Diagnosis and Surgical Management of Uroenteric Fistula

Harcharan S. Gill, MD, FRCS

KEYWORDS

• Fistula • Urinary • Diverticulitis • Crohn

KEY POINTS

- Uroenteric fistulae can occur between any part of the urinary tract and the small and large bowel. Nomenclature and classification are generally based on the organ of origin in the urinary tract and the termination of the fistula in the segment of the gastrointestinal tract.
- Colovesical fistula secondary to diverticulitis is the commonest fistula that urologist and surgeons treat.
- Enterovesical fistulae are managed either conservatively or surgically.
- Although the principles of management are uniform, surgeons should be familiar with different surgical approaches.

INTRODUCTION

A fistula is an abnormal communication between 2 epithelium-lined cavities. Uroenteric fistulae can occur between any part of the urinary tract and the small and large bowel. Nomenclature and classification are generally based on the organ of origin in the urinary tract and the termination of the fistula in the segment of the gastrointestinal (GI) tract. Fistulae can cause important physiologic, biochemical, and infectious alterations and can often be a source of considerable emotional and psychological distress, thus a methodical and expeditious treatment approach is important for a successful outcome. Although some fistulae heal with conservative management, surgery is often necessary. Constant reassurance in cases in which the fistula will take extended periods to heal is equally important.

Congenital fistulae occur but are rare; most are acquired. Causes of acquired fistulae include trauma, inflammation, radiation, and malignancy, and they can also be iatrogenic. Uroenteric fistulae most frequently occur in a setting of inflammatory bowel disease, and diverticulitis is the commonest cause, accounting for

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Department of Urology, Stanford University Hospital, 875 Blake Wilbur Drive, Stanford, CA 94305, USA
E-mail address: Hgill@stanford.edu

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approximately 65% to 79% of cases, and these are mostly colovesical. The second most common cause of fistulae is cancer (10%–20% of cases), followed by Crohn disease (5%–7%). The location and underlying disorder often determine the symptoms. Imaging with contrast in the bowel and intravenous contrast to outline the urinary tract in cross-sectional imaging with a computed tomography (CT) scan or MRI often helps in the diagnosis.

Although every type of fistula has specific methods and procedures necessary for treatment, the basic principles of managing urinary fistulae remain the same and include:

Adequate nutrition
Diversion of the urinary tract
Diversion of the GI tract, or bowel rest
Treat underling inflammatory processes or malignancy
Surgery

Principles of surgery when indicated include the following:

Appropriate timing
Anatomic separation of involved organs, maintaining adequate vascularity
Watertight closure in layers with interposition of omentum
Multiple-layer, tension-free closure with nonoverlapping suture lines
Urinary tract drainage with a stent or catheter
Surgeons should be familiar with a variety of techniques

VESICOENTERIC FISTULAE

Causes

This is the most common uroenteric fistula that surgeons and urologists treat. These fistulae usually occur in the setting of inflammatory bowel diseases such as diverticulitis and Crohn disease. Other causes include colorectal malignancy, radiation, trauma, pelvic abscesses, and iatrogenic surgical procedures. The underlying GI tract disorder determines the anatomic location of the fistula. Ileovesical fistulae are common in Crohn and colovesical fistulae are seen in diverticulitis or malignancies.[1]

Incidence

Diverticulitis is the commonest cause[1–3] and accounts for 65% to 70% of all cases. The peak incidence is between 55 and 65 years of age and it is estimated that 1% to 2% of patients with diverticulitis experience this. The underlying mechanism is a direct extension of ruptured diverticulum or erosion of a peridiverticular abscess into the bladder. The presence of a phlegmon and abscess are the risk factors for fistula formation The second commonest cause is colorectal cancer, which accounts for 10% to 15% of fistulae. Crohn disease accounts for 5% to 6% of vesicoenteric fistulae and the incidence of enterovesical fistulae in patients with Crohn disease is 2% to 4%. The duration of Crohn disease before discovery of the fistula has been reported to be from 6 months to 15 years and in rare cases this can be the initial presentation of this

disease. Fistulae from Crohn present earlier in the third decade.[1,4] Regional enteritis, secondary to the transmural inflammation characteristic of Crohn colitis, results in adherence to the bladder with subsequent erosion into the organ and fistula formation. More than 80% of the fistulae are ileovesical, with male predominance presumed to be caused by the protective presence of the uterus in women.[5,6]

