common etiology of VVF (>90%), especially in Sub-Saharan African countries.[7,8] Poor socioeconomic status, early marriage, malnourishment, low literacy rate, and poor health-care system contribute to the higher prevalence of VVF in these countries.[8] Radiotherapy, tuberculosis, foreign body reaction, and pelvic trauma are the other causes.[9-11]

CLASSIFICATION OF VESICOVAGINAL FISTULA AND ITS RELEVANCE TO THE MANAGEMENT DECISION

VVF, mainly obstetric, is often classified by two systems, namely the Goh and the Waaldijk classification systems. The Waaldijk Classification takes into account the (1) involvement of the closure mechanism, (2) involvement of the external urethral meatus, and (3) extent of the defect. The Goh Classification considers the (1) distance between the distal edge of the fistula to the external urethral meatus, (2) extent of fibrosis of the fistula site, and (3) size of the fistula tract. Capes *et al*. have demonstrated that the prediction of successful fistula repair was significantly better with the Goh Classification than with the Waaldijk Classification.[12]

For non obstreteric fistulas, Beardmore-Gray *et al*.[13] found that the Goh Classification could not predict the success of the fistula closure, rather it was predictive of continence outcomes when an anatomical closure was achieved. Further, a younger age and a smaller fistula size were significantly associated with successful anatomical closure.

VVF can also be classified as either simple or complex. Any fistula which is solitary and is ≤0.5 cm in size in a nonirradiated and nonmalignant situation is termed as a simple fistula. Fistulas that are large in size (≥2.5 cm), multiple, have history of failed previous fistula repair, are associated with chronic infection and disease, are postradiation induced, or are associated with malignancy are termed as complex fistulas.[14]

Clinically, VVF can be classified as follows:[12,13]

1. Based on the site of the fistula on cystoscopy – Supratrigonal, trigonal, and infratrigonal (bladder neck)
2. Based on the etiology of fistula – Congenital and acquired. Acquired VVF could be of the following types: Benign, malignant, traumatic, inflammatory or infective, and miscellaneous types
3. Based on the involvement of continent mechanism – (i) Type 1 – not involving the closing mechanism; (ii) Type 2 – involving the closing mechanism: (a) not involving total urethra (b) Involving total urethra; and (iii) Type 3 – miscellaneous, for example, ureteric fistula
4. Based on the size of VVF – small <2 cm, medium 2–3 cm, large 4–5 cm, and extensive >6 cm and
5. Based on the clinical examination – vesicocervical, juxtacervical, mid-vaginal vesicovaginal, suburethral vesicovaginal, and urethro-vaginal.[12]

The various classification methods help in management decision-making, adjunct treatment, and follow-up methods. However, they do not predict the overall success rates and other outcomes.[12]

MANAGEMENT OF VESICOVAGINAL FISTULA

Conservative methods – Newer trends

Conservative management of VVF has been followed for years. Various methods have been detailed that allow for a fistula to heal.

Continuous bladder drainage (CBD), catheterization with fulguration of the fistula tract, glue injection, injection of platelet-rich plasma (PRP), and administration of anticholinergics have been practiced with varied success rates. In intractable and recurrent VVF cases, methods such as percutaneous nephrostomy (PCN), PCN with bilateral ureteric occlusion, isobutyl-2-cyanoacrylate injection, balloons (detachable or nondetachable), nylon plugs, coils, gelatin sponges, and fulguration have been used. CBD is advised immediately after documenting leakage of urine from vagina either as a result of obstetric complication or following surgical intervention. Conservative management with CBD is useful if: (1) the urine leakage decreases with indwelling catheter CBD, (2) the fistula onset is <3 weeks, (3) the fistula tract is long and narrow, and (4) the size of the fistula <1 cm.[15] Similarly, conservative management should not be advocated in complicated VVF when (1) the size of the fistula is >3 cm, (2) the fistula is secondary to radiation-induced damage to the urogenital tract, (3) there is extensive scarring around the fistula, and (4) the onset of the fistula >6 weeks.[14,16] The overall success rate of CBD alone ranges between 3%–32%.[17] If the size of the fistula is <5 mm and the patient became dry after catheter placement, the chance of healing with CBD is high.[17]

