ABSTRACT

Common lower urinary tract fistulas can present as uroenteric fistulas, urogenital fistulas and urocutaneous fistulas. They usually occur as sequel after pelvic surgery, obstetric complications following childbirth and gynecologic procedures. In patients with underlying neoplasm, fistulas may occur from primary or recurrent tumors and as a consequence of pelvic irradiation. Infectious process, trauma and congenital abnormalities can also cause lower urinary tract fistulas. Clinical presentation depends on the location and type of fistula. Radiographic imaging can give diagnosis and demonstrate associated complications of fistulas. Being familiar with clinical signs and symptoms as well as choosing the appropriate imaging modality and technique are important. This article reviews common types of lower urinary tract fistulas correlated with their cause, clinical presentation and imaging modalities for diagnosis.

Keywords: Fistula, Lower urinary tract, Etiology, Clinical symptom, Radiographic imaging

INTRODUCTION

Fistulas involving the lower urinary tract usually occur in patients with underlying pelvic diseases. They can communicate with the gastrointestinal tract, female reproductive tract or skin. Common causes of these fistulas are from post surgical and obstetric complications as well as post pelvic irradiation. Other etiologies are pelvic malignancy, infectious process, inflammatory disease, trauma and congenital conditions [1]. Lower urinary tract fistulas may be suggested by clinical manifestation and physical examination. Radiographic contrasted imaging can confirm the presence of fistula, give accurate diagnosis about the correct type and location of fistula, and demonstrate complications such as abscess formation [2]. The appropriate imaging study depends on the

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anatomic location and type of fistula. Lower ureteric fistulas can be demonstrated by excretory urography, retrograde urography and cross-sectional contrast imaging. Bladder fistulas are detected by cystography, voiding cystourethrography (VCUG) and computed tomography (CT scan). Retrograde urography and VCUG are useful methods for visualizing urethral fistulas. To demonstrate uroenteric fistulas, barium enema examination and oral contrast CT scan without intravenous enhancement can be used. Fistulography can confirm the present of urocutaneous fistulas [2-7].

Other genitourinary tract fistulas can occur in the upper urinary tract including renal fistulas and fistulas of the pelvocalyceal system. They may communicate with the bowel, skin, blood vessel and lymphatic system.

LOWER URETERIC FISTULAS

Classification based on site: Two common types of lower ureteric fistulas are ureterovaginal fistulas and ureteroenteric fistulas. Other uncommon types are ureterovascular and ureterocutaneous fistulas, which are not discussed in this article.

Ureterovaginal Fistula

Definition
Ureterovaginal fistula is a communication between the ureter and the vagina. The urine flows directly from the ureter into the vagina without passing into the bladder.

Etiology
Pelvic surgery and obstetric complications are common causes. Pelvic radiation therapy, infectious process and urinary calculi can also lead to this type of fistula.

Clinical presentation
Most of the patients present with urine leakage from vagina. Abdominal pain, flank pain, fever and paralytic ileus may also develop.

Radiographic diagnosis
Preliminary test: Excretory urography is one of the common radiographic contrast study used as an initial test to diagnosis this fistula group. Extravasation outside the ureter, drainage of contrast media into vagina or evidence of hydronephrosis and hydroureter without vaginal drainage may be the presenting complaints. Demonstrable fistulous tract from ureter to vagina can be seen in some cases [1,3-5]. The sensitivity of excretory urography in detecting ureterovaginal fistula is about 33% [1]. Even though the sensitivity of this test is quite low, it's still widely used because of its non-invasive technique.

Confirmatory test: If the fistulous site is difficult to locate, retrograde pyelography should be the definite test [8].

Other tests used: Delayed contrast-enhanced CT scan and vaginography are alternative choices for investigation [3,8].

Ureteroenteric fistula

Definition
Ureteroenteric fistula connects the ureter to the alimentary tract.

