Vaginal Fistula Repairs

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Forrest C. Jellison and Shlomo Raz

Introduction

A vaginal fistula is defined by extra-anatomic communication between the vagina and an epithelial lined organ. This communication in the vagina may be straight forward with an abnormal connection to and involve the ureters, bladder, urethra, and rectum. A complex vaginal fistula might involve several different abdominal and pelvic organs which emphasize the importance of a complete workup before attempting to repair.

A vaginal fistula negatively affects an individual's quality of life and prompt repair is suitable in most patients that are properly selected. There are many surgical approaches to repair a fistula, the best repair centers on the first procedure being the most effective. However, there is a lack of high quality comparative studies to guide the surgeon. When selecting the initial surgical approach the surgeon should consider their expertise and experience after a thorough evaluation to determine the etiology and location of the fistula. In this chapter we will focus on the etiology, diagnosis, evaluation, and surgical repair of vesicovaginal (VVF), urethrovaginal (UVF), and rectovaginal fistula (RVF).

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General Principles of Fistula Repair

This chapter provides an overview of the principles for successful repair which involve the timing, condition of the patient, vaginal access, surgical approach, use of adjuvant procedures, and evaluation. The majority of fistulas encountered in developed countries are iatrogenic and will be the focus of this chapter.

Timing

Timing of repair begins with an assessment of risk factors for poor healing (malnutrition, radiation, immunosuppression, or vaginal atrophy) that should be corrected when possible before proceeding with repair. The timing of repair depends mostly on the etiology of the fistula and the experience and comfort level of the surgeon. The surgical timing and approach is individualized for every patient. The first repair should be the most successful in the surgeon's

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experience, since it is the most important in establishing successful results. Most fistulas are found after the acute period and traditionally it was thought that a period of about 6 months was required for tissue swelling and infection to resolve. However, by allowing edema and inflammation to resolve, this would promote tissue healing so that an optimal repair could be performed. There are similar outcomes with early or delayed repairs with several reports where fistula repair can be performed successfully after 2 weeks [1–3]. The prerequisite for early repair is no obvious infection and that patients do not have an ischemic fistula from radiation or obstructed labor which can impede healing from viability of tissue margins that vary with time.

In the cases of radiation-induced fistula, it is advisable to allow for tissue stabilization, although many fistulas present late when there is no active progression. Assuming there is no infection and the tissue has stabilized, the patient can proceed to surgical reconstruction. Radiation results in extensive tissue ischemia and the reported failure rates can be up to nearly 50 % [4]. Due to high failure rates, adjuvant procedures involving tissue interposition should be performed. Consideration of temporary fecal diversion or in severe cases permanent urinary or fecal diversion may be warranted. Additional findings of diminished bladder capacity are common with the fistula typically located in immobile region of the bladder trigone and may involve the ureteric orifices requiring an abdominal approach to perform bladder augmentation and/or ureteric reimplant.

Special consideration should be given to RVF from Crohn's disease by first contemplating medical therapy before proceeding to surgical repair. Medical therapy with antitumor necrosis factor therapy has a reported success rate of 60 % at 1 year, but this declines to 36 % at long-term follow-up with similar unsatisfactory results from other studies [5, 6]. Other medical treatments include 6-mercaptopurine, and cyclosporine with limited success [7, 8]. Even with advances in medical therapy, surgical repair is the primary basis for long-term cure.

Abdominal or Vaginal Approach, Combined

The goal of surgical repair is to have a durable repair with the least morbidity while preserving continence in the case of urethrovaginal fistula. In deciding the surgical procedure, consideration is made to the location of the fistula, number, size, etiology, quality of the surrounding tissue, and vaginal access all which could limit or change aspects of the surgery. Principles of repair regardless of approach include nonoverlapping sutures, tension-free approximation of tissue, avoid devitalizing of the tissue, removal of foreign bodies, good hemostasis of the surgical field, water tight, multilayer closure with or without interposition of tissue, and postoperative bladder and urethra drainage or fecal diversion. An infratrigonal VVF is typically approached vaginally. While a supratrigonal fistula or difficult vaginal access may be considered a limitation to be approached vaginally by some surgeons, although in our experience this can be repaired vaginally when the fistula is not complex and there is no history of radiation [3, 9]. Other options include the abdominal approach (open or robotic). An indication for an abdominal or robotic approach is based on surgeon preference or when there is a need for concomitant bladder augmentation, ureteric reimplant, intraperitoneal pathology, or bowel diversion.

Both abdominal and vaginal repair of VVF are well established and have excellent success rates with each approach having its advantages [10]. Laparoscopic and robotic repairs have been reported in small case series at centers of excellence with encouraging results, but further study may be warranted before wide scale adoption [11–13]. The advantages of a vaginal approach are decreased morbidity associated with shorter hospitalization; the majority of repairs are performed at an ambulatory surgical center with less than 24 h stay, and decreased complications due to the minimally invasive approach which avoids intraperitoneal injury and large bladder incision. In deciding the approach, a surgeon has to consider their experience, comfort, and familiarity with each approach.

Urethrovaginal fistula repair is tailored by the location, size, and symptoms. A fistula located in the distal urethra may only need an incision of the distal urethra or observation if asymptomatic. If the fistula is large in size (>1–2 cm), radiation induced, or tissue is necrotic, an inflamed use of an interpositional tissue flap is recommended. Interposition with a martius flap is the preferred method due to the location to the urethra and ease in dissection with minimal complications. In cases of extensive urethral destruction, complex reconstruction may require rotational vaginal or labial flaps, neo-urethral reconstruction, autologous fascia sling or bladder neck reconstruction.

As in other urinary fistula, there are no formal guidelines for RVF repair. Most urologists or gynecologists repair RVF vaginally, while colorectal surgeons are more familiar with transanal or abdominal repair. Most of the rectovaginal fistulae are easily accessed by the vaginal route with the abdominal approach reserved for sigmoid colon and proximal rectal fistula. There is limited experience with minimally invasive treatment with fibrin glue or endoscopic management [14]. We will focus on vaginal repair which avoids the morbidity of an abdominal surgery.

Before embarking on vaginal repair, there should be consideration to the fistula location, sphincteric function, quality of the tissues due to radiation or prior surgeries, and if concomitant abdominal pathology or the need of a diverting colostomy needs to be addressed. A high fistula is not an absolute indication for an abdominal repair. A vaginal approach allows for simultaneous anal sphincter reconstruction. The surgeon's expertise and familiarity should be considered for each case.

Concomitant Procedures

Vaginal fistula repair may involve concomitant procedures that depend on the surgical setting. These procedures include autologous fascia sling, ureteric reimplantation, bladder augmentation, fecal diversion, and adjuvant tissue interposition. A simple tissue interposition repair may involve vaginal, peritoneal, or martius flaps or in cases of complex repair require rotational labial flaps, inner thigh rotational or island flaps, omental, gracilis, or myocutaneous flaps.

Stress incontinence after successful VVF repair may cause distress and lead the patient to believe their surgery was a failure. Preoperative evaluation and education is important, so patients understand their surgical options. Concomitant anti-incontinence procedures can be performed with fistula repair and do not increase the risk of recurrence, although it may be better to stage the anti-incontinence procedures [15]. In select instances, we would consider placement of a fascial sling at the time of VVF repair, but in the majority of cases the procedure is staged because even temporary outlet obstruction can lead to fistula recurrence. A synthetic sling is not recommended as it is a foreign body and may lead to fistula recurrence. Our preference is to stage an anti-incontinence procedure to prevent the risk of high pressure voiding that may result in fistula recurrence.