Fulguration of the fistula tract

Fulgration is performed when the fistula is small in size, recent in onset, has a long and narrow tract, and fibrosis is absent. The lining epithelial layer of the fistula tract is fulgrated with electrocautery, with an intention to facilitate fibrosis. Stovsky *et al*. have reported a success rate of 73% with electrofulguration along with 2 weeks of CBD in patients with small fistulas (≤3.5 mm size).[18]

Fibrin glue injection

Fibrin glue is used as an adjunct to VVF repair. The glue is injected transvaginally under cystoscopic guidance after electrofulguration of the fistulous tract. CBD is followed for about 1–4 weeks duration, and the fibrin glue helps to promote fibrosis.[19] Fibrin glue could also be used as an interposition agent. It can act as a substitute to the more invasive method of harvesting a local flap.[20] Morita and Tokue have reported endoscopic closure of radiation-induced

VVF using the fibrin glue.[21] Fibrin glue is also used as an adjunct during the robotic VVF repair.[22]

Injection of platelet-rich plasma

PRP is injected around the fistula creating a mound,-similar to that created by injecting deflux in cases of vesicoureteral reflux, which occludes the fistula mechanically, meanwhile, the growth factors derived from platelets stimulate fibrosis and neovascularization. Shirvan *et al.* have successfully treated 11 of the 12 patients (92%) of iatrogenic VVF with perifistulous injection of PRP along with abrasion and fibrin glue injection in the fistula tract.[23]

Bilateral percutaneous nephrostomies and ureteric occlusion

Percutaneous nephrostomies are often performed as a palliative procedure in patients with malignant VVF, poor performance status and limited life span due to the advanced stage of the disease.[24] Permanent nature of the PCNs should be explained and the patient's willingness to remain on nephrostomy tubes *in situ* should be taken into account. Smaller fistulas may heal with PCNs. For larger fistulae, PCNs alone are insufficient to make the patient dry and percutaneous ureteric occlusion is required as an adjunct. Isobutyl-2-cyanoacrylate, balloons (detachable or nondetachable), nylon plugs, coils, vascular plugs, and gelatin sponges are used for bilateral ureteral occlusion along with PCNs.[25] Percutaneous ureterostomy and ureteral clipping are rarely performed and isolated success of these procedures has not been assessed in any of the reported series.

Most conservative methods have a reported success rate between 3% and 100%. These series have included a small number of patients without long-term follow-up. Hence, the choice of conservative methods depends on the physician preference with a thorough explanation that surgical intervention would be required if conservative treatment fails.[17,18,20]

Indications and contraindications of the conservative methods have been summarized in Table 1.

URINARY DIVERSION AFTER REPAIR OF VESICOVAGINAL FISTULA

Diversion of the urine would make the suture line dry and help in the healing process after VVF repair. Per-urethral catheterization is most commonly followed. However, concurrent suprapubic cystostomy (SPC) is claimed to provide an additional safety when the urethral catheter malfunctions.[26] Few have preferred suprapubic diversion alone.[27] Dalela *et al.* have described a unique method of placing a suprapubic cystostomy in patients with VVF.[26] This routine practice of keeping a SPC has been questioned as it does not improve the success rates of the surgical repair.[28] The duration of urinary drainage after repair is also debatable. Commonly, the catheter is removed by the 14th day,[29] but may be kept longer depending on the number, size, nature of the fistula, effectiveness of the repair, and the experience of the surgeon.

THE PRINCIPLES OF VESICOVAGINAL FISTULA REPAIR

Certain basic principles of VVF repair have to be followed to get successful outcomes. These principles apply to all the methods of repair performed by any route.[30] They are summarized in Table 2.

Timing of Surgery – Early or late?

