Introduction

Enterourinary fistulas are usually the result of underlying pathology involving the gastrointestinal or genitourinary tract. Pathologies such as diverticulitis, Crohn's disease, radiation enteritis, trauma, iatrogenic injury, bladder cancer, appendicitis, colon carcinoma, and gynecologic tumors are causes of enterourinary fistulas. The true incidence of enterourinary fistula is unknown, although the most frequent site of fistulization is between the bowel and the bladder (colovesical fistulas). Enterourinary fistulas include (a) rectourethral fistulas, (b) vesicoenteric fistulas, (c) uretroenteric fistulas and (d) pyeloenteric fistulas ***(Larsen et al., 1996).***

Rectourethral fistulas (RUF) are often a consequence of surgical procedures such as prostatectomies, resection of rectal lesions, and other pelvic operations and infections. Radiation therapy for gynecologic or urologic malignancies may lead to progressive rectal injury culminating with perforation and often fistulization. A common example is the development of rectourethral fistula postradiation therapy of prostate cancer. RUF closure using the perineal approach with pedicled gracilis muscle interposition is associated with low morbidity and a high success rate. It is the method of choice for urologists because of their

familiarity with the approach and because urethral pathologic features can be corrected simultaneously ***(Gupta et al., 2008).***

Colovesical fistulas are more common in men, probably because of the male anatomy maintaining close proximity between the sigmoid colon and the bladder. This is contrary to the female anatomy, where the uterus forms a barrier between the bladder and the sigmoid colon, except in posthysterectomy patients ***(Najjar et al., 2004).*** The treatment of colovesical fistulae involves colon resection and drainage of the bladder with a Foley catheter. Typically, a laparoscopic sigmoid colectomy is the ideal option. Primary repair of the bladder opening is only necessary when easily identified with relatively healthy surrounding tissues ***(Larsen et al., 1996).***

Ileovesical fistula is a very rare complication of primary urological malignancies. Ileal diverticula also may be the cause. The patient may present with fecaluria and urinary tract infection and bladder stone may be detected. Cystography reveals the passage of contrast medium into the small bowel ***(Ietsugu et al., 2002; Sekita et al., 2006).*** In these situations, the bladder can be primarily repaired and drained with a bladder catheter or just drained if the bladder opening is not clearly identified. In both instances, a follow-up cystogram should be performed approximately

6 weeks after the operation, before removal of the bladder catheter. The surgical treatment of radiation-induced fistula can be challenging, and a diverting proximal colostomy or ileostomy is advisable. Moreover, enterourinary fistulas in patients with Crohn's disease may respond to medical management ***(Manganiotis et al., 2001).***

Other varieties of enterourinary fistulas are commonly secondary to colonic diverticulitis and include renocolic fistula ***(Ito et al., 2004)***, pyelocolic fistula ***(Touiti et al., 2001)*** and ureterocolic fistula ***(Maeda et al., 1998).***

Aim of Work

The present essay aims to describe the various etiologic factors, diagnostic facilities and treatment modalities utilized for enterourinary fistulas with emphasis on the recent trends in this particularly important issue.

Surgical Anatomy of the Urinary Tract

The kidneys

The kidneys are located bilaterally in the retroperitoneal space at the level of T-12 to L-3. The organs are bean-shaped, measuring approximately 12 cm in length, 6 cm in width, and 2.5 cm in thickness, and weigh 120 to 170 grams in the normal adult. The right kidney is slightly lower than the left because of the large size of the right lobe of the liver. The kidneys are protected, not only by their anatomical position within the thoracic cage, but also by the perinephric structures. A tough fibrous capsule covers each kidney. The renal fascia provides support and perirenal fat acts as a cushion ***(Chmielewski, 2003).***

On each side, the suprarenal gland sits like a 'cap' on the superior pole of the kidney. Anteriorly on the left lie the pancreas and its vessels, the spleen, the descending colon and the stomach; the last separated by the lesser sac, with the lieno-renal ligament passing to the splenic hilum near the lateral margin of the kidney. On the right lie the second part of the duodenum (at risk of injury in performing a right nephrectomy), the liver and the ascending colon (Fig.1) ***(Brenner and Rector, 2000).***