Etiology
Ureterocolic fistula is the most common type of ureteroenteric fistula. Etiologies include colorectal malignancy, post pelvic surgery, radiation therapy and spontaneous fistulas. Spontaneous ureteroenteric fistulas are mostly caused by ureteric calculi or infectious process such as diverticulitis of the colon and tuberculosis. Ureterointestinal fistulas are less common. It may occur from inflammatory bowel disease especially Crohn's disease, accidental trauma and iatrogenic causes [3,9].

Clinical presentation
Patients can present with abdominal or flank pain, hematuria, recurrent urinary tract infection, pneumaturia, fecaluria and diarrhea.

Radiographic diagnosis
Preliminary test: Barium enema is the most helpful diagnostic test in this type of fistula. Because the mean pressure in alimentary tract is usually higher than the urinary tract, therefore, contrast media from the alimentary tract usually flows into the urinary system [5]. However, fistulous tract is difficult to detect. Mucosal abnormality of the bowel such as bowel wall irregularity is the clue for diagnosis [3].

Confirmatory test: CT scan is good for demonstrating associated intra-abdominal lesions such as collection, abscess formation or recurrent tumor [2].

Other tests used: Other diagnostic methods are excretory urography and retrograde urethrography which are usable in conditions when contrast media in the urinary system flows into the alimentary tract (Figure 1).

BLADDER FISTULAS

Classification bases on site
Common types of bladder fistulas are enterovesical fistulas, vesicovaginal fistulas and vesicocutaneous fistulas. Vesicouteric fistula occur but are not common.

Enterovesical fistula

Definition
Enterovesical fistula connects the bladder to the small bowel or large bowel.
Etiology

Trauma and neoplasm of the gastrointestinal or genitourinary tract often connects the bladder to the rectum and create rectovesical fistulas. Colonic adenocarcinoma and diverticulitis are common causes of colovesical fistulas. Crohn’s disease usually causes ileovesical fistulas. Pelvic surgery, radiation therapy, foreign body and infection such as tuberculosis and syphilis can also lead to enterovesical fistulas.

Clinical presentation

Patients may present with recurrent cystitis, pneumaturia, fecaluria, fever and abdominal pain.

Radiographic diagnosis

Preliminary test: Even though CT scan with oral contrast is the primary imaging modality, only 20-42% of fistulous tracts are visualized. Secondary signs are found more commonly. The suggestive signs of enterovesical fistulas are intravesicular air, presence of oral or rectal contrast in the urinary bladder, focal bladder wall thickening, thickening of adjacent bowel wall, and presence of extraluminal mass which contains air. (Figure 2)

Other tests used: Cystography is another reliable diagnostic method but less sensitive than CT. Its sensitivity is about 35-44%. Barium enema can also be used for diagnosis. The sensitivity is equal to cystography but less accurate [3,10,11] (Figure 3).

Vesicovaginal fistula

Definition

Vesicovaginal fistula communicates the bladder to the vagina.
Etiology

Vesicovaginal fistulas may be caused by surgical and obstetric complications, foreign bodies, catheters or infection such as tuberculosis or schistosomiasis. In patients with underlying malignancy, fistulas may occur from primary pelvic malignancies, recurrent neoplasm of the cervix, vagina and rectum or following radiation treatment. The most common cause of vesicovaginal fistulas in developing countries are from obstetric complication after childbirth, where as in developed countries, surgical procedures within the pelvis and complications after gynecologic procedures are more common.

Clinical presentation

Symptoms are watery leakage from vagina, menouria and perineal dermatitis.

Vesicouterine fistula

Definition

Vesicouterine fistula connects the bladder to the uterus.

Etiology

Vesicouterine fistula is less common. Obstetric complications following cesarean section, forceps extraction and curettage for removal of placenta are common causes. Complications following surgical procedures, perforation of intrauterine device and trauma may also lead to vesicouterine fistulas.

Clinical presentation

The suggestive symptom is intermittent urine leakage or urinary incontinence. Other symptoms
include cyclic hematuria, amenorrhea and urinary tract infection.

