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UROGENITAL TRAUMA. CONGENITAL GENITOURINARY ANOMALIES

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УРОГЕНИТАЛЬНАЯ ТРАВМА. ВРОЖДЕННЫЕ АНОМАЛИИ МОЧЕПОЛОВОЙ СИСТЕМЫ

UROGENITAL TRAUMA. CONGENITAL GENITOURINARY ANOMALIES

Учебно-методическое пособие

Минск БГМУ 2024

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На английском языке

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ABBREVIATIONS

PCNL — percutaneous nephrolithotomy

SWL — shock wave lithotripsy

ABC — airway, breathing, and circulation

FBC — full blood count

IVU — intraveneous urogram

CT — computed tomography

TURP — transurethral resection of the prostate

TURBT — transurethral resection of bladder tumor

CAKUT — congenital anomalies of the kidney and urinary tract

UPJ — ureteropelvic junction obstruction

UTI — urinary tract infection

PKD — polycystic kidney disease

UROGENITAL TRAUMA

TRAUMATIC INJURIES TO THE KIDNEY

Categories. *Blunt, penetrating, iatrogenic renal injury.*

Causes. *Blunt injuries*: direct blow to the kidney, motor vehicle accidents, rapid acceleration or rapid deceleration, compression forces, falls, assaults.

Penetrating injuries: stab or gunshot injuries.

Iatrogenic renal injury: open surgery (oncology, gynecology), percutaneous nephrolithotomy (PCNL), endopyelotomy, nephrostomy, shock wave lithotripsy (SWL). Severity scale for the kidney trauma is presented in the Table 1, Fig. 1.

Table 1

Severity scale for the kidney trauma

Grade	Type	Description
I	Contusion	Microscopic or gross hematuria, urologic studies normal
	Hematoma	Subcapsular, nonexpanding without parenchymal laceration
II	Hematoma	Nonexpanding perirenal hematoma confined to renal retroperitoneum
	Laceration	< 1 cm parenchymal depth of renal cortex without urinary extravasation
III	Laceration	> 1 cm parenchymal depth of renal cortex without collecting system rupture or urinary extravasation
IV	Laceration	Parenchymal laceration extending through renal cortex, medulla, and collecting system
	Vascular	Main renal artery or vein injury with contained hemorrhage
V	Laceration	Completely shattered kidney
	Vascular	Avulsion of renal hilum, devascularizing the kidney

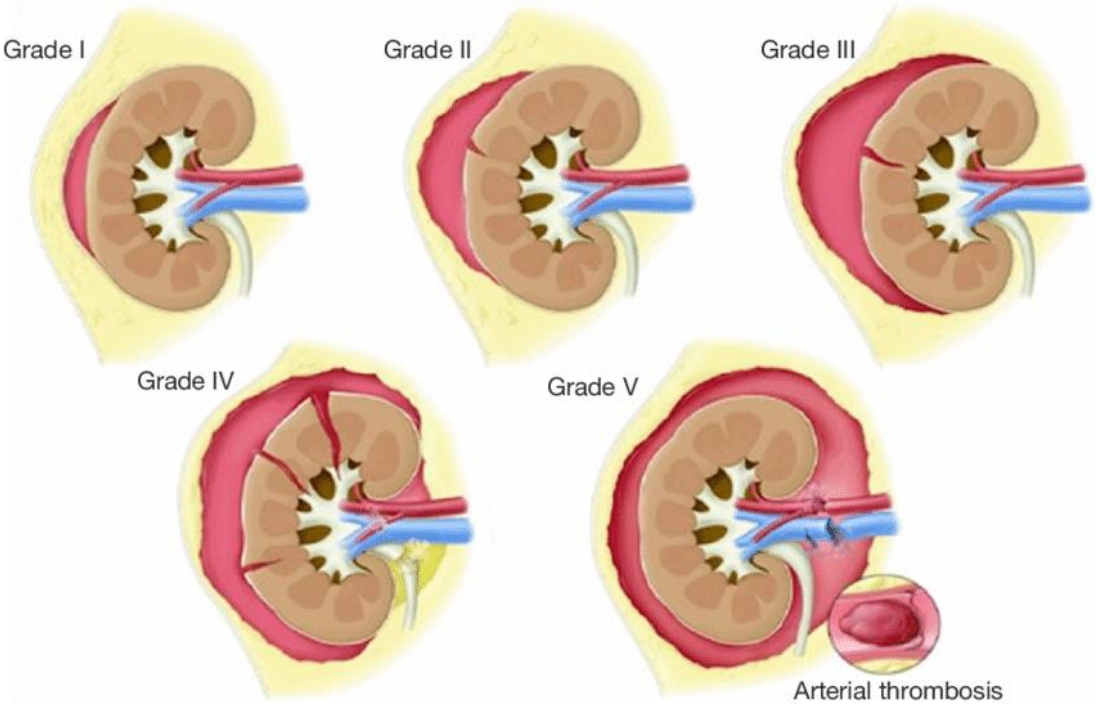


Fig. 1. Five stages of kidney injury (described in the Table 1)

Minor renal trauma (85 % of cases) — grades 1–3; *major renal trauma* (15 % of cases) — grades 4–5.

Diagnosis. Primary survey: assess the patient's Airway, Breathing, and Circulation (ABC). History and physical examination.

– Symptoms. Gross hematuria. The degree of renal injury does not correspond to the degree of hematuria, since gross hematuria may occur in minor renal trauma and only mild hematuria in major trauma. Shock (systolic blood pressure < 90 mm Hg). Pain (flank area or over the abdomen). Signs of lower rib fractures. Abdominal tenderness, palpable mass.

– Laboratory findings: urinalysis (haematuria), full blood count (FBC) and serum biochemistry profile.

– Renal imaging. Excretory/intraveneous urogram (IVU), contrast-enhanced CT (staging), ultrasound (Doppler), renal arteriography.

Complications:

– Early complications. Hemorrhage, urinoma (persistent urinary extravasation into the perinephral tissue), abscess formation and sepsis.

– Late complications. Hydronephrosis, arteriovenous fistula, renal vascular hypertension, calculus formation, pyelonephritis.

Treatment:

– Initial management of shock and hemorrhage, complete adequate resuscitation, and evaluation of associated injuries.

– Conservative management. Most renal injuries (75 %) can be managed non- operatively. Bed rest, haemostatic agents, hydration, analgetics, antibiotics.

– Surgical measures treatment. Indication for surgical exploration: high-grade penetrating renal injuries, bleeding, hemodynamic instability with shock, urinary

extravasation, pulsatile, expanding renal hematoma, combination of renal damage and organs of the abdominal or thoracic cavity. Operative technique: renal exploration and repair (closure of the renal collecting system, closure of parenchymal injuries with renal capsule, resection/partial nephrectomy). Main renal artery lacerations or avulsions commonly lead to nephrectomy.

TRAUMATIC URETERAL INJURIES

Etiology and classification. *Iatrogenic ureteral injuries.* The majority of ureteral injuries are *iatrogenic*. Open pelvic surgery: transabdominal hysterectomy, colectomy. Ureteroscopy: basketing and attempted removal of ureteral stones. The ureter may be divided, ligated, or angulated by a suture. Segment excised or damaged by diathermy (Fig. 2).

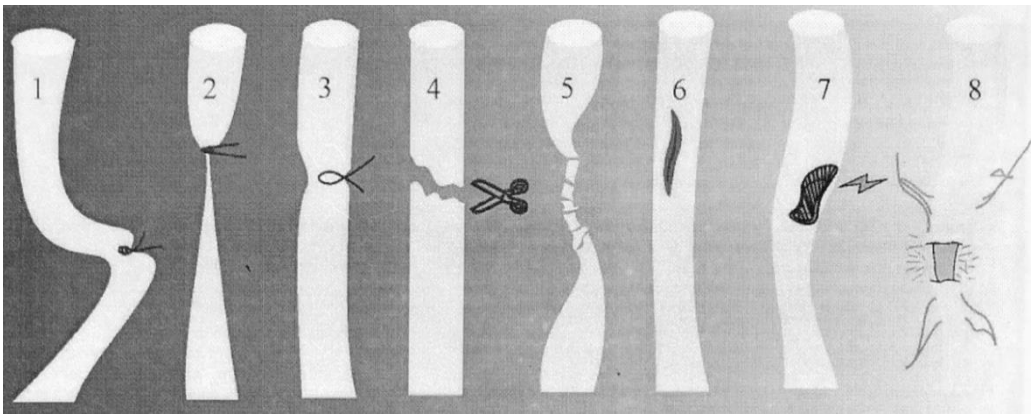


Fig. 2. Types of damage to the ureter in open surgery (gynecology)

Penetrating trauma: gunshot wounds or stab wounds. *Blunt trauma* (rare, pediatric population): falls, motor vehicle collisions.

Signs and symptoms. Flank pain, flank mass or discomfort, hematuria, fever, leukocytosis, sepsis, wound infection. Stricture or ureteral obstruction. Ureterovaginal or cutaneous fistula. Persistent drainage. Retroperitoneal urinoma, Ileus. Signs and symptoms of acute peritonitis (urinary extravasation into the peritoneal cavity). Acute hydronephrosis.

Complications. Stricture formation, hydronephrosis. Chronic urinary extravasation leads to large retroperitoneal urinoma. Pyelonephritis.