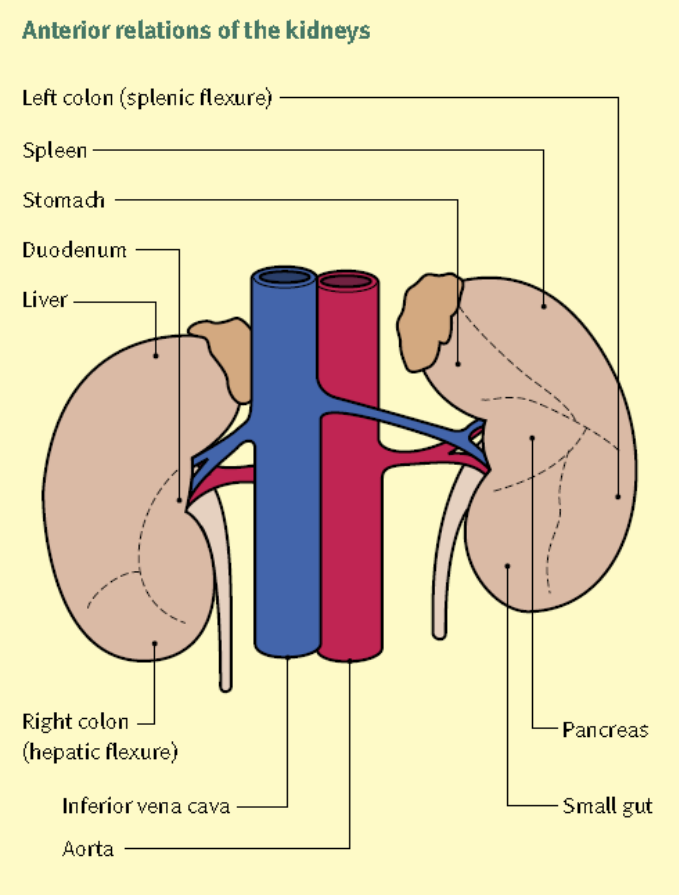


Fig. (1): Anterior relations of the kidneys ***(Ellis, 2005)***

Posteriorly, both kidneys lie on the diaphragm and quadratus lumborum, overlapping the psoas medially and transversus abdominis laterally. The twelfth rib defines the position of the upper pole, anterior to which is the lowermost recess of the pleura, which may be opened in the course of the loin approach to the kidney. Three nerves lie posteriorly: the subcostal, ilio-hypogastric and ilio-inguinal (Figure 2) ***(Chmielewski, 2003).***

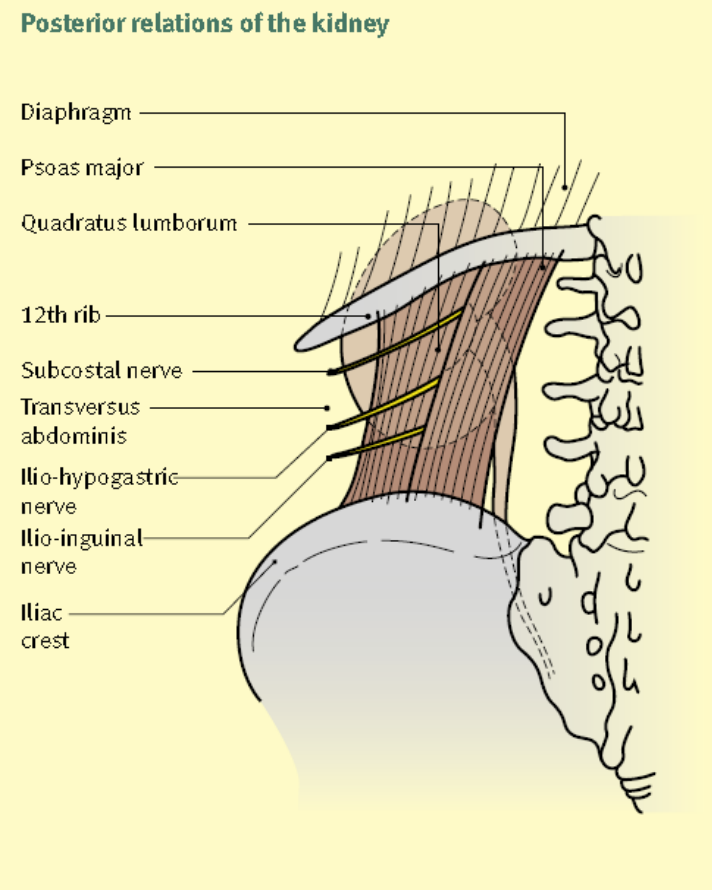


Fig. (2): Posterior relations of the kidneys ***(Ellis, 2005)***

The hilum is the deep vertical slit on the medial border. This transmits, from before backwards, the renal vein, renal artery, the pelvis of the kidney and, usually, a posterior arterial branch. In addition, the hilum transmits lymphatics and autonomic nerve fibres, principally sympathetics from spinal segments T12 to L1. Sympathetic afferents account for the classical referral of renal pain along these segments to the lower abdominal wall and to the external genitalia ***(Moore and Dalley, 2005).***