Radiographic diagnosis

*Tests used:* Conventional diagnostic methods are cystography, hysterography and excretory urography. Using excretory urography it is difficult to distinguish vesicovaginal fistula from vesicouterine fistula, because presence of contrast media in vagina is the only finding. Hysterography may show leakage of contrast media into the bladder. CT scan with intravenous contrast media or CT with sagittal reformation after hysterography is also diagnostic. However, results from these examinations are still inconclusive [3,5,8].

**Vesicocutaneous fistula**

**Etiology**

Vesicocutaneous fistula occurs from surgical procedures, post radiation treatment, trauma and iatrogenic causes. It can also occur after removal of suprapubic cystostomy. Spontaneous vesicocutaneous fistula is rare.

Radiographic diagnosis

*Tests used:* Fistulography and cystography are used for diagnosis. CT scan is recommended if the fistulous tract is complex or to evaluate associated malignant neoplasm [3,13,14].

**URETHRAL FISTULAS**

Classification based on site

Urethral fistulas may occur from congenital or acquired conditions. Types of urethral fistulas are urethrorectal fistulas, urethrococutaneous fistulas and urethrogenital fistulas.

**Urethrorectal fistula**

**Definition**

Urethrorectal fistula is not common. It connects the urethra and the rectum.

**Etiology**

In children, congenital anorectal anomaly is the cause. In adults, urethrorectal fistulas usually occur after prostate surgery, urethral instrumentation or due to fracture of the pelvis. Tubercular infection, genitourinary tumors and post radiation therapy can also develop this type of fistula.

**Clinical presentation**

Children usually present with meconium stained urine. Symptoms in adult are recurrent urinary tract infection, urine per rectum, fecaluria, hematuria and infection of the seminal vesicles.

**Radiographic diagnosis:**

*Confirmatory test:* VCUG and retrograde urethrography are used for diagnosis. In anteroposterior view, the fistulous tract may be
Urethrorectal fistula

Definition

Urethrorectal fistulas occur after radical prostatectomy. They are usually seen at the vesicourethral anastomosis. (Figure 5)

Etiology

Urethrorectal fistulas are usually seen at the vesicourethral anastomosis. (Figure 5)

Clinical presentation

Patients usually present with perineal infection or dripping of urine.

Radiographic diagnosis

Tests used: Urethral anomalies such as urethrovaginal fistulas can be identified by vaginal speculum examination and cystourethroscopy, radiographic diagnosis can be made by VCUG, sonography or delayed intravenous contrast-enhanced CT. Fistulous tracts in male patient can present with urethrography.

CONCLUSION

Lower urinary tract fistulas usually occur in patients with underlying pelvic diseases. Its etiology includes congenital conditions in children, infectious processes, malignant tumors, trauma and pelvic irradiation as well as complications following obstetrics and surgical procedures. Clinical presentation depends on the type of fistula. Diagnosis usually requires radiographic imaging. Common conventional radiography used in the diagnosis of lower urinary tract fistulas are excretory urography, cystography, voiding cystourethrography, urethrography and barium enema. Cross-sectional imaging by CT scan, is considered as an imaging modality of choice in some type of cases. Otherwise, it is used in fistulas that are difficult to demonstrate by conventional method or to detect intra-abdominal complications. The appropriate imaging modality and technique will lead to accurate diagnosis.

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Author Contributions

Wanaporn Burivong - Conception and design,
Acquisition of data, Analysis and interpretation of data, Drafting the article, Critical revision of the article, Final approval of the version to be published
Vichit Leelasithorn - Analysis and interpretation of data, Critical revision of the article, Final approval of the version to be published
Vithya Varavithya - Analysis and interpretation of data, Critical revision of the article, Final approval of the version to be published

Guarantor
The corresponding author is the guarantor of submission.

Conflict of Interest
Authors declare no conflict of interest.

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