Diagnosis. Intraoperative: direct inspection, injection of methylene blue into the ureter. Post-operative diagnosis: flank pain, post-hysterectomy incontinence. IVU or retrograde ureterogram (obstructed ureter or contrast leak). Ultrasonography (hydronephrosis).

Treatment. Percutaneous nephrostomy (infected urinoma). JJ stenting for 3–6 weeks. Primary closure of the ureter. Direct ureter-to-ureter anastomosis. Reimplantation of the ureter into the bladder: psoas hitch (vesico-psoas hitch), Boari flap or Demel's procedure (Fig. 3, 4). Transuretero-ureterostomy. Autotransplantation of the kidney into the pelvis. Replacement of the ureter with the ileum. Permanent cutaneous ureterostomy.

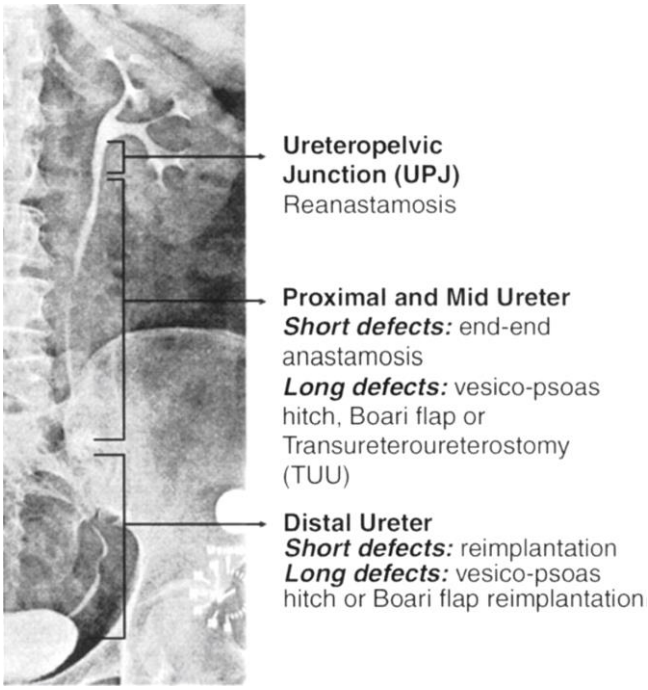


Fig. 3. Treatment options depending on the localization of damage

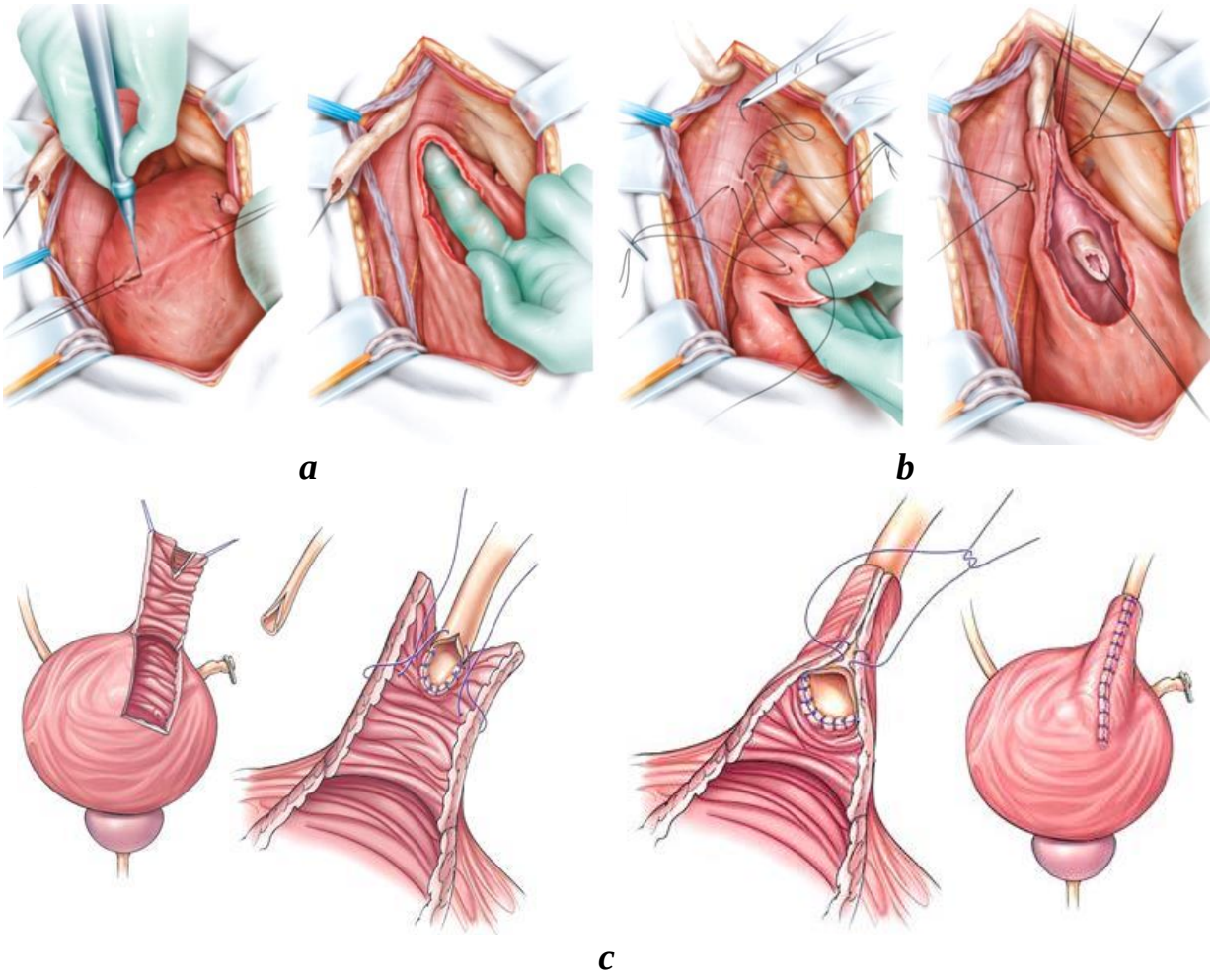


Fig. 4. Psoas hitch (*a*, *b*) and Boari flap (*c*) ureteroneocystostomy

BLADDER TRAUMA

Etiology and classification. *Blunt trauma*: ***Intraperitoneal*** (fully distended bladder because of the sudden increase in intravesical pressure from blunt lower abdominal trauma).

Extraperitoneal (associated with a pelvic fracture) (Fig. 5):

– *Iatrogenic injury* (TURBT, cystoscopic bladder biopsy, TURP, cystolitholapaxy, Caesarean section.

– *Open penetrating* trauma (gunshot or stab wounds).