The timing of VVF repair is influenced by multiple factors. Most surgeons would prefer to repair the VVF when there is no active inflammation, infection, and necrosis. Whereas, others advocated to intervene as soon as the VVF is diagnosed and have achieved similar results.[27] Usually, the repair is performed at 12 weeks duration after the diagnosis. Timing of the repair is influenced by factors such as: (1) nature of injury leading to fistula, (2) nutritional status of the patient, (3) presence of infection and foreign bodies, and (4) immunocompromised status.[31] The first attempt is the best attempt and has the highest probability of achieving successful outcome after VVF repair. Hence, choosing the ideal time for repair is of paramount importance. Women with VVF, while waiting for surgical repair, would go through an anxious depressive state. thus emotional and psychological support from the treating physician and the family is much needed.

For post-obstetric fistula

Delaying the repair of an obstetric fistula ensures that the necrotic tissue would slough out and the inflammation would subside. If the fistula is simple and has no evidence of infection, an early repair can be performed. However,

Table 1: Conservative management of vesicovaginal fistula

Indications
Progressively decreasing urine leakage with bladder drainage
Fistula onset <3 weeks
Fistula tract is long and narrow
<1 cm size fistula
Contraindications
Radiation-associated VVF
Scarring around the fistula site
Fistula onset >6 weeks
>3 cm size fistula

VVF=Vesicovaginal fistula

Table 2: Principles of vesicovaginal fistula repair

Adequate complete exposure
Ensuring hemostasis
Adequate tissue mobilization
Suturing without tension with absorbable sutures
Ensuring Watertight closure
Good blood supply at the repair site
Continuous bladder drainage postoperatively
Reducing post-operative bladder spasms

contemplating the repair in the settings of unresolved necrosis, and infection is very challenging.[32]

For postsurgical vesicovaginal fistula

The twelve weeks rule holds good for postsurgical VVFs too.[33] This time frame allows for inflammatory changes to subside and the necrotic tissues to get delineated. Exceptions to this rule are: (1) VVF confirmed within few days of primary causative surgery, (2) associated concomitant ureteric injury requiring intervention, and (3) patient's desire or compulsion on surgeon.

For radiation-induced vesicovaginal fistula

Early surgery should be avoided if the acute postradiation tissue response is progressing. Radiation induced reaction heals in about a year. Delayed repair after 6 months is often followed.[34]

Surgical approach-transabdominal versus transvaginal

The choice of surgical approach depends on the familiarity of the approach by the surgeon, location of the fistula, available space in the vaginal cavity, need for ancillary procedures such as ureteric reimplantation, and the feasibility of obtaining necessary interposition flaps. Hillary *et al*. showed that the success rate was much higher for the transvaginal repair (90.8%) when compared to the transabdominal repair (83.9%).[32] Kapoor *et al*. in their series, have preferred the transvaginal route for simple fistulae and the transabdominal route for complex fistulae and achieved successful outcomes in most of the VVFs repaired transvaginally.[27,35] There are certain situations where a specific surgical approach may be preferred.

Vaginal route has certain specific advantages[35]: (1) avoids abdominal and bladder incisions, (2) lesser blood loss, (3) options of interposition flaps are plenty, (4) shorter operative time, and (5) shorter hospital stay and rapid recovery. This approach is often used when the abdominal wall is scarred by previous surgeries. Vaginal route is contraindicated if there is: (1) narrow-scarred vagina, (2) postradiation fistula, and (3) concomitant rectovaginal fistula.

Abdominal route is preferred when the vaginal route is contraindicated. It is also often advocated if: (1) concomitant procedures such as ureteric reimplantation and augmentation cystoplasty are required, (2) presence of vesical stones, and (3) highly placed fistula with a narrow vagina.[36,37]

Augmentation cystoplasty is required in patients with complicated VVF when radiation, obstructed labor, or chronic infection lead to decreased bladder volume, significant loss of anterior vaginal wall and vaginal stenosis. Ureteric reimplantation and vaginal reconstruction with bowel may also be required concomitantly.[38]

Positioning during vesicovaginal fistula repair

The size and the location of VVF, amount of exposure required for the repair, and the experience of the operating surgeon would dictate the position for repair. The Lawson and Jackknife positions are ideal for proximal urethral and bladder neck fistulas. Addition of reverse trendenlenberg postion to these further improves the visualization of VVF and eases the repair.[39] However both positions may require general anesthesia to avoid patient discomfort in the prone position.