The approach is similar with UVF where in the majority of cases the sling procedure is staged to prevent development of urethral obstruction and the potential increase risk of fistula recurrence. The condition where there is less controversy about placing a fascial sling is when the fistula involves the mid-urethra sphincteric complex or distal third of urethra and there is suspicion that the patient will be incontinent postoperatively. The sling would be placed proximal to the repair at the bladder neck. Some have successfully reported concomitant autologous fascial sling at the time of a fistula repair, while we have not placed a sling distal to our urethral repair due to risk of the sling creating obstruction and high pressure voiding that may result in fistula recurrence.

Ureteric Reimplant and Bladder Augmentation

Diagnostic evaluation can determine the need for additional bladder or ureteral surgery which would require an abdominal approach. An abdominal approach is indicated when there is ureteric obstruction or fistula which would require

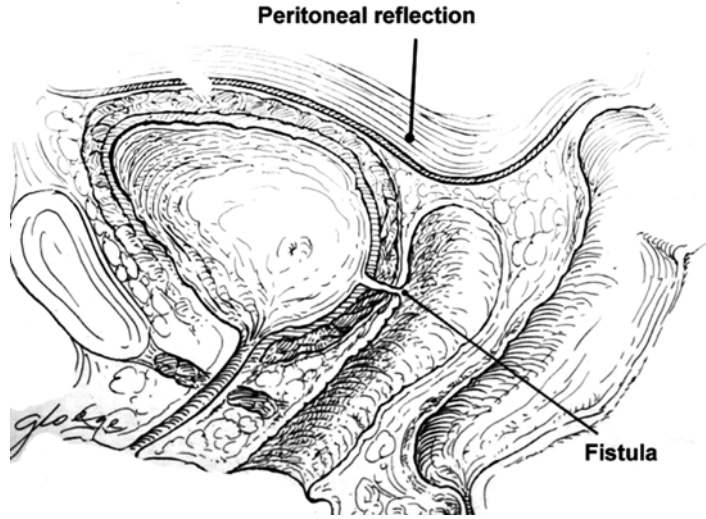

Fig. 10.1 The peritoneum is located near a post hysterectomy vesicovaginal fistula (Copyright © Shlomo Raz, MD)

ureteric reimplantation. Placement of preoperative ureteral stents when a VVF is located near the ureteric orifice may avoid ureteric reimplant. In cases of a small and contracted bladder capacity, an augmentation should be performed.

Fecal Diversion

The decision to perform a temporary diverting colostomy or ileostomy is made on an individual basis as there are no absolute indications when considering a RVF repair. The surgeon may elect to divert stool with complex fistula that are radiation induced, recurrent, large, or a result of malignancy. The diversion is taken down 3–6 months postoperatively after successful repair.

Tissue Interposition-Peritoneal, Martius, Labial, Gluteal Flaps (Inner Thigh Rotational Flaps Based on the Internal Pudendal Artery)

Vaginal repair and reconstruction is complex and requires many techniques to be in the surgeon's armamentarium. Successful repair consists of several layers in the closure of the fistula. The use of interpositional tissue is advised when the fistula is complex, large, a history of radiation, tissue is inflamed, or closure is suboptimal. There are differing opinions when tissue interposition is necessary as there are no definitive indications. Evan et al. in a retrospective study found improved success rates of VVF repair with interpositional flap [16]. There are several described flaps that can be used for interposition. After a hysterectomy the location of the VVF is often at the vaginal cuff and we routinely use a peritoneal flap due to its ideal location, ease of dissection, and it maintains a reliable vascular supply (Fig. 10.1). The results have been excellent with a peritoneal flap with 96 % success rate [9]. A peritoneal flap is an appropriate choice for supratrigonal fistula and in the case of a distal fistula it should be repaired with a martius flap due to its location. Successful repair has been reported at 97 % with a martius flap [9]. The martius flap is well vascularized with the blood supply located superiorly by the external pudendal artery, laterally by the obturator artery, and inferiorly by the posterior labial branches of the internal pudendal artery by which it is usually based (Fig. 10.2). The martius flap is mobilized by transection of the superior and lateral pedicles and its blood supply is based on the inferior pedicle in the majority of cases. Successful repair is subject to adequate mobilization so that the flap is off tension without

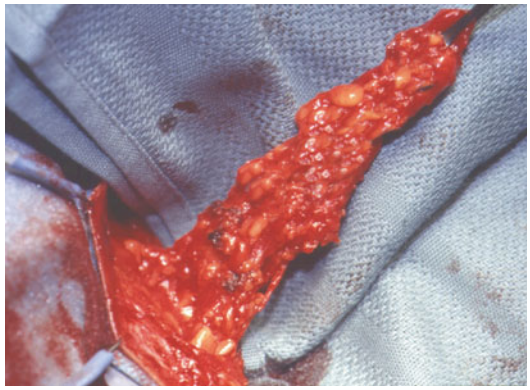

Fig. 10.2 Martius flap based on its inferior pedicle, posterior labial branches of the internal pudendal artery (Copyright © Shlomo Raz, MD)

compromising its blood supply. Disadvantages of a martius flap are that it may not reach a proximal fistula without compromising its viability or resulting in vaginal shortening [9]. Although the surgical harvest of a martius flap is feasible, complications such as hematoma, pain/numbness at surgical site, cosmetic deformity, and sexual dysfunction can rarely occur.

Rotational labial and inner thigh rotational flaps are selected for specific conditions: large vaginal defects, difficult vaginal access requiring a relaxing incision, and subsequent need for vaginal coverage, large, recurrent, or radiation-induced fistula. When there is a large vaginal defect these flaps can provide fibroadipose tissue and skin coverage with a well vascularized blood supply. Full thickness rotational labial flaps, for anterior vaginal wall, or gluteal flaps, for posterior or proximal vaginal wall, are chosen depending on the location of where the flap is needed. A full thickness rotational labial flap is the same fatty tissue of a martius flap with its overlying skin that is rotated to cover an anterior vaginal defect. The fistula is first repaired and then a U-shaped incision is made lateral to the labia majora with the apex located at the posterior fourchette. The flaps' blood supply is from the superior pedicle which is based on the external pudendal artery. This flap is dissected free from the fascia of the pubic bone so that it can be rotated medially to achieve repair. In a small series there has been a successful report of this technique [17].

A full thickness gluteal inner thigh rotational flap is reserved for complex refractory fistula. With the patient in the lithotomy position, a mediolateral episiotomy is made at 5 O' clock extending from the introitus to the vaginal apex. Dissection is continued into the para-rectal space. A 4×12 cm inner thigh flap is prepared by making an inverted U-incision lateral to the labia major extending from the ischial tuberosity inferiorly, and to the pubic rami superiorly. This incision preserves the blood supply from the internal pudendal artery and innervation from the labial branches of the internal pudendal nerve and perineal branches of the posterior cutaneous nerve of the thigh. Dissection is carried to the level of the fascia. The episiotomy is extended to the infero-medial aspect of the flap to allow complete mobility. This creates a lateral gluteal rotational inner thigh flap and a medial labial flap. The labial and gluteal rotational inner thigh flaps are crossed; the inner thigh flap medially and the labia flap laterally. The inner thigh flap is transferred and sutured to the vaginal defect. This is a functional full thickness flap that provides good sensation and adequate vaginal width and depth. A variation of the full thickness inner thigh flap is the Singapore island flap [18]. The dissection of the flap is similar except that the episiotomy is avoided and the flap is tunneled to the defect. The epithelium of the flap is removed except for the area that is covering the fistula. This flap is used in complex fistula repair and may be preferred to the full thickness rotational inner thigh flap when there is already adequate vaginal access.