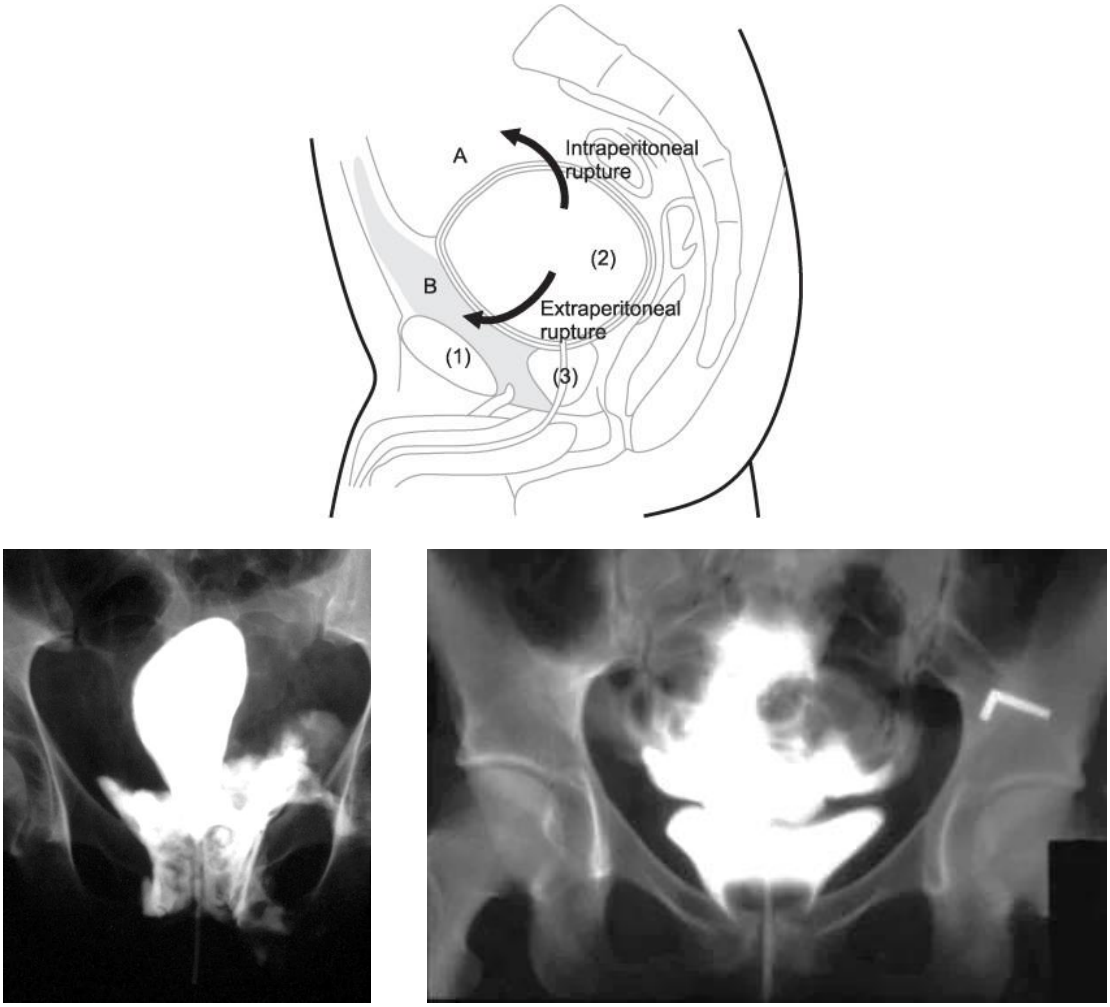


Fig. 5. Extraperitoneal and intraperitoneal bladder trauma

Symptoms and diagnosis. Suprapubic pain and tenderness. Difficulty or inability in passing urine. Gross haematuria. Abdominal wall muscle rigidity. Displacement of prostate. Symptoms of associated injuries (pelvic fractures, multisystem organ failure).

Imaging. Retrograde cystography or CT cystography (location and extent of contrast extravasation)

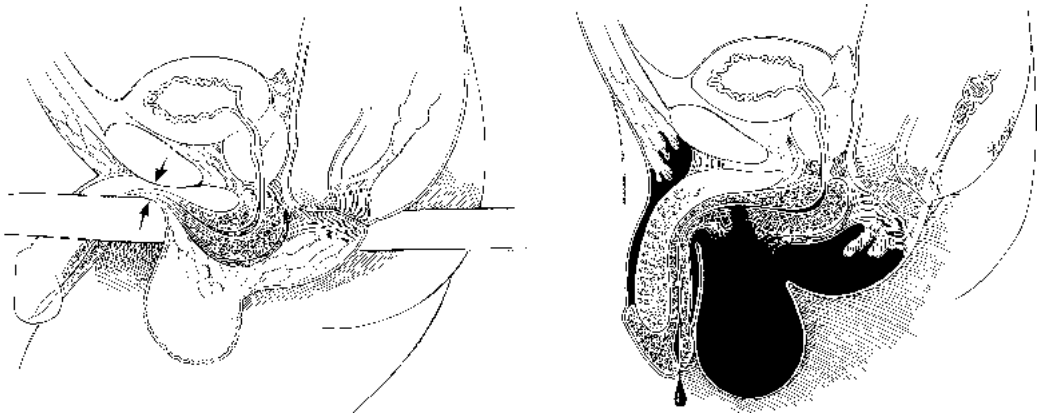
Treatment. Intraperitoneal: open surgical repair — laparotomy, drainage of the abdominal cavity, suturing of a ruptured bladder, cystostomy, in women — a permanent catheter.

Extraperitoneal: bladder drainage (with an indwelling urethral catheter for 2 weeks) or surgical repair (associated injuries) — suturing bladder ruptures, cystostomy, in women — a permanent catheter, drainage of pelvic tissue.

URETHRAL INJURIES

Etiology and classification. *Posterior urethral injuries*: external blunt (pelvic fracture, falls from a height, crush injuries), iatrogenic (endoscopic surgery, TURP).

Anterior urethral injuries: external blunt (straddle injury, kick to the perineum (Fig. 6), penetrating (gunshot, stab).



a ***b***

Fig. 6. Mechanism of urethral injury:
a — external blunt, *b* — penetration

Symptoms and diagnosis. Lower abdominal pain, inability to urinate. Haematoma. Butterfly bruising (following rupture of Buck's fascia) (Fig. 7). Urethroragia.

Imaging. Retrograde urethrography (extravasation of contrast) (Fig. 8).

Treatment. Primary urethral suture. Urinary drainage (suprapubic cystostomy). Urethral catheterization should be avoided. Delayed reconstruction (within 3 months).

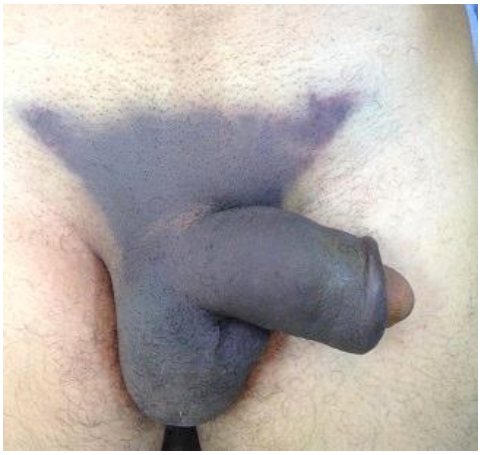


Fig. 7. Haematoma. Urethral injuries

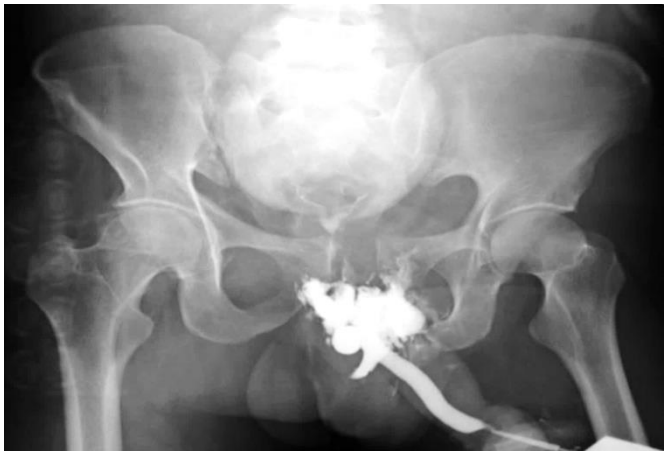


Fig. 8. Retrograde urethrography. Urethral injuries

TRAUMA TO THE EXTERNAL GENITALIA

Etiology and classification. ***Blunt scrotal trauma***. Types of scrotal injury may include: *Intrascrotal hematoma* (can result in considerable pain, infection, testicular atrophy and infarction). *Testicular dislocation* (testicle being displaced from its normal anatomical position in the scrotum: inguinal canal, pubic, penile, abdominal cavity, perineal, femoral canal; secondary injuries: torsion, rupture, and intratesticular hematoma). *Testicular rupture* (rupture of the tunica albuginea). *Hematocele* (blood accumulating between the visceral and parietal layers of the tunica vaginalis; rupture of the parietal tunica vaginalis will result in fluid extending into the perineum and groin).

Diagnosis: scrotal ultrasonography.

Management: observation or surgical exploration and repair (+/– orchiectomy).

Penetrating scrotal trauma. *Management:* surgical exploration and repair (+/– orchiectomy).

Traumatic penile injury. *Penetrating trauma, penile fracture.*

Penile fracture. Injury of the tunica albuginea that only occurs with full erection (Fig. 9). A urethral injury should be considered in the presence of urethrorrhagia or dysuria or acute urinary retention.

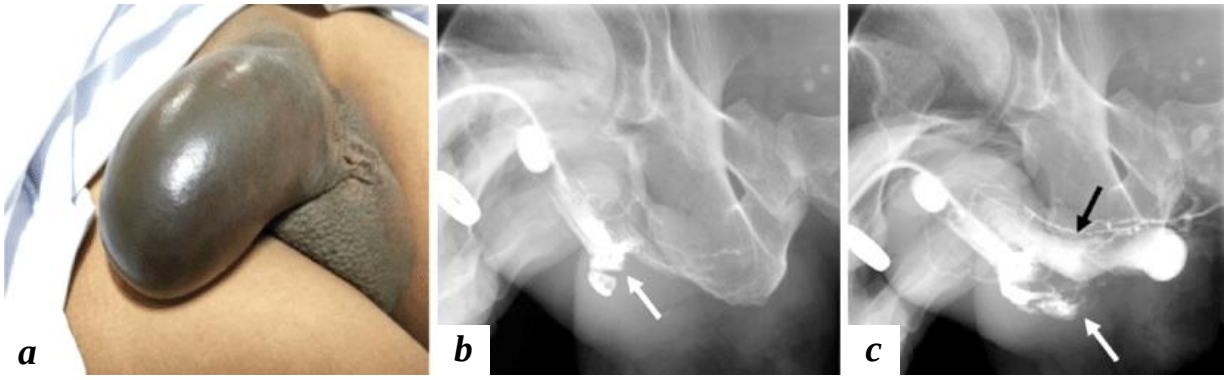


Fig. 9. Penile fracture with urethral injury (*a*). Retrograde urethrogram (*b*, *c*)

Treatment. Surgical. To evacuate the subcutaneous hematoma and to suture the tear of the albuginea of the corpora cavernosa.

CONGENITAL GENITOURINARY ANOMALIES

CLASSIFICATION

Congenital anomalies of the kidney and urinary tract (Tables 2, 3):

– Malformation of the renal parenchyma resulting in failure of normal nephron development.

– Abnormalities of embryonic migration of the kidneys.