Within the renal substance, the pelvis of the kidney divides into two or three major calyces, each then dividing into several minor calyces. Each of these is indented by a papilla, on which the renal collecting tubules discharge urine. The calyceal system is readily appreciated on inspecting a normal intravenous urogram ***(Ellis, 2005).***

Ureters

The ureters are muscular tubes that link the kidneys to the bladder. They are approximately 30 cm in length and 3mm in diameter. They consist of three layers: an inner layer of transitional epithelium, a middle layer made up of longitudinal and circular bands of smooth muscle and an outer layer of connective tissue which is continuous with the renal capsule. The ureters transport urine from the kidneys to the bladder. The ureters enter the bladder on the posterior wall and pass into the bladder at an oblique angle. This prevents backflow when the bladder contracts ***(Ross et al., 2001).***

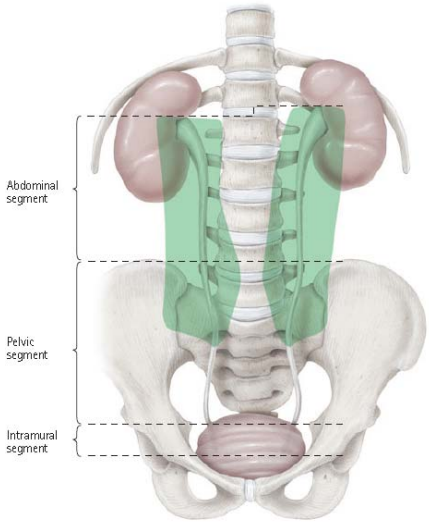
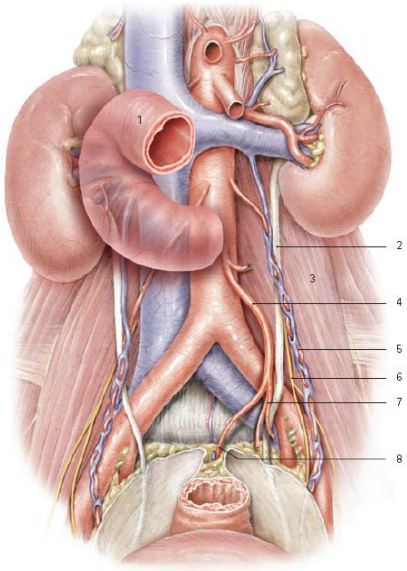


Fig. (3): The variability in the position of the ureter to the adult skeleton. In adults the ureter is 25–30 cm (in neonates 6.5–7.0 cm) long, with a diameter of 1.5–6 mm. In the retroperitoneum, the ureter is situated just lateral to the tips of the transverse processes of the lumbar vertebrae ***(Fröber, 2007).***



1 Duodenum
2 Ureter
3 Psoas
4 Inferior mesenteric artery
5 Testicular/ovarian artery and vein
6 Genitofemoral nerve; femoral and genital branches
7 Sigmoid arteries
8 Superior rectal artery

Fig. (4): The retroperitoneal space with the anatomical structures surrounding the left and the right ureter. The abdominal segment of the ureter extends from the renal pelvis to the pelvic brim ***(Fröber, 2007).***

The Urinary Bladder

The bladder is extraperitoneal and roughly pyramidal. Superiorly it is covered by the pelvic peritoneum, with coils of small intestine and the sigmoid loop lying against it. In the female, the anteverted body of the uterus lies against its posterosuperior aspect. Anteriorly, the bladder lies behind the pubis, with its apex attached by a fibrous strand, the median umbilical ligament, to the umbilicus. This represents the remains of the fetal urachus. Posteriorly in the male, the base of the bladder relates to the rectum, the vasa deferentia and the seminal vesicles; in the female, to the vagina and the supravaginal cervix. It receives the ureters at its upper lateral angles. Laterally, the inferolateral surfaces relate to the levator ani and obturator internus muscles on each side. In male, the bladder neck fuses with prostate; while in the female, it rests directly on the pelvic fascia. As the bladder distends, it becomes spherical and projects into the lower abdomen, stripping the peritoneum upwards from the anterior abdominal wall. This allows safe extraperitoneal puncture of the distended bladder to be performed. In the infant, because the pelvis is comparatively small, the bladder neck is in level with the upper part of the symphysis and the bladder itself, although still extraperitoneal, is in contact with the anterior abdominal wall ***(Ellis, 2005).***