There are several reports of gracilis myocutaneous flap for radiation-induced fistula in which it is used for vaginal reconstruction [19, 20]. We seldom find it necessary to perform this technique because the rotational gluteal flap can duplicate many of the same functions of this gracilis graft without the associated morbidity and cosmetic defects.

The most described interposition is the omental flap which has increased success rates for abdominal repair in retrospective studies [16, 21]. The omentum is based on the right or left branch of gastroepiploic artery, although typically it is based on the right which is usually

larger and more caudal. In cases of bowel resection the mesentery can be preserved and serve as a useful interposition which has similar properties as the omentum with a well vascularized blood supply and lymphatic drainage to decrease inflammation and promote healing. Other tissue interposition flaps that have been reported are bladder flaps [22–26].

Selection of closure and reconstruction of the urethra after UVF requires expertise and experience due to its complexity. Urethral reconstruction centers on different techniques, primarily urethral closure, vaginal and bladder flap advancement which includes pedicle flap (labia minora and anterior or posterior bladder), and use of grafts [27]. Surgical planning of the urethra reconstruction technique may influence vaginal incision location. In a complex fistula resulting in damage of nearly the entire urethra that can extend potentially to the bladder neck, a urethral reconstruction using vaginal or bladder flap construction with interposition of tissue would be preferred to a primary closure. It would be advised to place ureteral stents as the fistula may distort the anatomy and ureteral injury may be avoided during repair.

Evaluation

History and Physical Examination

Women with VVF and UVF most often present with constant urinary incontinence shortly after a pelvic surgery. The presenting symptoms may be recurrent urinary tract infections with chronic perineal changes exhibited by poor healing and irritated skin. Questioning the degree of difference voided and the amount leaked may give clues to the size and location of the VVF. Timing of the onset of leakage and whether there is stress incontinence or urge incontinence with overactive bladder symptoms before the VVF is important to consider in selecting treatment options and patient counseling. A patient with a UVF in the distal third of the urethra may remain continent and asymptomatic or they will commonly describe a splayed urinary stream. They may additionally complain of urinary leakage after vaginal voiding. When the fistula is in the mid-urethra and part of the external sphincter, the patient may have positional intermittent leakage of urine. Patients may have constant, large amounts of urine leaking indicating there is a large fistula that is located proximal to the mid-urethra in the proximal urethra or bladder neck. Gathering information to determine the etiology and prior surgical attempts to repair the fistula can affect the treatment plan.

On physical examination, there should be careful inspection of the fistula size, number, location, and quality of the surrounding tissue. The location of a VVF after hysterectomy is usually a single fistula at the vaginal cuff, although it may present as a complex VVF with multiple fistulas. Evidence of the fistula site is found with surrounding inflammation with granulation and tissue defect. Adequate vaginal access and the degree of mobility of the tissue surrounding the fistula is revealed by the amount of vaginal prolapse. Nulliparous patients or with a history of radiation may be challenging due to a lack of vaginal access and mobility because of narrow vaginal width. On exam, the integrity of the vaginal mucosa, urethral mobility, and assessment of stress incontinence with provocative maneuvers should be performed.

It is important to differentiate the origin of the vaginal drainage and not to make any assumptions as the fluid may be from the fallopian tube, vaginal secretions, peritoneum, lymph, or urine. The differential diagnosis of VVF is UVF, ureterovaginal, uterovaginal, ectopic ureter, or vaginal infection. It is important to differentiate the origin of vaginal drainage and not to make any assumptions as the fluid may be from other pelvic sources [3].

Patients with RVF have presenting clinical symptoms that include gas, stool, and purulent vaginal discharge. The physician should be aware that colonic or enteric fistula may present with similar symptoms as a RVF. The history should focus on causes of the fistula which is most commonly obstetric trauma, but also includes pelvic surgery, malignancy, history of radiation, pelvic abscess, and inflammatory bowel diseases.

Occasionally, small or intersphincteric rectal vaginal fistula may be asymptomatic. Vaginal and bimanual exam should be performed taking note of the location, number, tissue quality, and size of the fistula. On exam, the fistula is normally clearly visualized and instilling dye into the rectum may be of assistance. The location of the fistula is important in deciding the operative approach and is classified into high and low in relation to the anal sphincter. High fistula may need to be approached abdominally and low fistula transvaginally. Occasionally examination under anesthesia is indicated for a more thorough evaluation. During physical examination anal sphincter tone should be evaluated as this may need concomitant repair.

Diagnosis

The diagnosis of a urinary or rectovaginal fistula can most often be made upon a vaginal examination. A urethral catheter with retrograde filling of the bladder or rectum with dye may demonstrate the fistula on exam. A urinary fistula can be confirmed after administering phenazopyridine once it is excreted in the urine. By placing gauze or a tampon in the vagina, the gauze should turn orange in color in the presence of a fistula. A double dye tampon test can further delineate the origin and location of the fistula by giving the patient phenazopyridine followed by retrograde instillation of dye, methylene blue or indigo carmine, into the bladder through a catheter. A ureterovaginal fistula should be orange in the proximal part of the packing while a VVF or UVF should be blue in the mid or distal packing. A negative tampon test does not rule out a fistula and clinical suspicion is many times required to make the diagnosis.

There are varying opinions and no consensus on the imaging required in the evaluation of a VVF or UVF. Many patients have a complex history with postoperative complications and there are medico-legal implications that should be considered [28]. Our practice is to completely evaluate the patient to attempt to address all problems at the initial repair. A voiding cystogram during filling may demonstrate the fistula; however, the intradetrusor pressure may need to be increased during voiding to visualize small fistulas with the patient positioned in the lateral and oblique position. The lateral views may best demonstrate the fistula when it has a direct connection between the bladder and vaginal or when the connection is indirect and enters a collection/sinus tract before draining into the vagina. The VCUG can identify additional findings of a UVF which can be found concomitantly with VVF, the degree of vaginal prolapse, and stress incontinence [29]. Demonstration of preoperative stress incontinence may change the treatment plan by the addition of an anti-incontinence procedure or it may alter patient expectations, of postoperative leakage.

Upper tract evaluation to assess for abnormal findings of hydronephrosis or urinary extravasation from obstruction or fistula with CT urogram should be performed, although there are no formal recommendations to guide the surgeon. There is a 12 % upper tract injury with VVF [30]. Should there be further questions regarding ureteric involvement, a retrograde pyelogram would be justified as it is the most sensitive in detection of upper tract injury, although a CT urogram with reconstructions may be adequate in our experience [31]. Urine cytology is recommended for those with a history of malignancy or pelvic radiation.

It is our routine practice to perform a cystoscopy to evaluate for a urethral fistula and consider it mandatory when there is a history of hematuria or radiation. Urethroscopy should be performed with a short beaked rigid cystoscope (urethroscope or hysteroscope) or flexible cystoscope to allow full visualization of the urethra; the light and the irrigant are at the same level allowing direct vision and expansion of the urethral wall. A 30 and 70° optic lens allows identification of bladder abnormalities while a 0 or 15° lens is better for visualization of urethral foreign bodies or lesions. The fistula size and location in relation to the bladder neck, trigone, and ureteric orifice are determined on cystoscopy. If the fistula involves the bladder neck, it should be discussed with the patient as it may affect continence

after repair. Findings on a cystoscopy can determine if ureteral stents are necessary and if a combined vaginal and abdominal approach are appropriate when there is ureteric involvement.