– Abnormalities of the developing urinary collecting system (Renal pelvis, ureters, bladder).

Table 2

Anomalies of renal embryonic migration

Simple renal ectopia	Thoracic kidney Lumbar position Pelvic kidney
Crossed renal ectopia	
Fusion anomalies	S-shaped kidney L-shaped kidney I-shaped kidney Disc kidney Horseshoe kidney

Table 3

Anomalies of the collecting system

Renal pelvis	Renal pelvis duplication Ureteropelvic junction obstruction
Ureter	Duplication Megaureter Ectopic ureter Ureterocele Vesicoureteric reflux
Bladder	Bladder agenesis Bladder exstrophy Bladder diverticulum Bladder neck obstruction Urachal anomalies (persistent urachus, cyst, urachal diverticulum)

Anomalies of the External Male Genitalia and Urethra (Table 4):

– Gonadal (testicular) anomalies.

– Urethra and penile anomalies.

Table 4

Anomalies of the external male genitalia and urethra

Testicles	Cryptorchidism Testicular ectopia Testicular agenesis Monorchism
Urethra (penile)	Hypospadias Epispadias Duplication Congenital urethral stricture Posterior urethral valve Urethrorectal and vesicorectal fistulas
Penis	Micropenis Curvature of the penis Pathological phimosis

Pathogenesis of renal malformations: genetic factors, environmental factors.

Renal parenchymal malformations:

– Renal agenesis.
– Renal hypoplasia.
– Renal dysplasia.
– Simple renal cysts, parapelvic cysts.
– Multicystic dysplasia.
– Renal tubular dysgenesis.
– Polycystic kidney disease.
– Nephronophthisis.
– Medullary sponge kidney.

Abnormalities of renal vessels:

– Aberrant artery.
– Abnormalities of renal veins.

RENAL PARENCHYMAL MALFORMATIONS

Renal agenesis. Congenital absence of renal parenchymal tissue (one or both kidneys and ureters). In the case of unilateral agenesis (solitary kidney) the contralateral kidney is compensatory enlarged. Bilateral renal agenesis is fatal. **Renal aplasia** — involution of the kidney with a rudimentary collecting system. Supernumerary kidney (an additional kidney) is a distinct mass of renal parenchyma with its own capsule, vessels, and collecting system.

Renal hypoplasia. Small kidney with histologically normal nephrons.

Renal dysplasia. Abnormal differentiation and organization of the renal parenchyma. It may be unilateral or bilateral. Dysplasia is a histologic diagnosis.

Simple (solitary) renal cysts: do not communicate with any part of the nephron or the renal pelvis. They can be single or multiple. **Parapelvic cysts:** describe simple parenchymal cysts located adjacent to the renal pelvis or hilum. Most commonly diagnosed as an incidental finding following a renal ultrasonography.

Multicystic dysplasia. Nonfunctioning dysplastic kidney (renal tissue is replaced with cysts of varying sizes). The contralateral kidney is usually normal.

Renal tubular dysgenesis. Absence or poor development of proximal tubules. The disorder is characterized by early onset persistent anuria and early fetal death.

Polycystic kidney disease (PKD) is characterized by the bilateral, diffuse formation of renal cysts that replace normal parenchyma and cause progressive renal insufficiency. Two types of PKD:

1. *Autosomal dominant PKD* (adult polycystic disease) is characterized by bilateral renal enlargement secondary to multiple cysts (Fig. 10). Patients have clinical findings only in adulthood (after age 40). Presentation: hypertension, palpable abdominal masses, flank pain, hematuria, UTI, renal failure.

Nephronophthisis is abnormal renal tubules, interstitial inflammation, and fibrosis.

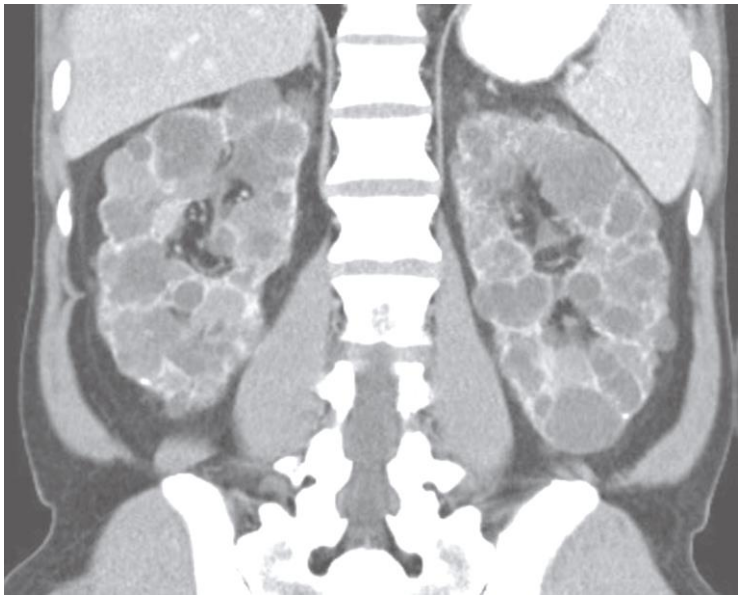


Fig. 10. Autosomal dominant PKD (computed tomography)

2. *Autosomal recessive PKD* (childhood polycystic disease) is characterized by multiple microscopic cysts. A disease of infancy and childhood where the renal collecting tubules and ducts become cystic dilated and numerous small cysts form in the renal cortex and medulla bilaterally. Manifestations: progressive decline of kidney function, congenital hepatic fibrosis, hypertension. End-stage kidney disease — kidney replacement therapy, kidney transplantation.

Medullary sponge kidney is a congenital disorder in which there is cystic dilation of the medullary collecting ducts. In most cases both kidneys are involved. This is associated with urinary stasis and the formation of small calculi (nephrocalcinosis) within the cysts (Fig. 11).

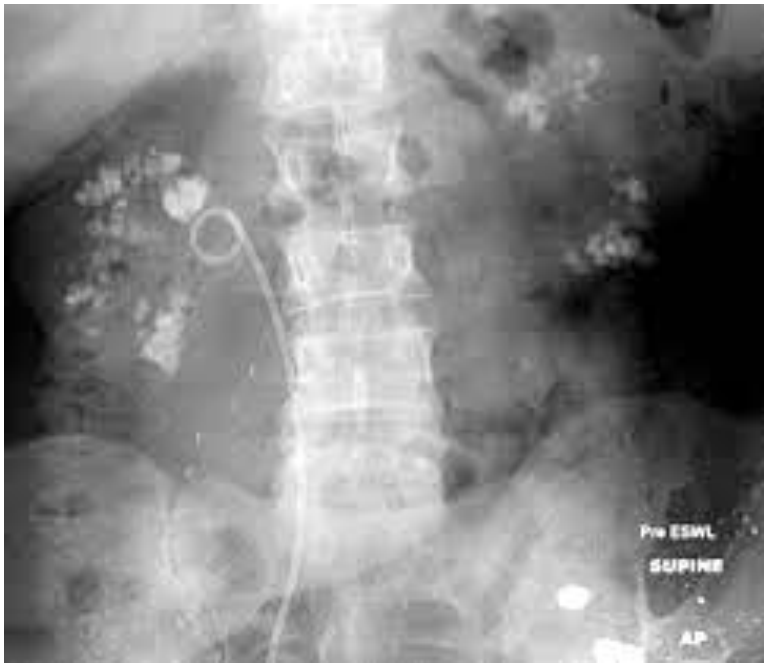


Fig. 11. Medullary sponge kidney (urogram)

ANOMALIES OF RENAL EMBRYONIC MIGRATION

Simple renal ectopia. Abnormal position of the kidney outside of the renal fossa (Fig. 12):

– Thoracic kidney (above the diaphragm).

– Lumbar position (in the iliac fossa).

– Pelvic kidney (below the aortic bifurcation).

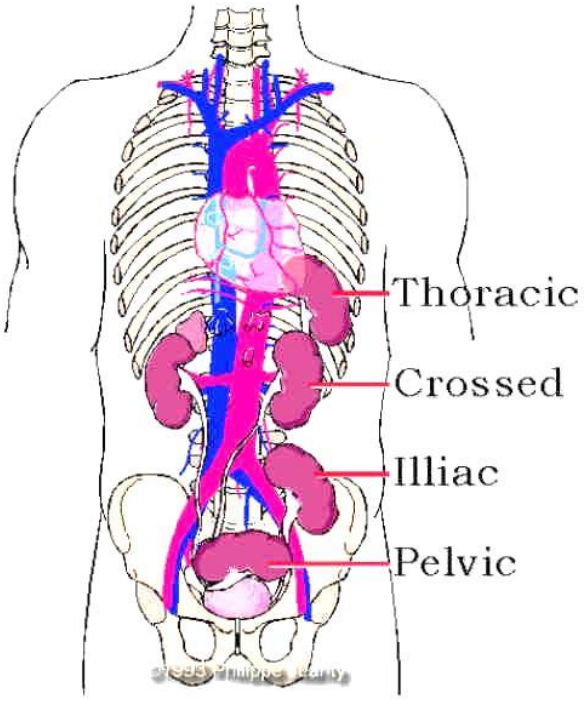


Fig. 12. Simple renal ectopia

Crossed renal ectopia. Kidney crosses to the other side of the body. This disorder is often associated with fusion of the kidneys (Fig. 13).