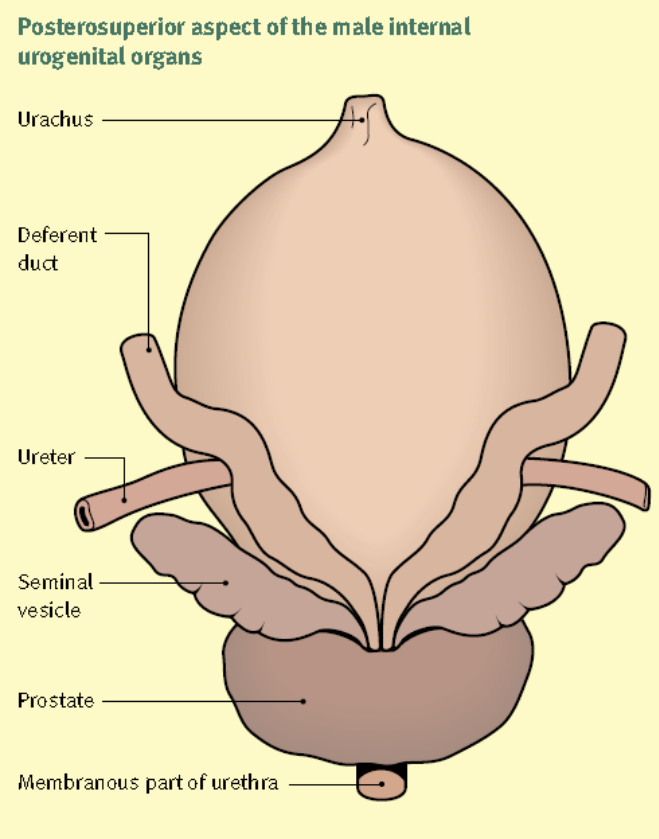


Fig. (5): Posterosuperior aspect of the male internal urogential organs ***(Ellis, 2005)***

Prostate

The prostate gland is a pyramidal fibromuscular and glandular organ, the size and shape of a chestnut that surrounds the beginning of the urethra. Above, it continues with the neck of the bladder, the urethra entering near its anterior border. Below, the apex of the gland rests on the sphincter urethrae, which lies within the deep perineal pouch. Behind lies the rectum, separated by the loose fascia of Denonvilliers, while in front lies the pubic symphysis separated from it by extraperitoneal fat in the retropubic

space (space of Retzius). Close against the prostate in this space lies the prostatic plexus of veins. Near its apex, a condensation of connective tissue, the puboprostatic ligament, passes forward to the pubis. Laterally lies the levator ani. On either side the ejaculatory duct, formed by fusion of the vas and the seminal vesicle, enters the upper posterior part of the prostate to open into the urethra at the colliculus seminalis, thus dividing off a median prostatic lobe between them ***(Ellis, 2005).***

Male urethra

The male urethra is 18–20 cm in length and is divided into the prostatic, membranous and spongy parts ***(Ellis, 2005).***

- **The prostatic urethra**

The prostatic urethra is 3–4 cm in length and traverses the prostate. Its posterior wall bears a longitudinal elevation along its length termed the urethral crest. On each side of this is the shallow groove of the prostatic sinus, into which the 15–20 prostatic ducts empty the secretion of the gland. At about the middle of the crest is a prominence, the colliculus seminalis (or verumontanum) into which opens the prostatic utricle, or utriculus masculinus, a blind tract about 5 mm in length. This is believed to be the male remnant of the paramesonephric duct, which develops into the female genital tract. On either side of the utricle open the ejaculatory ducts ***(Ellis, 2005).***

- **The membranous urethra**

The membranous urethra is 2 cm in length, the shortest, least dilatable and, apart from the external orifice, the narrowest part of the urethra. It traverses the external urethral sphincter within the deep perineal pouch ***(Ellis, 2005).***

- **The spongy urethra**

The spongy urethra is 15 cm in length and traverses the corpus spongiosum of the penis. First, it passes upwards and forwards to lie below the pubic symphysis (the bulb of the urethra); then, in the flaccid state, it bends downwards and forwards. The external orifice, a vertical slit, is the narrowest part of the urethra. Immediately within the meatus, the urethra dilates into a terminal fossa, the roof of which bears a mucosal fold, the lacuna magna, which may catch the tip of a catheter ***(Ellis, 2005).***