Presentation

Although the symptoms may originate from both the urinary tract and the GI tract, urinary symptoms tend to be commoner. The classic presentation syndrome of suprapubic pain, urinary frequency, dysuria, and tenesmus is named after a French physician, R. Gouverneur. Pneumaturia is the commonest symptom noted in 50% to 75% of the cases.[1] Urinary tract symptoms are most common in the early stages of the fistulae and may be nonspecific or dominated by prostatic symptoms, especially in older men. Rarely, patients can present in sepsis when concurrent urinary obstruction exists.[7]

Symptoms of vesicoenteric fistulae include:

Pneumaturia	52%–77%
Fecaluria	42%–51%
Frequency	37%–45%
Fever	12%–41%
Urinary infection	32%–45%
Abdominal pain	25%–33%
Hematuria	8%–22%
Urine per rectum, watery diarrhea	5%–9%

Diagnosis

The diagnosis of enterovesical fistula is primarily clinical, with the symptoms of pneumaturia, fecaluria, and persistent or recurrent urinary tract infections being essentially pathognomonic findings. A high clinical suspicion, detailed history, and selected diagnostic tests are all that are often necessary to establish the diagnosis. The following diagnostic tests are available and each has its potential false-positives and false-negatives:

Cystoscopy
Cross-sectional imaging: CT or MRI
Ultrasonography
Cystography
Upper GI contrast studies with small bowel follow-through
Barium enema
Colonoscopy
Bourne test
Activated charcoal test

Cystoscopy has the highest yield of identifying an abnormality in the bladder but on its own establishes a definitive diagnosis in only 35% to 60% of cases.[3,6,8] Findings on cystoscopy include focal hyperemia, bullous edema, air in the bladder, particulate material, and air extruding from papillary and bullous area in the bladder.

CT with oral contrast is the first test of choice in patients suspected of having fistulae. CT has a dual role of establishing the diagnosis and also identifying the site and segment of bowel involved. The diagnostic accuracy has been reported to be as high as 92% to 100%.[9,10] The classic findings on CT are air in the bladder, bladder wall thickening next to an inflamed or thickened segment of bowel, and presence of colonic diverticula. These finding have the highest yield in diagnosis of colovesical fistulae. Air in the bladder can be a false-positive finding if the patient has had a recent cystoscopy, or has a urinary infection from gas-forming organisms (**Fig. 1**).

Barium enema has a poor yield in the diagnosis of fistulae but may provide valuable information if a malignancy is suspected. Only 14% to 50% of colovesical fistulae were seen or suspected in barium enema.[11] Cystography, similarly, has a poor diagnostic value and is seldom necessary when cystoscopy has been done.

The Bourne test was first described in 1964, and remains an adjuvant test in the evaluations of patients suspected of having colovesical fistulae who have a negative or nondiagnostic barium enema. The first voided urine following a barium enema is collected, spun, and examined radiographically. Presence of radiodense material in the urine is diagnostic. In one report of 28 patients with colovesical fistulae, 7 out of 10 patients who had a negative barium enema had a positive Bourne test as the only positive evidence of the fistula.[10]

Oral activated charcoal test is sometimes indicated in the diagnosis of vesicoenteric fistula. Although it is an inexpensive test it does not localize the site of the fistula. A positive test is when black particles appear in the urine following oral administration of 25 g of activated charcoal. Kavanagh and colleagues[12] reported 5 of 7 patients with vesicoenteric fistulae to have a positive test and advocated the use of this test and cystoscopy as an initial evaluation of patients suspected to have enterovesical fistulae.

Management

The management of enterovesical fistulae can be either operative or nonoperative. The timing of surgical treatment is important and both single and multistage procedures may be necessary. Variables that affect the treatment choice include the underlying disorder, the patient's overall health and nutritional status, location of the fistula, and the presence of bowel obstruction. If a lesion is seen on cystoscopy, a biopsy should be done to rule out malignancy.

Nonsurgical, expectant treatment is an option for a select group of patients. In patients with minimal symptoms, who are not infected and have no underlying malignancy as a cause of the fistula, a trial of conservative therapy should be considered.

Fig. 1. CT scan in a patient with enterovesical fistula secondary to irradiation for ovarian cancer. Gas in the loop of bowel and fistula tract is seen.