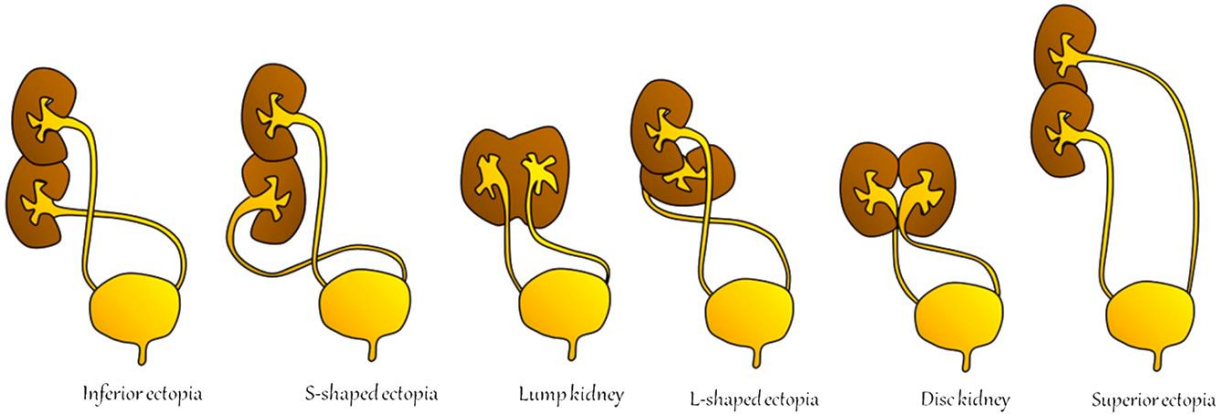


Fig. 13. Crossed renal ectopia and fusion anomalies

Fusion anomalies: *Horseshoe kidney. S-shaped kidney. L-shaped kidney. I-shaped kidney. Disc kidney.*

Horseshoe kidney is the most common type of renal fusion (Fig. 14). Isthmus (fibrous tissue or functioning renal parenchyma) connects the two kidneys

in the midline. A horseshoe kidney rarely causes symptoms and is typically an incidental finding. A minority of patients develop ureteropelvic junction obstructions, nephrolithiasis, or urinary tract infections.

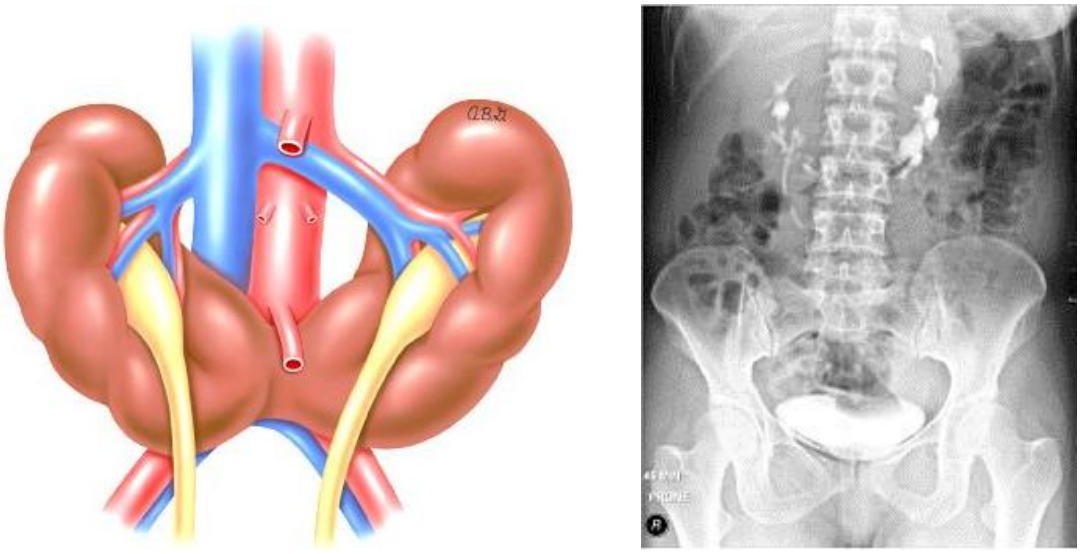


Fig. 14. Horseshoe kidney

ABNORMALITIES OF RENAL VESSELS

An **aberrant artery** passing to the lower pole of the kidney or crossing an infundibulum can cause obstruction and hydronephrosis. These causes of obstruction can be diagnosed on angiography (Fig. 15).

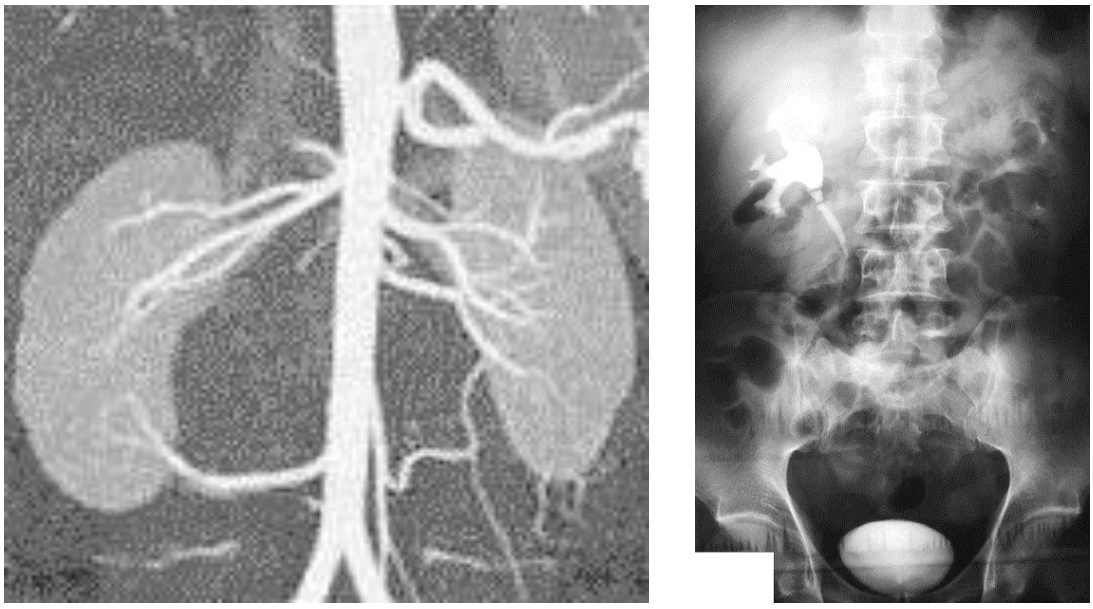


Fig. 15. Aberrant renal artery (aortogram and urogram)

Surgical treatment: pyeloplasty — the pelvis anastomose to the ureter in front of the aberrant renal artery.

Abnormalities of renal veins. Most anomalies remain asymptomatic. Persistence of the posterior cardinal vein on the right — retrocaval ureter (see below).

ANOMALIES OF THE COLLECTING SYSTEM

Renal pelvis duplication. ***Classifications:*** *Complete* or *partial* duplication of the renal collecting system (Fig. 16).

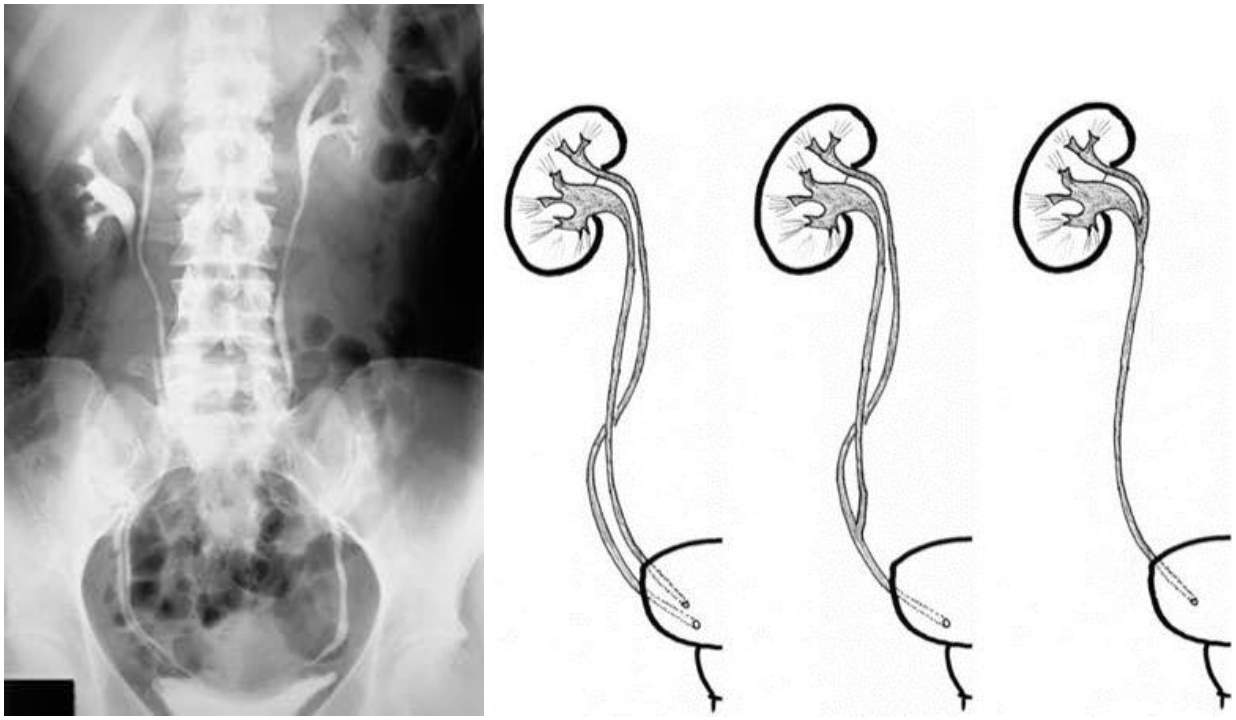


Fig. 16. Leftsided duplication of the renal collecting system (excretory urography)

Ureteropelvic junction obstruction (UPJ) is the most common cause of prenatal upper tract dilatation (Fig. 17). UPJ is caused by intrinsic obstruction (stricture, mucosal folds, polyps, convolutions) or extrinsic compression (crossing vessel).