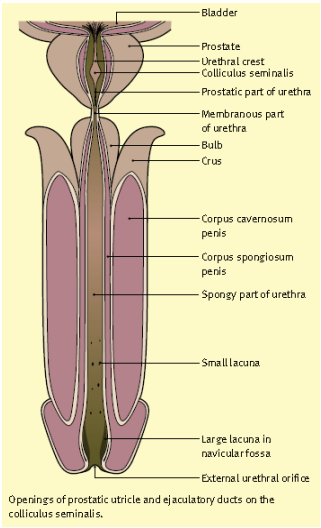


Fig. (6): The whole length of the lumen of the male urethra exposed by an incision extending into it from its dorsal aspect ***(Ellis, 2005).***

The Female Urethra

The female urethra is a narrow membranous canal, about 4 cm. long, extending from the internal to the external urethral orifice. It is placed behind the symphysis pubis, imbedded in the anterior wall of the vagina, and its direction is obliquely downward and forward; it is slightly curved with the concavity directed forward. Its diameter when undilated is about 6 mm. It perforates the fascia of the urogenital diaphragm, and its external orifice is situated directly in front of the vaginal opening and about 2.5 cm. behind the glans clitoridis. The lining membrane is thrown into longitudinal folds, one of which, placed along the floor of the canal, is termed the urethral crest. Many small urethral glands open into the urethra ***(Moore and Dalley, 2005).***

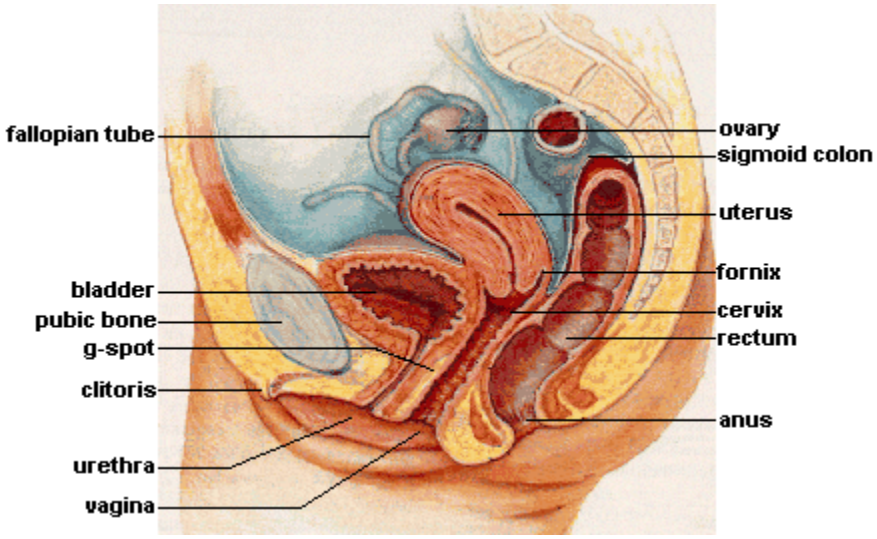


Fig. (7): Anatomical relations of the female urethra

Rectourethral Fistulas

Etiology

Recto-urinary fistula (RUF) is a serious and difficult to treat surgical condition. About 60% of cases are caused by iatrogenic lesions occurring during surgical procedures (radical prostatectomy, cryosurgery, radiotherapy or brachytherapy of the prostate, abdominoperineal procedures, posterior urethral surgery) ***(Brandes, 2008).***

In a recent study, ***Thomas et al., (2010)*** found that rectourethral fistulas developed in 13 of 2,447 patients (0.53%) after radical prostatectomy. The risk of rectourethral fistulas was 3.06-fold higher for perineal than for retropubic prostatectomy. Congenial malformations, genitourinary trauma and infectious diseases such as tuberculosis (TB) or ruptured prostatic abscess are less common causes ***(Renschler and Middleton, 2003).***

Clinical Presentation

The most common clinical manifestations are dysuria and recurring cystitis, which are present in almost all cases. Other irritative symptoms, including pneumaturia and fecaluria, are also common. Gastrointestinal disturbances, such as diarrhea, abdominal pain and vomiting, occur in 60% of cases ***(Culkin and Ramsey, 2003).***