This trial is especially warranted in patients with Crohn disease in whom immediate laparotomy with bowel resection is likely to result in complications. In addition, because of the relapsing nature of Crohn disease, nonoperative management should be tried first. This management includes bowel rest, total parenteral nutrition, antibiotics, and bladder drainage with a catheter.[1,13] Limited success (4 out of 30 patients) has also been reported with nonoperative management in patients with colovesical fistulae secondary to diverticulitis.[14]

The goals of surgical management are to separate the segment of bowel and bladder, close the defects in layers, and interpose healthy tissue like omentum between the 2 suture lines. Repair of the fistula often requires partial cystectomy and resection of involved bowel. The bladder has to remain decompressed with a Foley catheter to facilitate healing, and occasionally the bowel is temporarily diverted with a colostomy or ileostomy. In the presence of pelvic abscesses and severe local inflammation, a staged repair should be performed.

A 1-stage procedure involves removal of the fistula, closure of the involved organs, and primary reanastomosis of the bowel following resection of the involved bowel segment. Patients with an inflammatory cause of the fistula, but without gross contamination or abscess, can be treated with a 1-stage procedure.[14] Most patients with colovesical fistulae present electively with lower urinary tract symptoms, and therefore adequate preoperative support, including nutritional supplementation, and appropriate antibiotics can be used in most cases allowing an elective 1-stage approach.[15]

In Crohn disease, a conservative option with medical therapy including prednisone should be tried before considering surgery. Medical therapy can delay and occasionally obviate surgery. Greenstein and colleagues[16] reported that in 6 of 38 patients, surgery was able to be delayed with medical therapy for a mean of 3 years, and 2 of those patients never required an operation. Gorcey and Katzka[17] prospectively followed 11 patients with enterovesical fistula for up to 21 years with medical therapy. Seven patients ultimately required surgery for indications other than the enterovesical fistula, whereas the other 4 never required surgery. The indications for surgery include acute abdomen in ureteral obstruction, and refractory urinary tract infections, which can be a source of urinary sepsis. When surgery is considered, resection of the affected bowel, primary closure of the bladder, and interposition of an omental patch provides the best results. Occasionally a temporary diverting ileostomy is necessary, which can be taken down within 6 months.[6,18] All patients should have a cystogram at 10 to 14 days before removal of the catheter. In addition, appropriate antibiotics should be used to provide optimal healing of the bladder and bowel.

PROSTATORECTAL AND URETHRORECTAL

Causes

Although congenital rectourethral fistulae (RUF) can occur with imperforate anus, most are acquired. Iatrogenic causes lead this group with surgery, cryotherapy, high-frequency ultrasonography (HIFU), and radiation as the causes. Other causes include trauma, malignancy, and infection.

Incidence

The incidence of rectal injury during radical prostatectomy for prostate cancer ranges from 1% to 2 %.[19–21] The incidence is higher in salvage prostatectomy following irradiation. If the rectal injury is repaired primarily the incidence of prostate urethral fistulae is very small[22]; however, unrecognized injury to the rectum is likely to result

in a rectourethral fistula.[20,21,23] The risk factors in the setting of a radical prostatectomy include prior radiation therapy or cryotherapy, rectal surgery, or previous transurethral resection of the prostate.[21] The incidence of fistulae following primary cryotherapy for prostate cancer is also 1% to 2%, but salvage cryotherapy after irradiation has a 3% to 4% rate of fistulae.[22] The reported incidence of prostate-rectal fistulae following brachytherapy is 0.4%, and following HIFU is 2% to 3%.[24] RUF in patients with Crohn disease are often complex and the incidence is less than 1%.

Presentation

Symptoms include urinary infection, fecaluria, hematuria, urinary incontinence, watery diarrhea, and (rarely) sepsis.

Diagnosis

Digital rectal examination often is diagnostic in patients with suspicious history. Definitive diagnosis is made with proctoscopy, urethrogram, barium enema, and a voiding cystourethrogram (**Fig. 2**). Accurate anatomic location is necessary for surgical planning. In complex cases of trauma or malignancy, upper tract imaging should also be done to rule out ureteral involvement.