It is important to document preoperative sexual function and discuss potential postoperative complications. Vaginal stenosis is a potential complication that can be corrected with a subsequent vaginoplasty in most cases. Vaginal shortening may result when a martius flap has insufficient length for a proximal fistula or as a result of Latzko partial colpocleisis. The peritoneal flap is better situated for proximal fistula repair to prevent vaginal shortening.

Further radiologic evaluation with a CT of the abdomen and pelvis should be performed in cases of prior malignancy or in patients without other risk factors for RVF. Gastrografin enema may identify the location of the rectovaginal fistula. Proctosigmoidoscopy and colonoscopy may establish the diagnosis and evaluate for malignancy, especially in the case of radiation-induced fistula where about a third are malignant [32]. If there is any concern for malignancy, the fistula should be biopsied.

Anal sphincter tone should be evaluated preoperatively with physical examination. Nearly 50 % of patients have fecal incontinence which should be discussed and potentially treated simultaneously with fistula repair [33]. Our practice is to routinely obtain an endoanal ultrasound when the cause of the fistula is from trauma after vaginal delivery. Endoanal ultrasound and anal manometry testing can provide valuable information regarding sphincteric function and defects preoperatively.

Vesicovaginal Fistula

Background

Vesicovaginal fistula is an abnormal extra-anatomic connection between the bladder and vagina. Women with VVF suffer enormous amounts of physical, social, and psychological limitations. It is uncommon in western countries, although it remains a widespread problem in undeveloped countries due to obstructed labor [34]. In developed countries, VVF is most often a complication of pelvic surgery (hysterectomy) which we will direct the majority of our attention. VVF may associate with UVF and/or RVF [9, 35]. VVF usually presents with constant urinary incontinence that is distressing and may be intensified as a result of a surgical complication.

Etiology

VVF in the USA and developed countries are the result of gynecologic pelvic surgery in over 80 % of cases, with the remaining causes being comprised from radiation, malignancy, trauma, and obstetric instrumentation during childbirth [29]. Hysterectomy accounts for 91 % of the gynecologic pelvic surgeries that resulted in VVF [9]. A total of 600,000 hysterectomies are performed annually in the USA and nearly a third of women have hysterectomies for benign disease [36–38]. The reported incidence of fistula after hysterectomy for benign disease is reported to be 0.1 to 0.4 %. The risk of fistula increases about tenfold to 1–4 % after radical hysterectomy [39]. The majority of hysterectomies in the USA are performed abdominally with a Cochrane review reporting the risk of fistula formation is similar regardless of the approach, although there is increased risk of injury of urinary tract with laparoscopic hysterectomy [40, 41]. A national database registry study in Sweden found that abdominal and laparoscopic surgery had the highest fistula rate [39]. Fistula formation after hysterectomy is thought to be the result of unrecognized injury to the urinary tract at the time of surgery. The injury may be directly to the bladder or from inadvertently placed sutures that result in tissue necrosis. These injuries result in a urinoma that accumulates and drains through the vaginal cuff [42]. Preoperative risk factors for fistula formation after hysterectomy for benign and malignant disease are diabetes, smoking, history of c-section, endometriosis, pelvic inflammatory disease, and radiation [43–45]. Intraoperative findings of pelvic adhesions, bladder injury, extensive surgery, and higher stage cancer have higher risk of fistula [43–46]. Performing a subtotal hysterectomy with preservation of the cervix

decreased the fistula rate which may be the result of a less extensive surgery [42]. Attention to avoiding injury to the urinary tract and performing a cystoscopy during difficult dissections where bladder injury is suspected may prevent a fistula [28]. It may be helpful to retrograde fill the bladder with dye or saline in these select cases to detect injury. Observation of the urine draining from the foley during hysterectomy should be clear and if there is question further investigation is indicated.

Pelvic surgery with mesh-augmented repair is another cause of fistula. There are reports from transvaginal mesh causing VVF at low rates 0.29 % [47]. A mid-urethral sling may inadvertently injure the bladder and cause a VVF [48]. This reinforces the importance of a cystoscopy at the time of sling placement to prevent urinary fistula. As the number of transvaginal mesh surgeries has been increasing, there may have been a rise in the number of urinary fistula from mesh complications [49]. Whether this trend may reverse as a result of decreased transvaginal mesh-augmented repairs due to the FDA safety communication in July 2011 regarding complications related to transvaginal mesh for POP remains to be seen.

Radiation-induced fistula represents a minor portion of VVF. The mechanism of injury is from obliterative arteritis resulting in ischemia which also produces inflammation of encompassing tissue [50]. Presentation of radiation fistula can occur acutely or be delayed for several years [3, 29]. Suspicion of recurrent cancer or secondary malignancy must be considered with a history of radiation fistula.

Treatment

Conservative Treatment

The goal of surgical repair is to have resolution of the fistula with the least morbidity. In select circumstances it is reasonable to attempt a trial of catheter for about 4 weeks [51]. There are reports of spontaneous resolution of fistulas that are simple and small with the overriding principle that there should be no delay in definitive repair [52–54]. Consideration of endoscopic treatment with fulguration and fibrin glue has been successfully reported in small case series when fistulas are less than 3.5 mm in size [55, 56]. This is a reasonable approach when patients meet these defined criteria; however, few patients are candidates for these conservative or minimally invasive procedures and require surgical repair. Patients with a history of fistulas that are complex, large, or radiation induced should proceed with definitive repair as minimally invasive treatment is futile.

Transvaginal Repair

Prior to surgery a detailed physical examination, urine analysis with culture if indicated, cystoscopy, and VCUG are performed with CT urogram with 3D reconstruction of the ureters in selected cases. We describe our basic technique and adjuvant procedures performed in complex cases. With the patient in lithotomy position, surgical repair begins with vaginal exposure with a ring retractor and vaginal speculum. The key to performing this repair is identification of the fistula tract. A cystoscopy is performed to identify the fistula and a wire is placed through it. Bilateral stent placement is done when the fistula is near the ureteric orifices. A 16–18 Fr catheter is inserted into the bladder. The vaginal cuff is grasped with Allis clamps or with stay sutures to expose the fistulous tract which is dilated with sounds over the guide wire to allow the passage of a 8–10 Fr catheter. The catheter is important in the exposure and retraction of the bladder during the repair. A circumferential incision is made less than 1 cm from the fistula track. An inverted U-incision is made on the anterior vaginal wall and it is mobilized 3–4 cm to create the anterior vaginal flap (Fig. 10.3). A posterior vaginal wall flap is created from the cuff to expose the prerectal fascia, the vesico-rectal space, and the posterior cul de sac where the peritoneal flap can be retrieved.

The fistula tract is isolated and closed with 2-0 or 3-0 delay absorbable interrupted sutures. Care is taken to incorporate the entire fistulous tract and the bladder wall. At the end of the closure, diluted indigo-carmine tests the integrity of the repair. We omit excision of tract unless there is concern of malignancy or extensive necrotic tissue. The fistula tract is not routinely excised

because it provides excellent anchoring tissue for closure, avoids creating a larger defect to repair that may prevent the need for ureteric reimplant, and prevents bleeding from the fistula tract edges that can become devitalized from electrocautery during control of bleeding [3, 57]. The bladder is filled with indigo carmine once the fistula tract is closed to ensure there is no extravasation. A second layer of sutures 1 cm from the fistula and imbricated over the tract with 2-0 or 3-0 delay absorbable interrupted suture for the second layer of closure. A double layer of peritoneal flap is dissected from the vesico-rectal space in the cul de sac, mobilized and advanced 2–3 cm distal to the fistula closure (Fig. 10.4). This flap is approximated with 3-0 absorbable interrupted sutures. A small segment of the distal flap is excised and the posterior flaps are advanced and closed beyond the fistula side with absorbable 2-0 interrupted suture to result in a four-layer closure (Fig. 10.5).