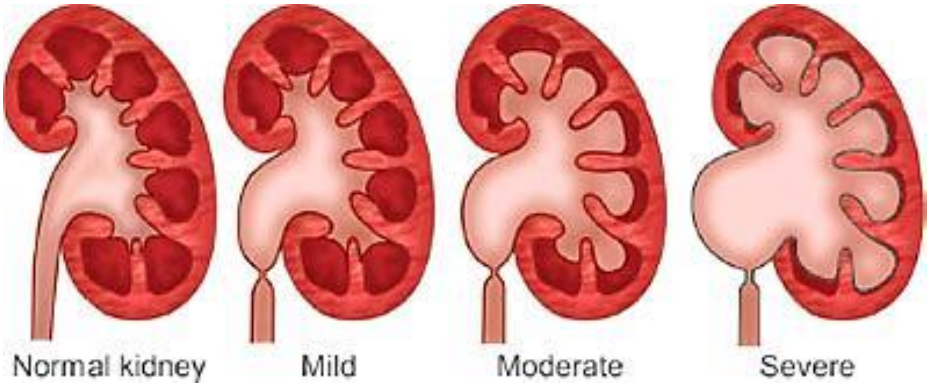


Fig. 17. Ureteropelvic junction obstruction

Management: conservative or pyeloplasty (Fig. 18).

Megaureter. Ureteral diameter > 7 mm considered a megaureter (Fig. 19).

Classifications: *nonobstructed/nonrefluxing, obstructed, refluxing, obstructed and refluxing.*

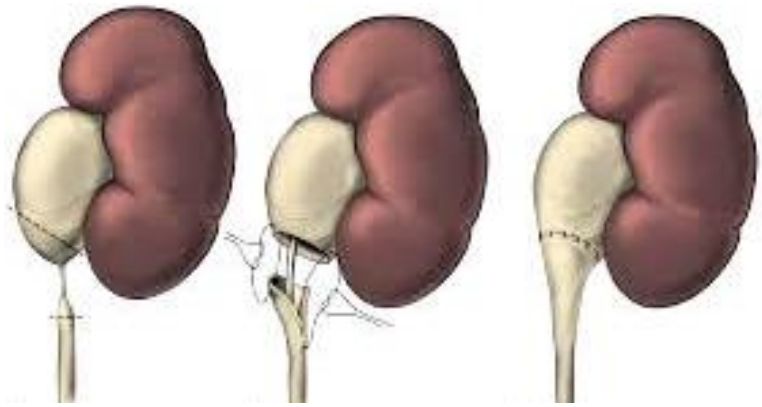


Fig. 18. Pyeloplasty of ureteropelvic junction obstruction

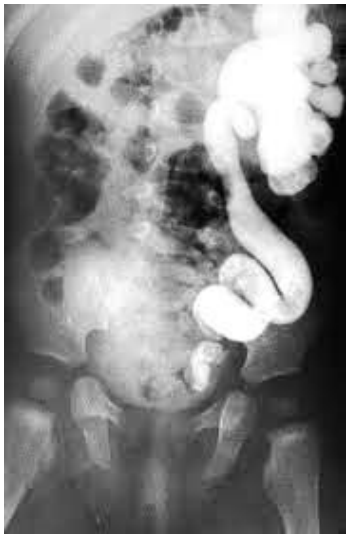


Fig. 19. Urography of megaureter

Clinical presentation: prenatal hydroureteronephrosis, UTI and urolithiasis.

Management: observation, temporizing procedures (ureterostomy, stent placement, balloon dilation), reimplantation.

Retrocaval ureter. Anomaly in the development of the inferior vena cava (Fig. 20).

Clinical presentation: hydronephrosis and the dilation of the proximal ureter.

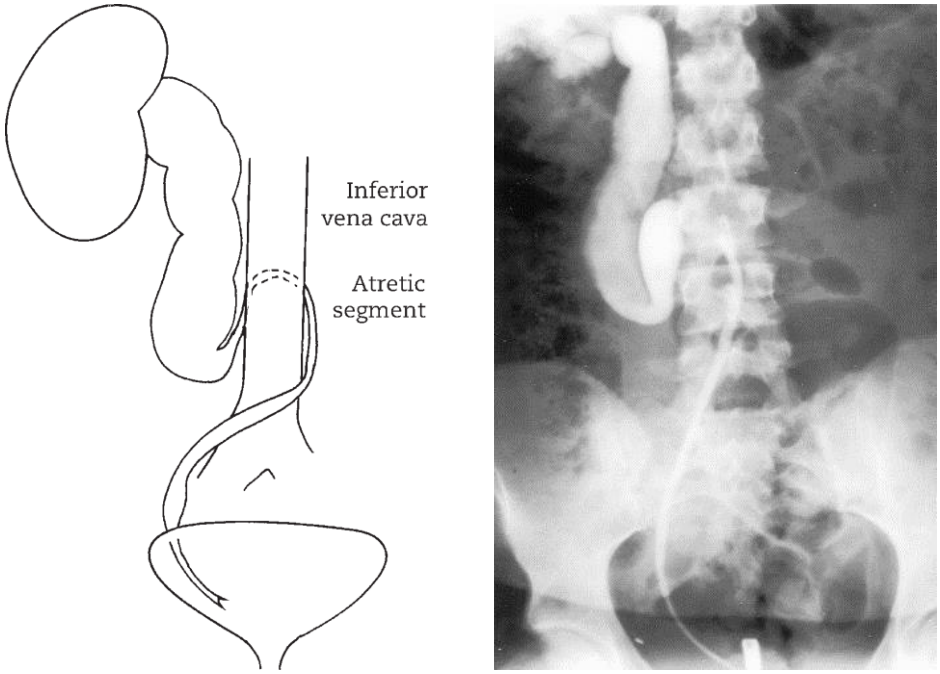


Fig. 20. Retrocaval ureter

Surgical treatment: ureteroureteroanastomosis.

Ectopic ureter (Fig. 21). It is any single or duplex ureter that enters beyond the anatomical area of the triangle of the urinary bladder. Woman: bladder neck, urethra, vagina, vaginal vestibule, uterus. Man: posterior urethra, seminal vesicles, ejaculatory duct. 80 % are associated with a duplicated collecting system.

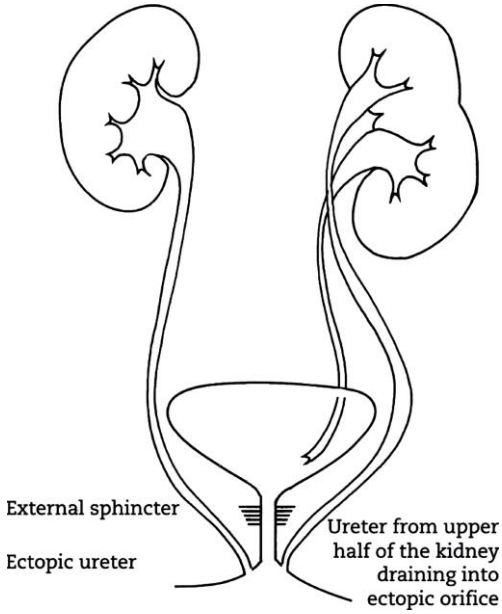


Fig. 21. Ectopic ureter

Clinical presentation: Men — urinary tract infection or epididymitis (ureter may drain directly into the vas deferens or seminal vesicle). Women — persistent vaginal discharge or incontinence / continual dribbling despite normal voiding pathognomonic (ureteral orifice in the urethra, vagina or perineum), infection / recurrent UTI (urgency and urge incontinence). Obstruction of the ectopic ureter can lead to hydroureteronephrosis.

Ureterocele is a cystic distention of the distal part of the ureter around its orifice, which can bulge inside the bladder (Fig. 22). This defect is highly associated with ureters of the duplex pelvicalyceal system.

