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Obstetric and Gynecologic Genitourinary Fistulas

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Abstract: Urinary incontinence shortly after childbirth or gynecologic surgery can be the result of obstetric or iatrogenic fistula formation. This can be a confusing and challenging diagnosis for medical providers. While the number of iatrogenic fistula cases is rising worldwide, obstetric fistulas are an issue uniquely particular to resource poor settings. Appropriate treatment of genitourinary fistulas spans beyond surgical intervention of leakage, and includes re-integration into the community, widespread education and counseling, and battling social stigma and cultural biases. Current and future research must focus on rigorous, unified efforts to set evidence-based practices to help the millions of women affected.
Key words: obstetric fistula, vesicovaginal fistula, iatrogenic fistula

Introduction

Urinary incontinence presenting shortly after childbirth or gynecologic surgery can be multifactorial and confusing to the unsuspecting medical provider. While vesicovaginal fistulas are rare, they occur after 0.08% of hysterectomies in the United States.[1] Ureteral injury which may result in ureterovaginal fistulas occur in 0.02% to 0.33% of hysterectomies.[2] Globally, genitourinary fistulas occur at much higher rates.

Approximately 2 million women currently live with an obstetric-related urinary fistula. One systematic review found an incidence of up to 4 cases of obstetric fistula per 1000 deliveries and a prevalence of up to 81 obstetric fistula cases per 1000 women.[3] While these estimates are on the higher end, there is a lack of robust data on incidence and prevalence.

As the quality of obstetric care increases globally through the improved access to cesarean deliveries, iatrogenic fistulas appear to increase. However, because of the lack of data on fistulas in general, we do not know if iatrogenic cases outnumber obstetric cases. Therefore, improved access to

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surgery and enhanced surgical technique are necessary across the board.

Gynecologic Genitourinary Fistulas

While obstetric fistulas are relatively unknown in resource-rich settings, iatrogenic genitourinary fistulas are known complication of gynecologic surgeries, and recent studies have shown a growing incidence of iatrogenic fistula throughout the world.[4] Genitorurinary fistulas can occur during obstetric or gynecologic surgery because of the close proximity of the bladder, ureters, uterus, and vagina and cause an abnormal communication between the bladder or ureter and the uterus, cervix, or vagina. While any surgery carries the risk of injury to nearby structures, fistula formation is a known complication of several obstetric and gynecologic procedures. Common obstetric and gynecologic procedures, which may result in genitourinary fistulas include cesarean delivery, uterine rupture, and hysterectomy.[4]

Postsurgical fistulas tend to be small, isolated, and surrounded by healthy tissue. In the United States, 80% of vesicovaginal fistulas are caused by benign gynecologic surgeries.[5] Urinary tract injuries occur in ~3/1000 gynecologic surgeries.[5] Other risk-factors include a history of pelvic irradiation, gynecologic malignancy, endometriosis, pelvic inflammatory disease, infection, trauma, foreign bodies, or history of pelvic surgery.[6]

Possible mechanisms of fistula development include direct injury to the tissue during a surgical procedure or suboptimal placement or use of surgical instruments while dissecting or clamping. Sutures placed too close to the bladder or ureter may also lead to necrosis and fistula formation. Though rare, fistula formation has also been reported after uterine perforation at the time of dilation and curretage or hysteroscopy or after procedures utilizing synthetic mesh.[6] Unrecognized intraoperative ureteral injuries, including lacerations, transection, crushing, avulsion, suture ligation, or ischemia, lead to urinomas, and potential drainage from the vaginal cuff, leading to a ureterovaginal fistula. This is most often the lower third of the ureter, and may be the result of bleeding intraoperatively which obscures the operative field, a markedly enlarged uterus, or pelvic adhesions because of prior surgery.

Diagnosing an iatrogenic fistula requires a thorough history, physical exam, and a high level of suspicion. Timing and presentation vary widely from patient to patient and is dependent on etiology and location of the injury. Some fistulas present immediately after inciting trauma with leakage of urine from the vagina; however, iatrogenic fistulas resulting from surgical intervention may take up to 30 days postoperatively to present.[5] This is because of the slower process of devascularization as a result suture, clamp, or thermal injury, which leads to necrosis and tract formation over time. Iatrogenic fistulas because of other causes, like radiation therapy, may take months or years to develop. The evaluation of size, number, and exact location of the fistula is important for diagnosis and surgical planning.