Management

Conservative management with placement of a catheter with or without temporary bowel diversion is an option for a small and select group of patients, including small

Fig. 2. Patient with fistula between rectum and prostatic urethra following a combination of brachytherapy and external irradiation for prostate cancer. Decompressed bladder with gas and brachytherapy seeds are evident.

postprostatectomy RUF in a nonirradiated patients who are in excellent nutritional status.[25–27] In such cases, fulguration of the fistula tract with application of fibrin glue has also be been reported with limited success.[28]

Surgical treatment is based on the basic principles outlined earlier. The surgical technique and approach are determined by the underlying disorder and the surgeon's experience.[29,30] Although repair of the fistula in 1 or multiple stages is desired, some patients are best managed with permanent urinary and bowel diversion. These patients include those who have a history of extensive irradiation to the pelvis, or have failed multiple attempts at surgical repair. One-stage repair is appropriate for small, surgically induced RUF in the absence of infection or previous irradiation. Staged repair that includes bowel diversion before the repair is best for large fistulae, those with history of irradiation, local infection, and previous failed repairs. Surgical approaches include:

- Transanal with division of the anal sphincter
- Transanal without division of the anal sphincter
- Perineal
- Transabdominal

Transrectal, transsphincteric approach, as described in the York Mason procedure, has been reported to have up to 90% success.[31] Meticulous attention to excising the fistula and tension-free closure in layers is critical in obtaining excellent outcome. Transanal approach without division of the sphincter involves dilatation of the anus to provide exposure. Repair technique principles are similar to York Mason with the disadvantage of poor exposure and limited maneuverability.[32] Use of rectal advancement flaps using this approach has also been reported in cases secondary to Crohn disease.[33] A perineal approach is popular with urologists because of familiarity with the local anatomy. This approach gives easy access to interpositional grafts, with the gracilis muscle being the commonest.[34,35] Transabdominal approach provides easy access to omentum for interposition, but has poor success rates compared with other approaches, probably secondary to poor exposure in a deep pelvis.[36,37] Fistulae secondary to radiation therapy and cryotherapy are generally larger, with significant perifistula ischemia. Surgical outcomes for repair are generally poor and therefore these patients often require permanent urinary and fecal diversions.[36,38]

URETEROENTERAL

Causes

Inflammatory bowel disease, such as Crohn disease, remains the commonest cause of ureteroenteric fistula. Other causes include iatrogenic causes, malignancy, radiation, calculus, and infection. Malignancies are either primary urothelial or invasion from surrounding organs.[39] The segment of bowel most likely to be involved is the terminal ileum and thus most cases of ureteroenteric fistula are unilateral, right sided, and usually at the level of the sacral promontory.[40] Rarely, diverticulitis or ulcerative colitis leads to a left-sided ureteroenteric fistula.

Incidence

Ureteroenteric fistulae are uncommon. This condition is a rare complication of Crohn disease[41] but remains the commonest cause. Iatrogenic causes are increasing slightly with the increase in ureteroscopic procedures and interventions.

Presentation

Ureteroenteric fistulae usually present with bowel rather than urinary symptoms. Recurrent urinary infection and flank pain as the presenting symptom have also been reported in some cases.

Diagnosis

Gas in the upper urinary tract collecting system is pathognomonic, but CT IVU (CT intravenous urogram) had the best yield. GI contrast studies are rarely diagnostic.

Management

This involves resection the bowel segment, stenting the ureter, and (rarely) placing a nephrostomy tube. A nephroureterectomy is only indicated in failed cases or if the involved ureter has a nonfunctioning kidney.[41]

RENOENTERAL OR PYELOENTERAL

Causes

Iatrogenic causes secondary to percutaneous renal surgery are increasing slightly compared with the historical cause from chronic infections. Xanthogranulomatous pyelonephritis or other infectious diseases involving the kidney or bowel have in the past been reported as the most common cause of this condition.[42] Other causes include penetrating trauma, complex calculus disease, ingested foreign bodies, and duodenal malignancies.

Presentation

Urinary infection associated with flank pain and fever is the commonest presentation. Patients may also have nonspecific GI symptoms and malaise.[43] It is rarely an incidental finding on imaging. Cloudy and particulate drainage from a nephrostomy tube following a percutaneous procedure should raise the clinical suspicion of a fistula.

Diagnosis

Imaging with CT IVP, nephrostograms (especially in iatrogenic cases), upper GI barium studies, and occasionally barium enema are appropriate.

Management

This is determined by the underlying disorder and renal function. In a poorly or nonfunctioning kidney the optimal treatment is a nephrectomy with repair of the appropriate bowel segment. In patients with normally functioning kidney, conservative treatment with drainage and bowel rest is preferred. A large nephrostomy tube with or without a ureteral stent, in combination with bowel rest, can result in successful closure of the fistula.[43]

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