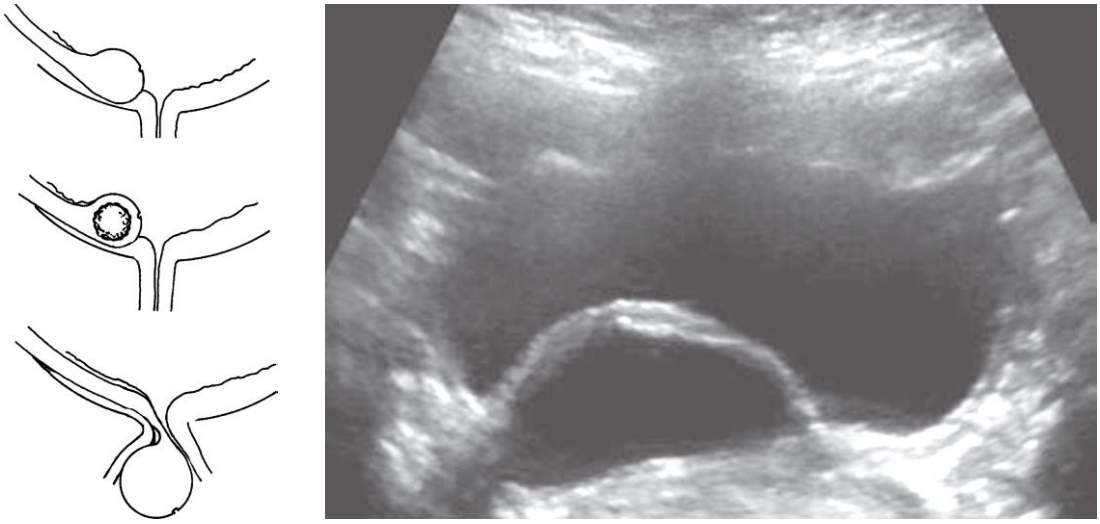


Fig. 22. Ureterocele (bladder ultrasound)

Presentation: hydronephrosis, UTI, reflux nephropathy, stone formation, extravesical prolapsing ureterocele, acute retention of urine.

Treatment. Endoscopic incision/puncture, open or laparoscopic procedures (heminephrectomy, ureteropyelostomy, ureteral implantation).

Vesicoureteric reflux (VUR) results from abnormal retrograde flow of urine from the bladder into the upper urinary tract (Fig. 23). Primary (ureterovesical junction is abnormal), secondary reflux (very high filling pressures in the bladder, a common cause is posterior urethral valves). Classification of VUR — Fig. 24.

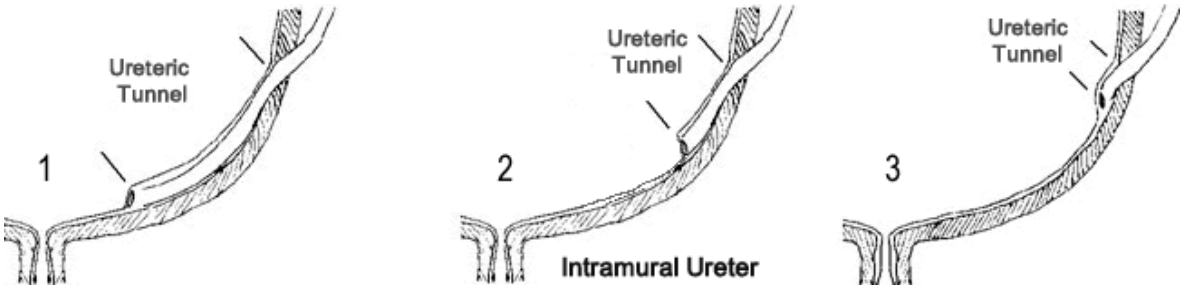
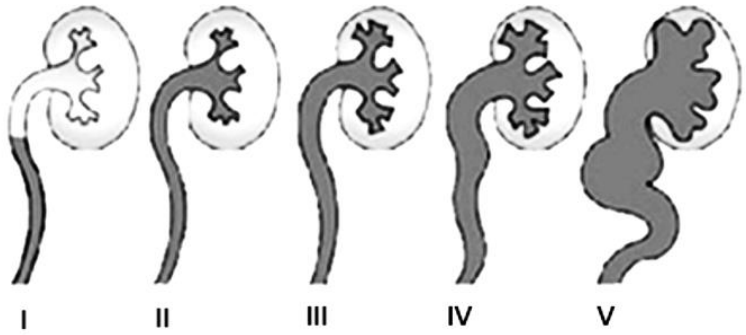


Fig. 23. Bladder wall ureteral tunnel length:
1 — long tunnel, no reflux; *2* — medium tunnel, possible reflux; *3* — short tunnel, reflux



Grade	Description
I	Into a nondilated ureter
II	Into the pelvis and calyces without dilation
III	Mild to moderate dilation of the ureter, renal pelvis, and calyces with minimal blunting of the fornices
IV	Moderate ureteral tortuosity and dilation of the pelvis and calyces
V	Gross dilation of the ureter, pelvis, and calyces; loss of papillary impressions; and ureteral tortuosity

Fig. 24. Classification of VUR

Presentation and complications: UTI (fever, dysuria, suprapubic and abdominal pain). Cystitis, pyelonephritis and hydroureteronephrosis. Reflux nephropathy and renal scarring, causing hypertension and rarely end-stage renal failure.

The gold standard *diagnostic test* is a voiding cystourethrogram.

Treatment:

– Medical (conservative). VUR grades I–II will resolve spontaneously (80 %). Good fluid intake, regular voiding, perineal hygiene, treatment of constipation. Low-dose antibiotic prophylaxis.

– Surgical. Indications: febrile UTI despite antibiotic prophylaxis (acute pyelonephritis recurs), scarred kidney (increased renal damage). Reflux caused by ectopic ureteral orifice, ureteral duplication, ureterocele associated with ureteral duplication will not disappear spontaneously. Endoscopic injection (hyaluronic acid) (Fig. 25), ureterovesicoplasty (ureteric reimplantation, antireflux surgery) performed by open surgery or laparoscopically.

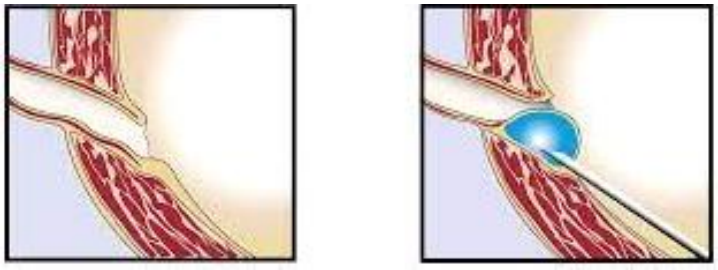
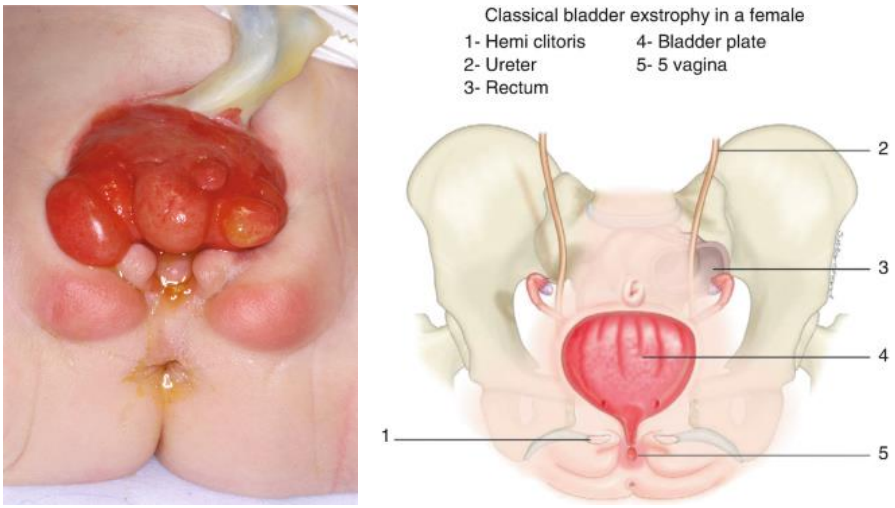


Fig. 25. Endoscopic injection for the correction of VUR

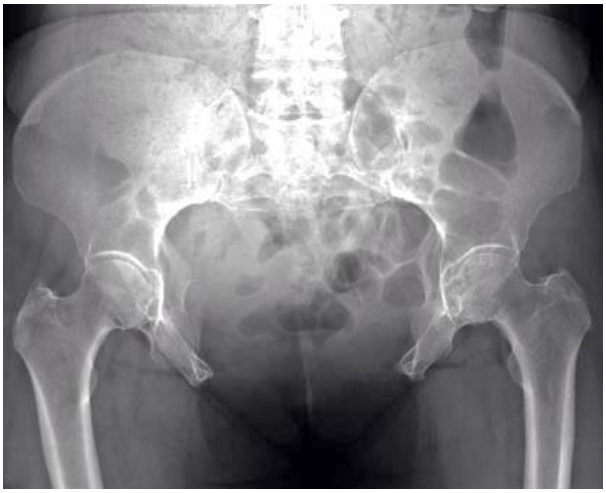
ANOMALIES OF THE BLADDER AND URACHUS

Agenesis of the bladder is a rare anomaly, and it is usually associated with the absence of the urethra.