DIAGNOSING VESICOVAGINAL AND URETEROVAGINAL FISTULAS

Patients with a vesicovaginal and ureterovaginal fistulas typically present several days to months after a pelvic operation with continuous leakage of urine through the vagina. This warrants a prompt physical exam. Using a speculum, the vagina should be carefully inspected. If a hole or defect is identified, the surrounding mucosa may be erythematous or inflamed. Patient rarely cannot tolerate office exam and require anesthesia. A careful physical exam is necessary to evaluate for acute inflammation, edema, necrosis, or other bladder pathology, any of which may delay surgery. Evidence of scarring, fixation to adjacent

organs, or postirradiation involvement may alter the surgical approach. If a vesicovaginal fistula is identified, one must also evaluate to ensure there is not a concomitant ureteral injury.

The standard office test for diagnosis of a suspected fistula is the double dye tampon test. This allows the surgeon to identify if the patient has a vesicovaginal fistula, ureterovaginal fistula, or both in the office setting. The patient is given 200 mg oral phenazopyridine at least 30 minutes before test to dye the urine orange. The bladder is then retrograde filled with ~250 mL of saline dyed blue with methylene blue or indigo carmine. For large vesicovaginal fistulas, blue dye can often be seen pooling in the vagina immediately (Fig. 1). After removal of the catheter, a tampon is placed into the vagina, and the patient is allowed to ambulate for 30 minutes without voiding. It is important that the patient not void during the test as urine can wick on the tampon and obscure the results. The tampon is removed and inspected to identify suspected vesicovaginal, ureterovaginal, or both vesico and ureterovaginal fistulas. Figure 2 displays several possible outcomes of the double dye tampon test. A dry, colorless tampon suggests that there is not a fistula and other sources of incontinence should be considered. If only the distal edge of the tampon is blue and the top is dry, stress incontinence or transurethral urine leakage should be considered (as in first image). A damp, colorless tampon suggests a peritoneal fistula or even cuff dehiscence if a hysterectomy was performed during the original surgery. A damp, blue tampon (last image) suggests a vesicovaginal fistula. If the tampon is orange, a diagnosis of ureterovaginal fistula is likely, while a damp tampon with both blue and orange dyes suggests that patient may have both a vesicovaginal and ureterovaginal fistula. If either a vesicovaginal or ureterovaginal fistula is suspected referral to urogyneoclogy or urology is appropriate.

FIGURE 1. Dye test with methylene blue. full color online

A myriad of other tests and imaging may be utilized to further characterize and/or confirm lower urinary tract fistulas. Cystoscopy is often performed to evaluate the size and location of the fistulous tract, its relationship to the ureteral orifices, and the health of the surrounding urothelium, all of which guide the surgeon in when and how to repair the fistula. Leukocytosis may be seen on complete blood count. If there is fluid pooling in the posterior vagina, it can be sent for creatinine and compared with serum creatinine levels. Markedly higher levels of creatinine in the vaginal fluid than serum suggest urine can confirm urinary leakage; however, it does not differentiate bladder and ureteral fistulas. A study by Thayalan et al remarked that these additional tests often incurred high expense while not yielding useful additional information after a physical exam and double dye test have established the presence of a vesicovaginal fistula.[7] Additional imaging should be ordered with discretion by the diagnosing physician to evaluate other

FIGURE 2. Tampon dye test. full color online

pelvic abnormalities and the ureters. When additional imaging is ordered, we recommend computed tomography (CT) urogram rather than CT with intravenous contrast or ultrasound. To accurately evaluate to the distal ureter, the delayed images obtained with urography are essential. A CT with intravenous contrast or ultrasound can miss a distal ureteral injury. This will avoid delay of diagnosis and referral to a urogynecologic surgeon or urologist.

When disease of the upper urinary tracts is suspected, CT urogram or magnetic resonance imaging is used to further characterize the fistula. Retrograde pyelography and voiding cystourethrogam may demonstrate ureteral abnormalities. Findings on imaging that may suggest ureteric fistula include extravasation of dye, hydronephrosis, or a persistent column of contrast in the ureter. CT findings may include contrast within the vagina, detection of air/fluid in the vagina, or the fistulous tract itself. Imaging may also identify radiation or anatomic changes, pelvic masses, or adherent thickened bowel, any of which will affect surgical planning.