The dorsal high lithotomy position with steep Trendelenburg positioning gives excellent view for the repair of a high VVF and is also used during laparoscopic and robotic VVF repairs. Traditional Sims position for VVF repair is no longer used.

Almost all the cases of obstetric VVF can be performed in lithotomy position with Trendelenberg position as evident by the surgeons performing complicated obstetric fistula repair in centres with limited resources.[40]

Role of colpocleisis in vesicovaginal fistula repair – today's scenario

Partial colpocleisis may be performed as a part of VVF repair. Two techniques of colpocleisis in VVF repair are (1) Simon colpocleisis (transverse closure) and (2) Latzko colpocleisis (sagittal closure).[41] Simon colpocleisis is complicated and leads to pseudodiverticular formation and is not practiced. Latzko technique has prerequisites,[42] namely (1) posthysterectomy status, (2) adequate preoperative vaginal vault length, and (3) close proximity of the fistula to the vaginal vault. Currently, colpocleisis is perfromed in women with small proximal postsurgical VVFs and in postradiation-induced VVFs. Colpocleisis leads to a significant shortening of the vaginal space and can cause sexual dysfunction. Advantages of the Latzko procedure include simplicity of the technique, high success rate, low morbidity, no impairment in bladder capacity, and no compromise of the ureteral orifices, even in fistulae that lie close to the orifices. The success rate in patients with simple post hysterectomy VVFs vary between 93% and 100%.[43]

Technical modifications in transabdominal vesicovaginal fistula repair: Vertical cystotomy versus horizontal cystotomy versus transvesical repair

Classically, bivalving the bladder to repair the fistula as described by O'conor and Sokol was the standard practice for abdominal VVF repair.[44] This classical approach has been questioned by newer and recent techniques that report similar outcomes. These include limited vertical cystotomy,[45] horizontal cystotomy,[46] and intravesical repair[47] of VVF. These approaches have been proposed to: (1) decrease the operating time (2) improve the ease of laparoscopic suturing leading to better luminal delineation, (3) decrease the incidence of overactive bladder, and (4) help in early anterior dissection which reduces the

tension on the suture line.[46] Limiting the dissection while following the principles of VVF repair is claimed to provide better post operative recovery, however, long-term results of these techniques need evaluation.

Role of interposition of tissue between the layers of repair

Grafts and flaps are interposed between the bladder and the vagina to improve healing and to reduce the chances of recurrence.[48] A number of flaps have been described for both transabdominal and transvaginal VVF repair. Labial fibrofatty tissue (Martius flap), peritoneum, omentum, gluteus muscle, rectus abdominis muscle, gracilis muscle, small intestinal submucosa, human dura grafts, sigmoid epiploicae, and urachus are some of the tissues described for interposition.[49-55]

A retrospective analysis of 26 patients undergoing transabdominal VVF repair with omental or peritoneal flap interposition, 16 of which had complex VVF, has been reported by Altaweel *et al.* which showed a 100% success rate with a maximum follow-up of 73 months.[33] Pshak *et al.* studied 49 patients with benign VVF, of which 25 had recurrent VVF, undergoing transvaginal repair and .and reported a 100% cure rate even without the use of tissue interposition.[56]

Interposition flaps are not routinely utilized when the surrounding tissues appear healthy and well-vascularized, such as in a benign etiology. Gousse *et al.* evaluated the use of interposition flaps among 29 patients with benign etiology and 8 patients with malignant etiology. They showed a 100% success rate when the interposition flap was used, as compared to 63% success rate when a tissue flap was not used.[57] Thus, interposition flaps would be a valuable adjunct in the reconstruction of malignant and radiation fistulas.