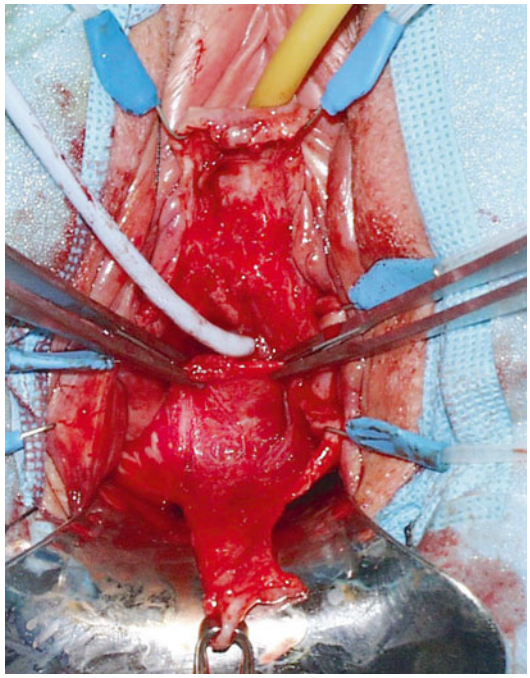

Fig. 10.3 Anterior vaginal flap that has been mobilized (Copyright © Shlomo Raz, MD)

Latzko Partial Colpocleisis

The Latzko partial colpocleisis is an alternative technique to our transvaginal vesicovaginal fistula repair. Our approach avoids vaginal shortening and overlapping suture line that may result in recurrence. Other authors report low recurrence rates and vaginal shortening only when there is already a shortened vagina [58]. Potential advantages of this approach are decreased morbidity from less blood loss and shorter operating time. The Latzko technique is attempted for proximal post hysterectomy fis-

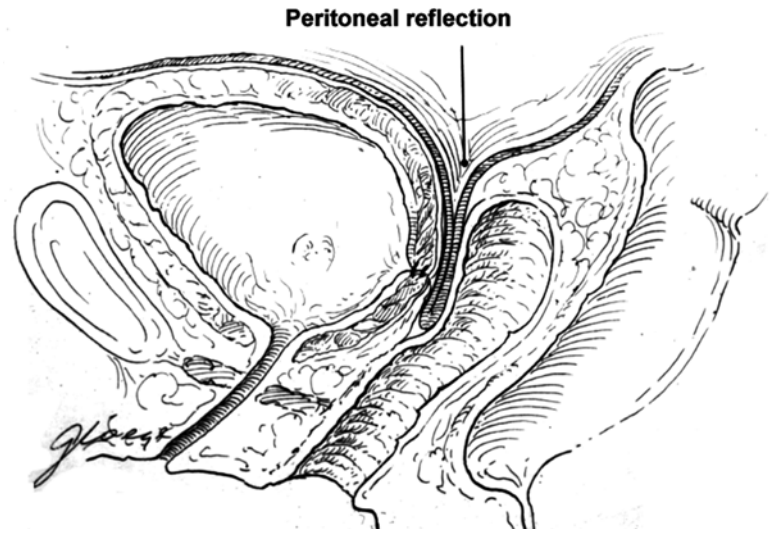

Fig. 10.4 The peritoneum is advanced distal to the fistula closure (Copyright © Shlomo Raz, MD)

tula. It involves a circumferential elliptoid incision around the fistula with wide mobilization of the vaginal epithelium in all directions.

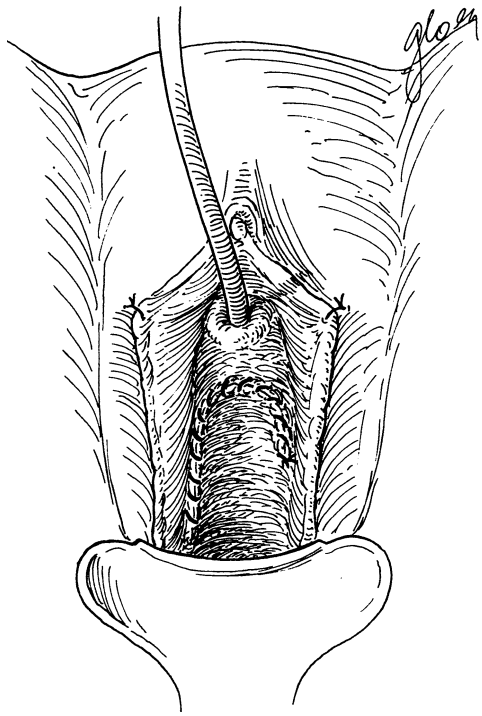

Fig. 10.5 Repair and closure of the fistula with four layers (Copyright © Shlomo Raz, MD)

The fistula tract is closed and the repair is reinforced by an inverted layer of the perivesical tissue. The suture lines are overlapping in this repair (Figs. 10.6a–c and 10.7a–c).

Abdominal Repair (Fig. 10.8a–e)

An abdominal approach may include open, laparoscopic or robotic repair. Indications for an abdominal approach include intraperitoneal pathology, concomitant ureteric reimplant, or bladder augmentation, or need for fecal diversion. Abdominal repair is typically approached with the O'Conor technique. Our standard approach begins with a midline incision that extends from the umbilicus to the pubic bone. Once entering the peritoneum the bladder is identified by retrograde filling of the catheter. A vaginal probe is inserted and retracted superiorly. The bladder is dissected free from the vagina until the fistulous tract is encountered. A decision to bivalve the bladder is made if the fistula tract is not visibly patent and open. The bladder is bivalved extending the incision to include the fistula which can be biopsied if there is concern for malignancy. The vaginal wall is dissected and separated from the bladder 3–4 cm surrounding the fistula. The bladder and the vagina are closed in two separate layers and indigo carmine is injected to

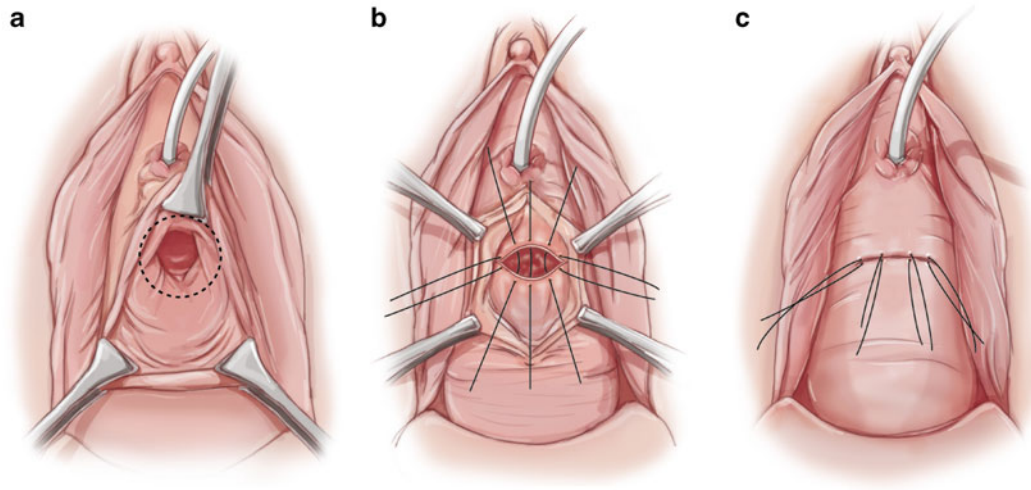

Fig. 10.6 (**a**, **b**) Circumferential incision and mobilization of the vaginal epithelium around the fistula. (**c**) Closure of vaginal epithelium results in overlapping suture lines