MANAGEMENT OF GENITOURINARY FISTULAS

Identification and management of a genitourinary injury at the time of the initial surgery is optimal for patient outcomes and decreases litigation. Intraoperative cystoscopy has a 97% detection rate for lower urinary tract injury at the time of hysterectomy and should be done routinely after hysterectomy.[8] Cystoscopy is also associated with better litigation outcomes. Unfortunately, however, not all lower urinary tract injuries can or will be identified at the time of surgery and may go on to fistulize.

TREATMENT OF VESICOVAGINAL FISTULA

Most posthysterectomy vesicovaginal fistulas are repaired primarily, but multiple repairs are sometimes necessary. Small vesicovaginal fistulas may resolve with placement of an indwelling bladder catheter for 4 to 6 weeks. Most experts recommend immediate early repair if the fistula is identified in the first 7 to 10 days after the initial surgery; however, if the vesicovaginal fistula is diagnosed after this time frame, repair should be postponed for ~6 weeks and until the surrounding vaginal epithelium and urothelium appear healthy.

Vesicovaginal fistulas can be repaired using transvaginal or minimally invasive abdominal routes of access. Regardless, several important principles apply. It is essential to have adequate visualization of

the fistula and excellent mobilization of the fistula from surrounding tissues. A two-layer closure is typically performed ensuring the repair is not left under any tension. If the surrounding tissues do not have adequate vascular supply, surgeons often consider placement of vascular interposition flaps (omentum if the repair is abdominal and martius graft if it is vaginal). Prolonged bladder drainage for 2 to 3 weeks is recommended.

TREATMENT OF URETEROVAGINAL FISTULA

Treatment of ureterovaginal fistula revolves around resolution of urinary leakage, prevention of urosepsis, and preservation of renal function.[9] Partial ureteral obstruction is commonly present, and therefore drainage of the affected upper urinary tract is essential. If a surgical subspecialist is not available, gynecologists can consider referral to interventional radiology for temporary management. Interventional radiologist can place a percutaneous nephrostomy tube and/or anterograde ureteral stent.[10]

Expert opinion regarding optimal management of ureterovaginal fistulas varies with some recommending surgical repair or ureteral reimplanation[11–13] and others advocating for endourologic management as first line treatment.[9,10] Most commonly, the patient will initially be taken to the operating room for retrograde pyelography and ureteral stent placement. We recommend evaluating both ureters and kidneys. A recent case series reported outcomes of 19 cases of ureterovaginal fistula after obstetric or gynecologic surgery (18 after hysterectomy and 1 after cesarean delivery) at a single academic center.[9] Twelve of the ureterovaginal fistulas were managed with initial ureteral stenting, which was successful in 92% of the patients. Primary ureteral reimplantation was selected in 6 patients for the following reasons: 3 had a concomitant vesicovaginal fistula, 2 were identified intraoperatively at the index surgery; and 1 had a 1-year delay in diagnosis. Therefore, in the majority of women who sustain ureterovaginal fistulas after hysterectomy, ureteral stenting is an effective first line therapy.

When endourologic management of ureterovaginal fistula is not successful or appropriate, surgical intervention is necessary. This may be accomplished by reimplanting the ureter into the bladder or reanastomosis of the injured ureter. Given that damage is most commonly in the lower 1/3 of the ureter after gynecologic surgery, ureteral reimplantation through ureteroneocystotomy is the most effective surgical correction. In this circumstance, the ureter is identified at the pelvic brim and mobilized to the fistula site. The distal end of the ureter is transected, and any scarring or devitalized tissue excised. The ureter is spatulated and reimplanted into the posterior bladder near the dome under no tension. Adjuvant procedures, such as a psoas hitch or Boari flap, may be utilized to facilitate ureteroneocystotomy repair without tension.[9] In the rare instance where direct reimplantation is not feasible, end-to-end or end-to-side anastomoses of ureteral segments may be considered to repair the defect.

Obstetric Fistulas

Obstetric fistulas occur rarely in developed countries, but are prevalent in resource poor areas of the world. In much of sub-Saharan Africa and south Asia, women deliver infants in facilities that lack electricity, basic surgical instruments and materials, and personnel to provide timely and high-quality obstetric interventions such as a cesarean delivery in the case of obstructed labor. The result is often death of the neonate and at times, the mother. Those who survive the difficult childbirth may develop a vesicovaginal fistula because of the fetal head applying constant pressure on the pelvic

tissues, interrupting the normal blood supply. The tissues under pressure will eventually necrose and slough off, leaving the fistula usually between the bladder or bladder neck and the vagina. In the worst cases, this connection continues into the rectum, and resulting in urinary and rectal fistulas.