Radiation-induced vesicovaginal fistula

Pelvic radiation is the primary cause of delayed VVF.[58] The majority of the fistulae form 1.5–2 years after the completion of radiotherapy. Recurrence of malignant disease at the edges of the fistula must be excludedby multiple focal biopsies.[34]

Radiation-induced recurrent VVFs have the lowest success rates and require the most demanding treatment. Due to radiation-induced fibrosis, it is necessary to completely excise the scar till the fresh tissue margin, and consequently, because of the large size a primary closure of the defect may become difficult. The radiation-induced fibrosis also causes tissue hypoxia, which makes tissue repair difficult.[59] The approach, abdominal or vaginal, is decided by the location of the fistula and surgeons experience and should be tailored to the individual case. Laztko technique (colpocleisis) is preferred in patients with small radiation-induced VVF, as it avoids injuries to the ureters and the trigone. However, colpocleisis leads to shortening or near obliteration of the vaginal space, thereby causing permanent sexual dysfunction. It is worth attempting when the tissues around the fistula are healthy and the reported success rate is about 89%–100%.[42,43]

Tissue interposition should be considered whenever the closure lines or the vaginal tissues are of questionable quality.[34] Adjacent muscle flaps have better success rate than bulbocavernosus flap, as the vascularity of bulbocavernous muscle may be compromised by the previous radiation.[60] Fibrin glue has also been used in patients with previously failed repairs and who underwent have radiation therapy and chemotherapy with good success rates.[61]

Pushkar *et al.* analyzed the outcomes of vaginal approach for radiation induced VVF among 210 patients and found that the success rate of the primary repair was 48.1%, which increased cumulatively to 80.4% after three surgeries. They found that subsequent repairs did not reduce the chances of cure and reported a high cumulative cure rate. They emphasized that the failure of the repair could be attributed to the continuing tissue reaction caused by radiation and hence the authors suggest considering the re-do surgery of a failed fistula repair as the primary surgery.[34] Also, the approach, either the vaginal or abdominal does not affect the success rates which usually range from 40% to 100%.[14]

Trauma-induced vesicovaginal fistula

VVF, as a result of pelvic fracture, is rare and only a few anecdotal reports have been published [10] The site of injury is at the bladder neck, and is often associated with urethral injury. Female urethral injury secondary to pelvic fracture is reported in 6% of the cases.[62]

Female urethral injury can be classified as complete (avulsion) and partial (longitudinal). Immediate repair of the pelvic fracture with the urethral and vaginal injuries is advised as mere suprapubic drainage often leads to obliterative stricture of the urethra along with urethrovaginal fistula. Affected patients would often be hemodynamically unstable and may need intervention for associated injuries which may preclude immediate repair of the lower urinary tract. Primary endoscopic realignment of the separated urethral ends over a catheter may be an alternative method. Even though the injury will heal, the resultant bladder neck or urethral stricture will require delayed reconstruction with vaginal or bladder wall flaps depending on the length of the stricture and degree of scarring.[63]

Urinary diversion in inoperable vesicovaginal fistula

Although the literature regarding the role of urinary diversion in patients with inoperable VVFs is scarce, they are being opted by few patients as the last resort. Urinary incontinence despite successful fistula closure may result

from small bladder capacity due to the loss of tissues at the time of injury, impaired urethral function, or from complete absence of the urethra. Also, extensive tissue destruction may render a fistula inoperable. These patients with total urinary incontinence continue to experience social isolation and discrimination.

In a study by Kirschner *et al.*,[64] a total of 118 urinary diversions for intractable VVF, including 9 ureterosigmoidostomies, and 109 modified Mainz II pouches were performed. Severe urethral incompetence (33.9%), inoperable VVF (32.2%), complete absence of urethra (9.3%), failed pubovesical sling (3.4%), and unknown (21.2%) are the indications for urinary diversions. Complete urinary continence, was achieved in 106 patients (89.8%).

Mainz II pouch and ureterosigmoidostomy can be performed at VVF centers with minimal resources.[65] The long-term dangers of urinary diversion should be clearly explained to the patients and a plan for early detection and management of complications should be made. Until, the safety, efficacy, practicality, and ethical acceptability of these operations can be ascertained, they should be offered with great restraint and with a maximum of effort to explain our limitations to the patients.