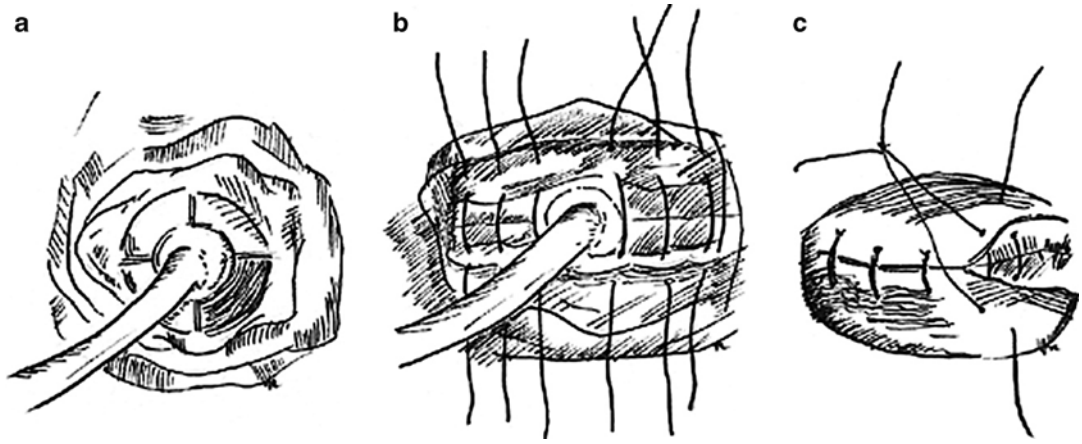

Fig. 10.7 (**a**, **b**) Circumferential incision and dissection of the epithelium around the fistula with inverted closure of the fistula tract and perivesical tissue in two layers. (**c**) Closure of vaginal epithelium results in nonoverlapping suture lines (Copyright © Shlomo Raz, MD)

assure complete closure. Interposition of tissue flap between the layers is added for security. The most described interposition is the omental flap which has increased success rates in retrospective studies or free flap of peritoneum can be used [16, 21].

Laparoscopic/Robotic

The first description of a laparoscopic VVF repair was by Nezhat in 1994 [59]. The robotic repair was first described in 2005, which is a platform that allows more surgeons to perform the technical aspects of this surgery of suturing and knot tying that are technically demanding with laparoscopic surgery [60]. The success rates are about 90 % or greater in the few case series reporting on these techniques [11–13, 61, 62]. There is one study comparing open to robotic repair of VVF with similar outcomes [11]. As in open repair, the robotic approach allows the surgeon to perform ureteric reimplant when indicated. These emerging technologies appear to be promising for the surgeon skilled in robotic or laparoscopic surgery. Outcome data on robotic repairs remains limited as this is an emerging technology. Vaginal surgery has decreased operating time, costs, and can be performed in an ambulatory surgical center.

Complications

Complications of vaginal bleeding, bladder spasm, and infection increase the risk of recurrence. These should be treated to prevent fistula recurrence. Fistula recurrence is the most significant complication and every attempt should be made to prevent it. Postoperative antibiotics are routinely given for about 2 weeks postoperatively. Anticholinergics or B & O suppositories may be needed to prevent bladder spasms. Patients should be advised to have pelvic rest for 3 months postoperatively. Recurrent fistula should be treated with a tissue interposition and at least a 3 month delay in repair. Rare complications of injury to the ureters, bowel, and rectum occur and should be discussed.

Urethrovaginal Fistula

Background

A UVF is an abnormal connection between the urethra and the vagina that may be the result of obstetric, iatrogenic, neoplasm, trauma, or infection. This should not be confused or grouped together with VVF because the etiology, surgical repair, and potential complications of urethrovaginal