These patients present with uncontrollable urinary leakage and often do understand its mechanism. In an effort to reduce the urinary leakage, women often avoid drinking water, which in turn causes the urine to have a more concentrated putrid odor. For these women, even the most understanding partners and family members find it difficult to share close quarters with them. As coping with the incontinence is often not possible while working, many women experience a lifetime of disability and social isolation.

Obstetric fistula has been described as "the worst problem you have never heard of," (http://www.operationfistula.org). Colloquially shortened to "fistula," it is a problem often overlooked that leads to deep social embarrassment. The women affected either limit their interactions in their communities or spend most of their lives hiding their incontinence. In some contexts where fistula exists, communities blame the woman for her child dying, and then she is blamed for the subsequent uncontrollable leakage of urine.

Obstetric fistulas in low-resource settings are largely caused by obstructed labor and could be prevented by high quality and skilled monitoring of labor and timely operative delivery. The women affected by fistula are generally of low socioeconomic status, with little to no education and often experience social isolation and stigma as a result of the fistula. Browning et al[14] examined physical attributes as risks for fistula and found those affected are significantly shorter and have a smaller pelvic intertuberous space. Cultural patterns, such as young age of marriage and genital cutting, have been attributed to increasing the risk for developing a fistula. However, if these individuals receive access to intrapartum obstetric services, they would likely not develop fistulas. While child marriage and genital cutting should come to an end to protect the rights of girls and women, obstetric fistula will only come to an end if poor women are prioritized in improving access to health care and if obstetric interventions are improved worldwide.

MEDICAL SEQUELAE

Obstetric fistula can be seen as a larger injury "complex," incorporating vesicovaginal fistula, rectovaginal fistula, stress incontinence, renal involvement, secondary infertility, vaginal stenosis, and footdrop, and other physical ailments that often accompany obstetric fistulas.[15] Similarly, psychosocial effects and economic detriment have also been documented, all contributing to the injury complex. Approximately 90% of all births during which obstetric fistulas occurs are accompanied by stillbirth.[16] Wilson et al[17] found that women with fistulas are more likely to be depressed, experience post-traumatic stress disorder, have somatic complaints, and lack a social network. Community qualitative studies have demonstrated a deep layer of secrecy surrounding obstetric fistulas and surgical repair. Barriers to accessing repair continue to be unveiled in multiple countries. Baker et al[18] found that financial barriers were the most frequently mentioned (65%).

Treatment of Obstetric Fistulas

CATHETER PREVENTION

In 1841, Ryan in London described spontaneously closing fistulas by keeping patients on their face or side, tying a catheter into the bladder and tamponing the vagina with oiled lint. We still recommended

prolonged catheter drainage to facilitate spontaneous vesicovaginal fistula healing, especially when the fistula is recognized soon after it develops. Prolonged catheter drainage can be utilized for prevention in individuals at high risk of developing a fistula. Waaldijk reports healing rates of 15% with prolonged, early catheterization as conservative management of obstetric fistuas.[19]

REPAIRING VESICOVAGINAL FISTULAS

Traditionally, surgeons have waited three months from delivery to operate on women with vesicovaginal fistulas so that any spontaneous closure may occur, and granulation tissue is no longer present. Some surgeons, however, advocate for operating on "fresh fistulas" rather than waiting. In cases of newly identified fistulas, Waaldjik[19] published on immediate surgery after catheterization for 3 months. The catheter is kept until the fistula edge is no longer necrotic at which time the fistula is repaired. Outcomes using this timing for repair were highly successful at 91.8% (n = 156). Short interval from fistula development to repair could greatly decrease stigma and the social consequences of living with an obstetric fistula.

PREDICTORS FOR SUCCESS and FAILURE

Reported rates of successful surgical closure of obstetric fistulas are high (84% to 94%), but increasingly complex fistulas are less likely to heal.[20,21] Repair outcomes are associated with duration of the fistula before surgery, fistula size, circumferential fistulas or those with urethral involvement, and moderate to severe vaginal scarring.[21] Women with large fistulas (> 3 cm) are 6 times more likely to fail repair ($P < 0.01$).[22] Previously failed attempts suggest that patients may not be properly triaged or referred to surgeons with expertise in repairing complex cases. It is imperative that training programs, junior surgeons, and visiting surgeons take into consideration the additional trauma a failed repair presents to a woman who has been suffering from incontinence and also consider the decreased chance for healing with subsequent attempts before choosing to take on the surgery and not refer to a surgeon experienced in closing complex obstetric fistulas.