Management of overactive bladder in vesicovaginal fistula

Overactive bladder, an acute spasmodic pain arising from the bladder, is an important problem that needs to be tackled during the postoperative period after VVF repair.[66] However, the literature evaluating bladder spasm following surgical urogenital fistula repair is scarce. Spasms can occur despite postoperative analgesia, and require multiple medications. Ekwedigwe *et al.* evaluated the incidence of bladder spasms amongst patients who underwent urogenital fistula repair by a vaginal or an abdominal approach and has noted higher prevalence in abdominal approach. The highest incidence of bladder spasms was observed among patients with vault fistula, followed by those with vesicouterine fistula.[67] Abdominal approach essentially requires bladder splitting and results in a higher incidence of bladder spasm however, this increase may not be significant. A reduction in the tension at the suture line may prevent/reduce the postoperative bladder spasms.[68] Patients with bladder spasm after ureteric reimplantation could benefit from ketorolac.[69] Besides, all patients post VVF repair will have continuous catheter drainage for few weeks, which is one of the nonmodifiable factors causing bladder spasm.[67] Anticholinergics, along with adequate analgesics in the 1st postoperative week, may reduce patient discomfort and avoid unnecessary tension at the suture line.

Biopsy/excision of the fistulous tract – Is it necessary?

Tuberculosis, actinomycosis, schistosomiasis, and endometriosis[9,70,71] have been reported in the biopsy specimens of the fistulous tract. However, these reports are anecdotal and routine biopsy is not recommended and an individually tailored approach would be helpful to avoid undue complications secondary to the biopsy.[72] Biopsy is recommended when: (1) there is a previous history of genitourinary malignancies and (2) staging information is required for locally advanced malignancies involving the urinary bladder as the entire management plan would be dependent on local staging.[30] Excising the fistula tract may compromise the vaginal space when a transvaginal repair is being performed. Also, preserving the fistula tract (1) avoids injury to ureteric orifices, (2) retains fibrosis and allows for suturing, and (3) minimizes the blood loss and fistula size.

Stress urinary incontinence (SUI) after vesicovaginal fistula repair

An ischemic or iatrogenic injury to the supports of the urethra, either from the inciting or from the surgical trauma, may result in SUI post VVF repair. Repair of the fistula near the bladder neck or in the proximal urethra usually result in SUI.[16] Placement of a mid-urethral sling during the primary repair of VVF is controversial. Artificial suburethral sling should be avoided in the primary settings as the chances of erosion and failure of repair are high.[73] Rectus fascial sling, pubococcygeal sling, plication of pubocervical fascia, and avoiding tight closure of the vagina with judicious use of skin grafts and Martius flaps are measures recommended to prevent SUI.[16]

Vesicovaginal fistula repair and sexual outcomes

Sexual outcomes following VVF repair have been analyzed in recent studies.[74,75] Mohr *et al.* evaluated 91 patients undergoing VVF repair and reported a post surgery continence rate of 82% (transvaginal) and 90% (transabdominal) at 6 months of follow-up. Also, the sexual function in the 64 sexually active patients was significantly improved post surgery, but neither approach was superior to the other.[74] Pope *et al.* studied sexual function among 115 patients with 12 months of follow-up. They found that the vaginal length decreased on an average by 5 mm following surgery. Also, larger-sized fistulas (>3 cm diameter) and reduced vaginal caliber were associated with a higher risk of postoperative sexual dysfunction.[74] They also found that 30% of patients were waiting for doctor's permission to resume intercourse even after 6 months of surgery.[74] Although some patients avoid sexual intercourse and pregnancy due to fear of recurrence, others have a strained relationship because of prolonged abstinence.[74] Although the literature on the ideal time to resume sexual activity after VVF repair is scarce, intercourse is usually prohibited for a period 3–6 months following VVF repair. However, recent studies have shown that sexual activities can be resumed as early as 6 weeks.[75] Adequate foreplay, avoiding rough sex, and intercourse during menstruation are the general postoperative advice given to these patients.