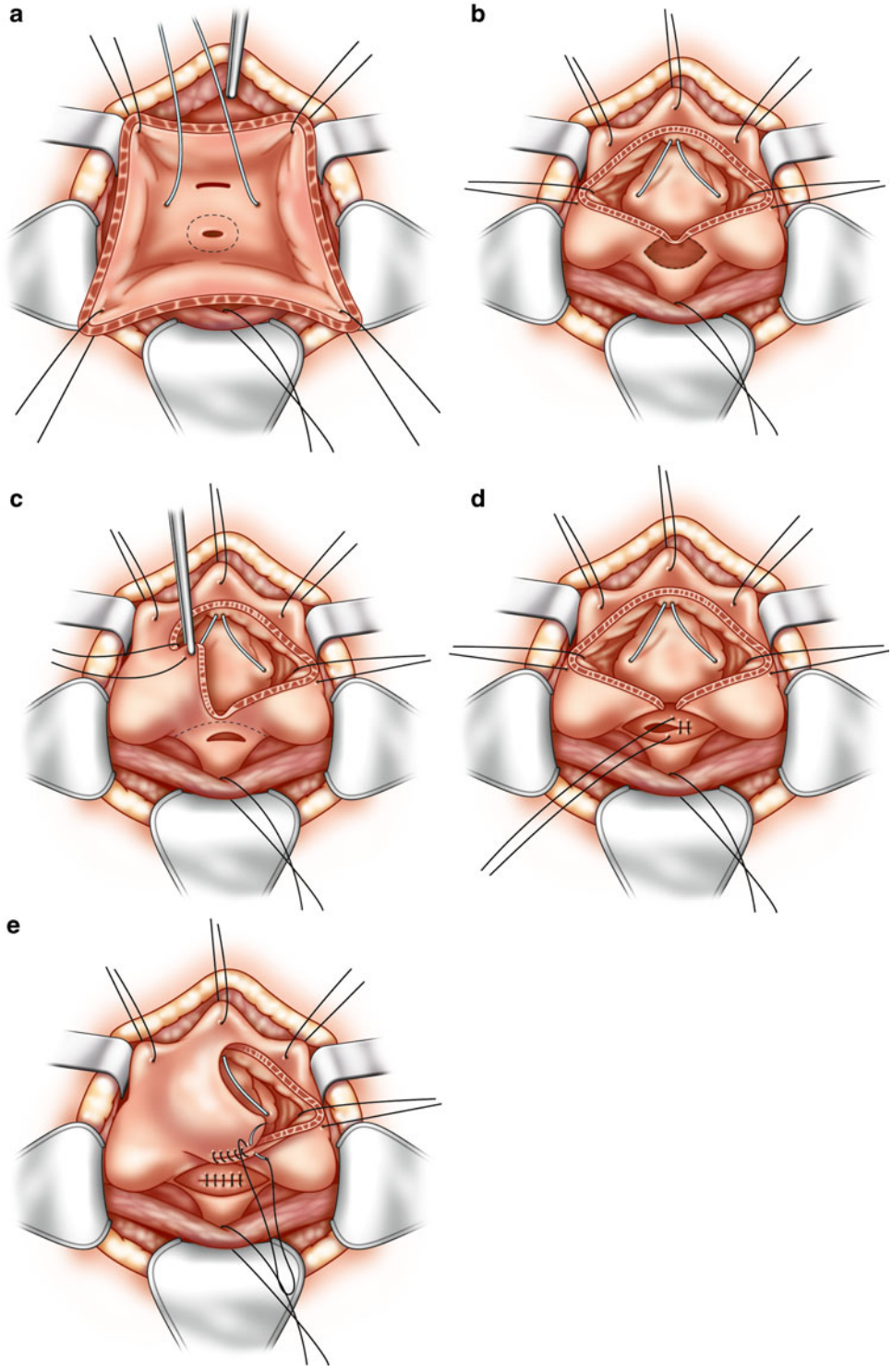

Fig. 10.8 (**a**–**e**) Open approach for vesicovaginal fistula. (**a**) An incision is made in the anterior bladder wall and retraction sutures are placed to expose the fistula. Ureteral stents identify the ureters during repair. (**b**) The incision in the bladder is extended to include and excise the fistula tract. The vaginal tissue in the fistula tract is excised. (**c**) The bladder and vagina are separated using sharp dissection along the *dotted line*. This is a difficult plane to develop, but it is important to mobilize and separate the bladder and vagina for a successful repair. (**d**) The vagina is closed with tension-free interrupted sutures. (**e**) The bladder and vagina are closed in separate layers. Tissue can be interposed between the repairs at this time

fistula differ. UVF is a rare condition due to the female urethra being seldom involved in injury because of its short length and protection from the pubic bone [63, 64]. The majority of UVFs in developed countries are iatrogenic and arise from pelvic surgery or radiation and less often from obstetric procedures during childbirth [29, 34, 65].

Etiology

UVFs in developed countries are the main focus and can be divided into two main categories; causes from vaginal/pelvic procedures which make up the majority and less often from radiation. Currently with the increased use of mesh, mesh exposure or erosion into the urethra needs to be considered as a source of the fistula. There are case reports of synthetic mid-urethral slings causing urinary fistulas [48, 66]. This mechanism of injury is likely unrecognized iatrogenic injury of the urethra from urethral perforation which increases the risk of fistula formation [67–69]. Urethral diverticulectomy surgery is the most common surgical cause of UVF and contributes to 25 % of patients who undergo pelvic surgery [29]. This may be the result of incomplete excision of the diverticulum or inadequate urethral closure without sufficient tissue interposition.

Radiation fistula formation can present immediately or can occur years after exposure and may contribute to 15 % of UVFs in one series [3, 29]. There should be consideration of malignancy when patients have a history of pelvic cancer or radiation treatment.

Rare cases of UVF in the USA may be the result of trauma, injury during childbirth, malignancy, or infection. As childbirth techniques have improved, there are less injuries and trauma contributing to UVF [34]. The use of forceps or instruments may result in laceration of the urethra that if not identified and repaired can lead to UVF. Blunt trauma with pelvic fracture rarely can cause an avulsion of the urethra or develop into an UVF with an incidence range of 0–6 % [4]. Instrumentation of the urethra is another unusual cause of fistula [70, 71]. Chronic indwelling foley can cause pressure necrosis of the bladder neck and distal urethral which can form a hypospadic urethra and UVF [72, 73].

The majority of UVFs in undeveloped countries originate from prolonged obstructed labor and are not iatrogenic as in western countries. These UVFs are due to ischemia and commonly involve the bladder and urethra with extensive tissue loss. The mid-urethral sphincteric complex may be irreversibly damaged making for a tenuous repair with unwanted outcomes [4, 74].

Treatment

Transvaginal Repair

This is a description of a UVF that is closed primarily (Fig. 10.9). Surgical repair begins with vaginal exposure with a ring retractor and vaginal speculum. A foley catheter is inserted into the urethra. A small foley catheter is inserted in the fistula with dilation of the tract if necessary. Injection of retrograde dye in the urethral meatus

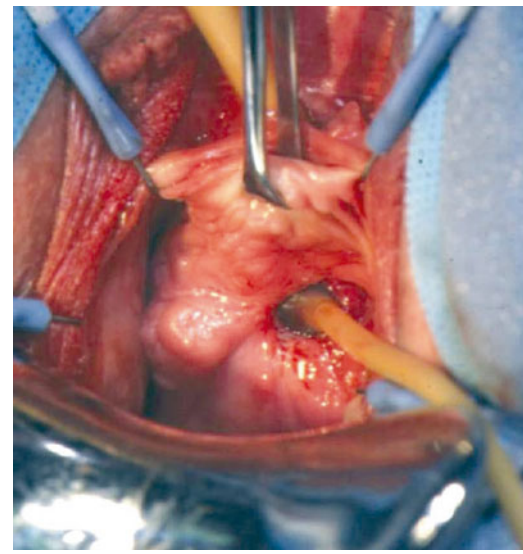

Fig. 10.9 Urethrovaginal fistula with a foley used as a retractor (Copyright © Shlomo Raz, MD)

may help to identify a small fistula. An inverted U incision is made on the anterior vaginal wall. The anterior vaginal wall flap is dissected and freed so that it has mobility to advance 2 cm distal to the fistula. The anterior vaginal wall flap is dissected lateral and proximal to the fistula which facilitates creation of the flap by avoiding scarring and friable tissue. Lateral and distal vaginal flaps are dissected which expose the fistula tract and the periurethral fascia. Once the vaginal wall is separated and is adequately mobilized, a transverse incision of the periurethral tissue is made at the level of the fistula as in a urethral diverticulectomy repair. Superior and inferior flaps of the periurethral fascia are created, isolating the urethral wall with the catheter in place. The fistula is closed in two layers with the urethra as the first layer closed transversely like a Heineke–Mikulicz technique. The periurethral fascia is closed in a transverse fashion to cover the area of reconstruction (Fig. 10.10). The fistula tract is not routinely excised as mentioned previously. Optional creation of a martius flap to cover the periurethral fascia (radiation, multiple surgeries, large defects, poor tissue quality) is performed. The vaginal wall flap is advanced to cover the area of reconstruction. The foley catheter is left for 2–3 weeks and removed with a negative voiding trial or VCUG.

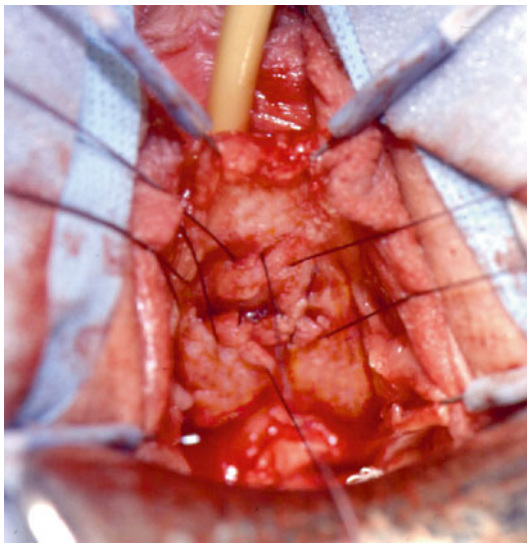

Fig. 10.10 Transverse closure of the periurethral fascia (Copyright © Shlomo Raz, MD)

Complications

Complications should be discussed preoperatively so the patient has realistic expectations after repair. Patients may develop obstructive voiding due to urethral stenosis in 5–20 % of cases [64, 65]. There is a 50 % chance they will develop stress incontinence symptoms requiring an anti-incontinence procedure [64]. Patients requiring extensive urethral reconstruction or a history of radiation with an immobile poorly vascularized urethra may fail fistula repair necessitating a bladder neck closure and urinary diversion.