CLASSIFICATION

Frajzyngier et al[23] examined prognostic values of classification systems and found them to be "poor to fair." Bengtson et al[24] looked for prediction of incontinence after surgery using Goh's classification. Using a scoring algorithm based on clinical and demographic characteristics, they found age above 50 years, length of time with a fistula above 20 years, previous surgical attempts, advanced Goh classification relative to the urethra, moderate to severe scarring, circumferential fistula, and urethral length of 1.5 cm or less were all highly associated with residual incontinence. The authors suggest using the scoring tool before surgery to guide diagnostic purposes and to assist with referring complex patients to expert-level surgeons.

REPAIR TECHNIQUE

Vaginal approach to vesicovaginal fistula closer is generally described in the literature and preferred by most surgeons.[25] The type of suture and number of layers of closure have not been studied in a systematic way, but retrospective data demonstrates no superiority of 2 layers when controlled for bladder size.[26] Circumferential fistulas appear to occur after longer and potentially more severely obstructed labor (see Fig. 3). More bladder tissue is lost and vaginal scarring is often also more severe with circumferential fistulas resulting in residual incontinence more frequently.[27] Repeat procedures are common after failed closure, and some

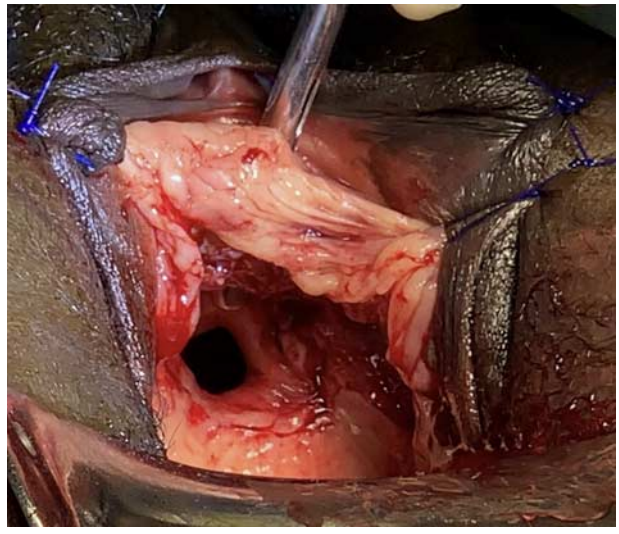

FIGURE 3. Circumferential fistula. full color online

authors argue that an interpositional layer with a new vascular supply in the form of a gracilis flap should be used as the Martius graft has not demonstrated improvements in patient outcomes.[28,29] The first attempt is still widely considered to be the best chance for success and therefore, triaging cases according to surgical skill would optimize outcomes.

RISKS FOR ONGOING INCONTINENCE and SOLUTIONS

Defining "cure" after obstetric fistula repair is not straight forward as many of these women have severe transurethral urine leakage after the fistula is repaired. While a dye tampon test can help differentiate between a healed fistula and urethral leakage, not all surgeons perform dye tests at the time of catheter removal. Browning reported that persistent urinary leakage after obstetric fistula repair was associated with the following: fistula involving the urethra [odds ratio (OR): 8.4 (3.9-17.9)], small bladder (< 5 cm depth from external ureteral orifice) [OR: 4.1 (1.2-13.8)], vaginal scarring [OR: 2.4 (1.5-4.0)], and larger fistula size [increase OR: 1.3 (1.16-1.56) with each centimeter increase in diameter of fistula].[30] Kopp et al[31] examined 346 women after repair to determine a significant pad weight for incontinence. They determined that a 1-hour pad weight after catheter removal of > 1.5 g had a positive predictive value of 94% (confidence interval: 90.0-96.9) in predicting ongoing continence. Sexual dysfunction is a challenge for a significant proportion of patients after surgery. Of 102 patients interviewed, 23 (22.5%) reported not being able to engage in penetrative vaginal intercourse and 12 (52%) of these patients ascribed this to a "narrow" vagina.[32] Reconstructive techniques to improve the quality of vaginal reconstruction and sexual function are imperative to improve quality of life.[33]

Conclusion

Genitourinary fistulas in developed countries are uncommon and most often a sequalae of pelvic surgery and hysterectomy. Early identification and management are essential to optimize outcomes for patients and minimize litigation. In contrast, genitourinary fistulas in

developing countries are often related to obstetrics and obstructed labor.

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