Open versus laparoscopic versus robotic repair

Traditionally, the VVFs are repaired via the transabdominal or the transvaginal approach. Laparoscopic repair of VVF requires a high level of surgical skill especially during dissection and intracorporeal suturing. The advent of surgical robot has made these demanding tasks easy.A rapid rise in utilization of these minimally invasive techniques has hastened the post operative recovery and has reduced the hospital stay. Two approaches have been described for robotic VVF repair– (1) transperitoneal transvesical and (2) transperitoneal extravesical. Both the laparoscopic and robotic VVF repairs have been shown to have similar outcomes with minimal complication rates.[76] Robotic repair of VVF certainly has advantages over conventional laparascopy such as a magnified three-dimensional vision, enhanced 7° degrees of freedom of movement, easy suturing, precise dissection, and lesser blood loss. Although robotic surgery has revolutionized the outlook of minimally invasive surgery in the 20th century, the debate, whether the robotic VVF repair is feasible on a large scale in developing nations where the disease burden is high and the economic conditions are unfavourable, still exists. The cost of robotic urological procedures is high even in the developed nations.[77] In fact, most of the VVFs in developing nations are still repaired transvaginally like in African nations. It pronounces that advanced surgical tools like robotics may not be mandatory to guarantee success as long as the essential principles of VVF repair are followed well. No randomized studies are available to compare the outcomes of open, laparoscopic, and robotic methods of VVF repair. With improvements in minimally invasive surgery, open transabdominal surgical repair of VVF may become obsolete. But still, the transvaginal repair should be the gold standard wherever feasible.

Suturing in vesicovaginal fistula repair

Traditionally, VVF is repaired with absorbable sutures such as polyglactin (Vicryl) or similar ones. With the advent of laparoscopic and robotic techniques, rapid and precise suturing has become important. Barbed sutures such as the V-Loc™ and STRATAFIX™ are being frequently used to improve the suturing maneuvers and reduce the operating time.[78] Long-term outcomes of these repairs are yet to be published.

Is filling cystogram required prior to catheter removal after vesicovaginal fistula repair

Cystograms are often performed after reconstructive surgery of lower urinary tract to assess the integrity of the repair and to decide on the time of catheter removal. Time of catheter removal following VVF repair also varies from 2 to 4 weeks.[28,32,47,59] There is no recommendation on when to perform a cystogram after VVF repair. As most of the surgeons prefer catheter removal after confirming absence of leak on filling cystograms, we suggest cystogram should be performed under dynamic fluoroscopy to avoid inadvertent complications.[79] Salient features of management and newer trends have been highlighted in Table 3.

Table 3: Management strategy for vesicovaginal fistula

Percutaneous nephrostomies for urinary diversion in malignant VVF - often permanent
Suprapubic cystostomy as adjunct urinary diversion following VVF repair is useful
Bladder drainage for 2 weeks is sufficient for healing of VVF repair
Early repair of VVF - optional, Delayed repair - trouble-free: Repair at 12 weeks preferable
Transvaginal route of repair - greater versatility and more range of flap options than the transabdominal route
Limited cystotomy during transabdominal approach is preferred, especially in minimally invasive era of VVF management
Interposition flaps are valuable adjunct in malignant- and radiation-induced fistulae
Anticholinergics and bladder relaxants help in postoperative recovery and comfort
Biopsy of the fistula - not mandatory in nonmalignant VVF
Vaginal intercourse initiation after repair to be done cautiously, safe after 3 months
Filling cystogram after VVF repair - not mandatory

VVF=Vesicovaginal fistula

CONCLUSIONS

Conservative methods should be used in carefully selected patients. The decision to repair the VVF surgically should be taken early and should be based on sound clinical judgment after considering all the factors about the fistula. Delayed repair is better than early repair of VVF. The transvaginal route is preferred, as it has low morbidity, higher success rates, and minimal complications. When facilities are available, all the patients may be referred to a tertiary care center where expertise and advanced resources are available. This may not be applicable to many developing nations where economy and health-care system are suboptimal.

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