Rectovaginal Fistula

Background

Rectovaginal fistula is an extra-anatomic epithelial connection between the rectum and vagina. It is a disabling disease that severely devastates and impacts an individual's social life and self-esteem.

Etiology

RVF is most often a complication after a traumatic vaginal delivery that occurs in about 0.1 % of vaginal deliveries in modern developed countries [75, 76]. Fistula formation is the result of high grade rectal lacerations, grade 3 and 4, involving the perineal body and rectum that is unrecognized or becomes infected after repair. Risk factors for high grade rectal lacerations at time of vaginal delivery are midline episiotomies, use of forceps, first vaginal delivery, and increased birth weight of the fetus [77]. Investigation should be given to additional causes of RVF from pelvic surgery including low anterior resection, synthetic mesh for POP, hysterectomy, pessary (Fig. 10.11), colorectal or gynecologic malignancy, history of radiation, pelvic abscess, and inflammatory bowel diseases which include Crohn's disease, ulcerative colitis, and diverticulitis [78–80].

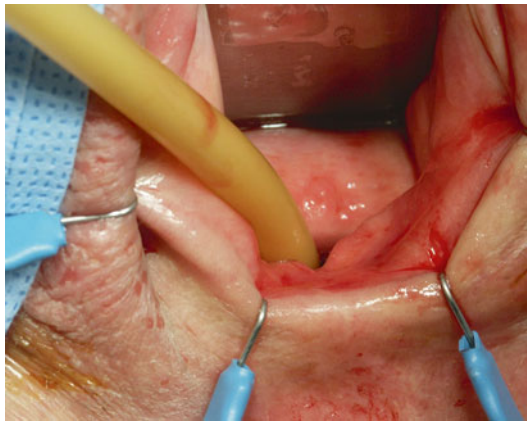

Fig. 10.11 A rectovaginal fistula that resulted from prolonged tissue necrosis and ischemia from a pessary (Copyright © Shlomo Raz, MD)

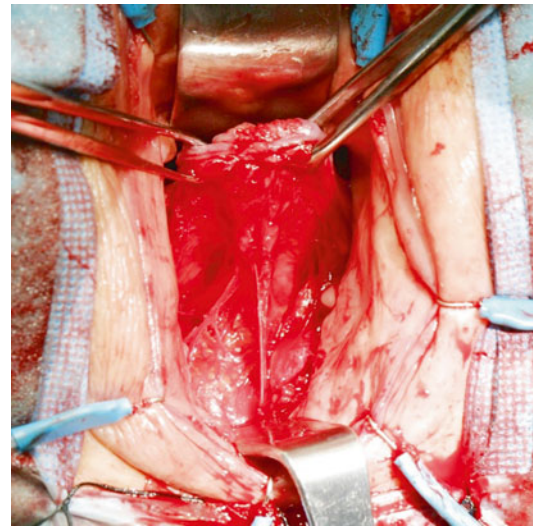

Fig. 10.12 Perirectal fascia is advanced 2–3 cm beyond the rectovaginal fistula repair (Copyright © Shlomo Raz, MD)

Treatment

Surgical Procedure

Tissue Interposition

The majority of RVF repairs involve interposition of tissue to prevent recurrence with little added morbidity. Interposition of a martius flap after a transvaginal repair of low fistula is our preference and typically reserves gluteal rotational inner thigh flaps for high, difficult vaginal access, large defects, or fibrotic vaginal tissue that is suboptimal for fistula closure.

Vaginal Repair

Routine administration of broad spectrum antibiotics and mechanical bowel preparation are given preoperatively. The transvaginal repair is performed with a multilayer closure with routine use of tissue interposition. Fecal diversion is performed selectively in cases of complex fistula. Complex fistulas are defined as radiation induced, recurrent, large, or a result of malignancy.

The patient is positioned in high lithotomy position and the fistula is exposed with a ring retractor. A foley is inserted into the fistula tract and can be used a retractor. A U-incision is made on the posterior vaginal wall and it is mobilized 3–4 cm to create a vaginal flap. The vaginal wall is dissected free on the lateral wall and the pre-rectal fascia is dissected to create a flap that will be cover the fistula at the end of the procedure. The fistula tract is closed in two layers with interrupted delayed 3-0 absorbable suture that results in a water-tight closure. The first layer includes the rectal and vaginal wall. The second layer includes the perirectal fascia that is advanced 2–3 cm over the fistula repair (Fig. 10.12). A martius flap that had been previously prepared is placed for additional coverage. A vaginal flap is advanced for a four-layer closure (Fig. 10.13). There is also description of use of biological material to reinforce the fistula repair [81].

Transanal Repair

The transanal approach is most commonly used for low fistula. It begins with the patient in prone jackknife position. A rectal advancement flap is created that includes the mucosa, sub mucosa, and the circular muscular fibers (internal sphincter). The flap is dissected 5 cm proximal to the fistula with its proximal base being twice the width of the apex. The fistula tract is excised and the rectal side of the fistula is closed leaving the vaginal side open.

Perineal Repair

The perineal approach involves a two-step procedure which is more morbid than transvaginal

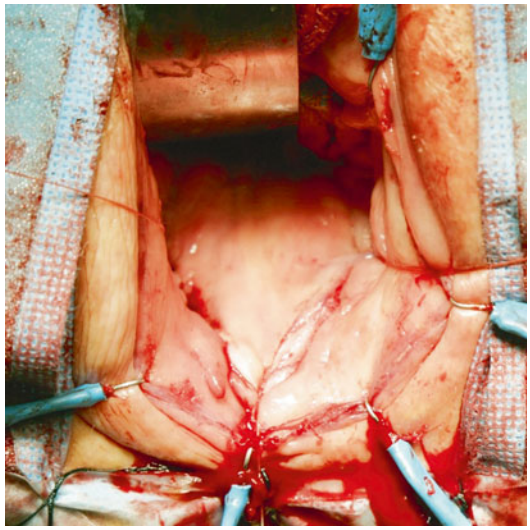

Fig. 10.13 The repair is completed with advancement of a vaginal flap for a four-layer closure (Copyright © Shlomo Raz, MD)

repair. Perineal repair is used primarily for perineal fistula that many times involves the anal sphincter integrity. First a catheter is inserted into the fistula and the overlying tissue is incised creating a perineoproctotomy. Optimally, the fistula tract is excised and then the layers that were divided are approximated without tension. The vaginal and rectal mucosa are separated and closed in two layers. The second step is a sphincteroplasty and rebuilding of the perineal body. The internal and external sphincters are approximated and the perineal body is reconstructed. In our experience, we perform adjuvant procedures to improve the repair by making the incision asymmetric and excising only the epithelium, so the subcutaneous fat can be crossed over and interposed to provide an additional layer.

Complications

Complications of hematoma and infection increase the risk of recurrence which should be prevented. Preoperative broad coverage antibiotics are given. In cases of recurrent fistula the patient should have a fecal diversion before exploration and repair. The repair should include interposition of tissue.

Summary

Vesicovaginal, urethrovaginal, and rectovaginal fistulas are significant complications that require complex repair. There is controversy surrounding the ideal timing, approach, technique, and use of adjuvant procedures in repair. Although there is debate in management, the principles in the diagnosis, treatment, and surgical repair of fistulas decrease the risk of complications and improve patient outcomes. Surgeon experience and principles of repair dictate the chosen repair. In our experience, the majority of fistulas can be successfully repaired transvaginally thereby limiting the postoperative morbidity, complications, and hospital stay.

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