Bladder exstrophy describes congenital malformations affecting the bladder, abdominal wall, pelvis, and uretra. This is a defect in the development of the anterior bladder and lower abdominal walls, resulting in the posterior bladder wall lying exposed on the abdomen. All cases are associated with epispadias and bone defects (pubic diastasis) (Fig. 26).



a



b

Fig. 26. Bladder exstrophy in a female (*a*). Bone defects: pubic diastasis (*b*)

Investigation. Prenatal ultrasound scanning.

Management. Surgery: pelvic osteotomy (correct the deformity), closure of the bladder, abdominal wall, and posterior urethra, epispadias repair bladder neck reconstruction from newborn to 4–5 years of age.

Bladder duplication. *Complete* (two bladders are fully separated and are drained by an individual urethra) or *incomplete* (two bladder halves communicate and are drained by a single urethra).

Bladder diverticula. It develops as herniation of bladder mucosa between defects of bladder smooth muscle fibers. The cause of diverticulum development is obstruction of the bladder neck (Fig. 27).

Bladder neck obstruction is a condition in which the bladder neck does not open appropriately or completely during voiding.

Symptoms: storage symptoms (frequency, urgency, urge incontinence, nocturia) and voiding symptoms (decreased force of stream, hesitancy, incomplete emptying), urinary retention. Vesicoureteric reflux.

Diagnosis. Videourodynamic investigation. Voiding cystogram (Fig. 28).

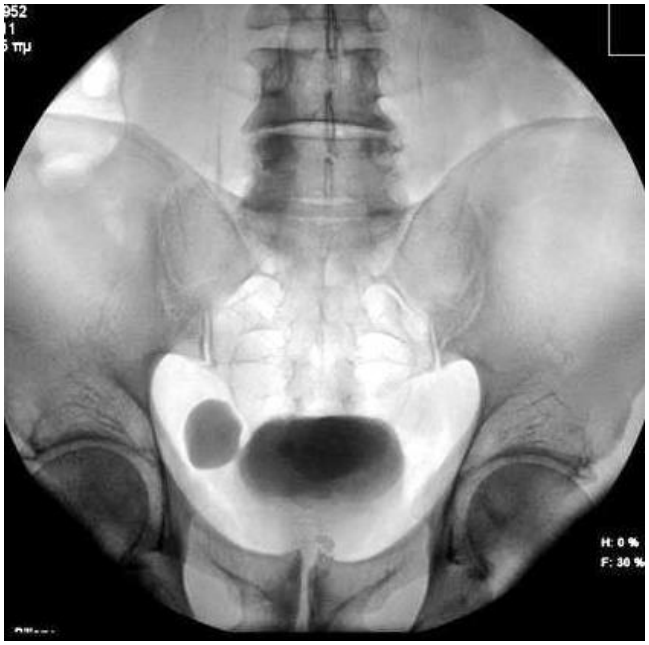


Fig. 27. Bladder diverticula (cystogram)

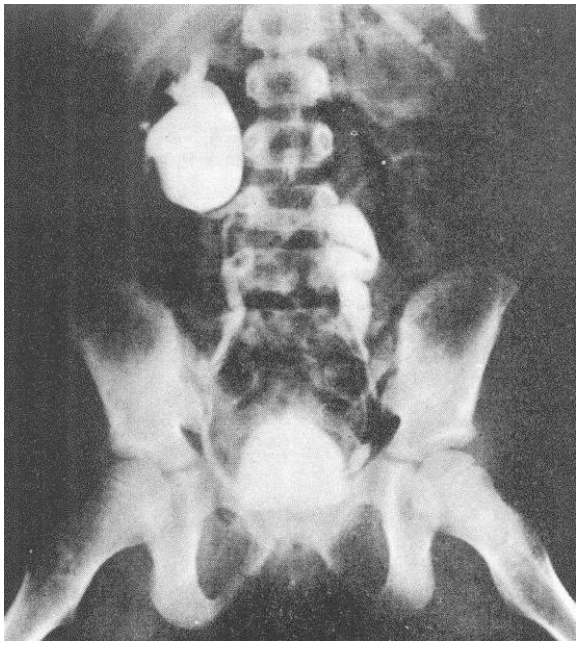


Fig. 28. Obstructed vesical neck and vesicoureteric reflux (voiding cystogram)

Treatment. Pharmacotherapy: α-blockers. Surgical intervention: transurethral incision of the bladder neck.

Urachal anomalies. *Patent urachus, urachal sinus, urachal cyst, urachal diverticulum* (Fig. 29).

Presentation. Asymptomatic, symptomatic (umbilical drainage, infected urachus).

Treatment. Conservative treatment with antibiotics in infected cases. Surgical excision.

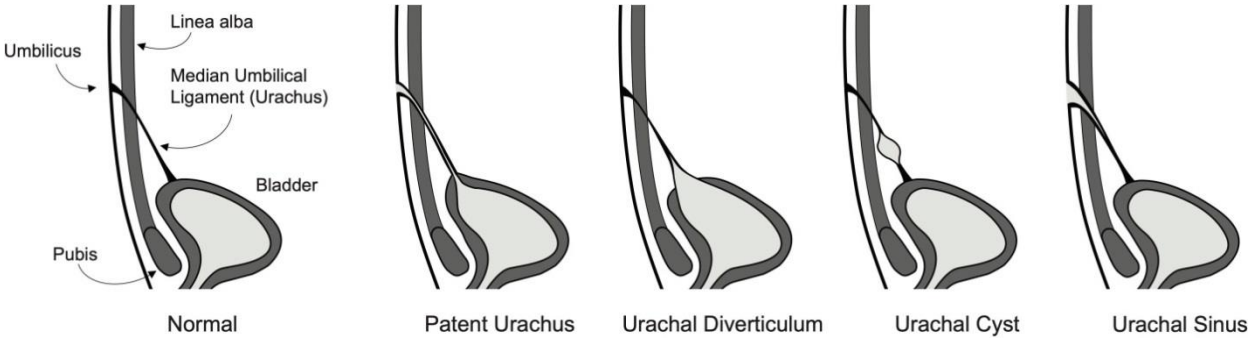


Fig. 29. Urachal anomalies

ANOMALIES OF THE EXTERNAL MALE GENITALIA, URETHRA AND PENIS

Cryptorchidism. Undescended testis. It is the absence of one or both testes in normal scrotal position (Fig. 30).

Complications. Long-term complications: risk of testicular cancer is higher, infertility, higher risk of testicular torsion.

Diagnosis. Examine the scrotum (testis is palpable or impalpable). Endocrine evaluation (in cases of bilateral cryptorchidism). Ultrasonography. Diagnostic laparoscopy.

Treatment. Surgical correction: orchidopexy (between 3 and 12 months). Descent and fixation of the testicle in the scrotum. Inguinal exploration or laparoscopic approach. Medical management: hormonal therapy.

Ectopic testis. Testicle position outside the inguinal canal (femoral, penile, perineal, pubic ectopies) (Fig. 31).

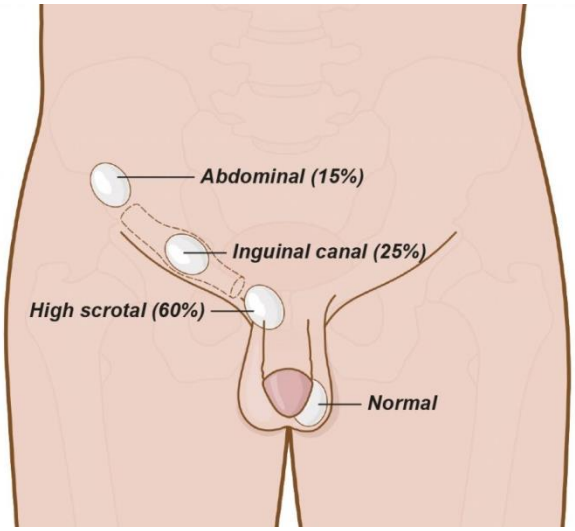


Fig. 30. Cryptorchidism

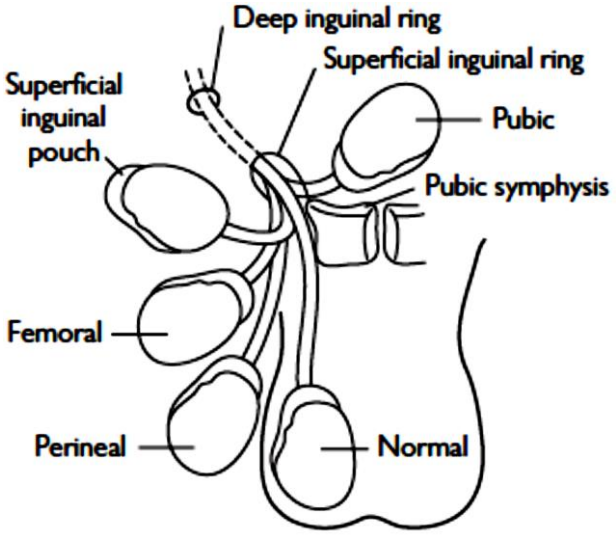


Fig. 31. Testicular ectopia

Monorchia (monarchism) is absence of one testicle (agenesis).

Anorchia — bilateral absence of both testicles.

Hypospadias. Anomaly where the opening of the urethra (the meatus) is sited on the underside (ventral) part of the penis.

Classification according to the anatomical location of the urethral meatus (Fig. 32).

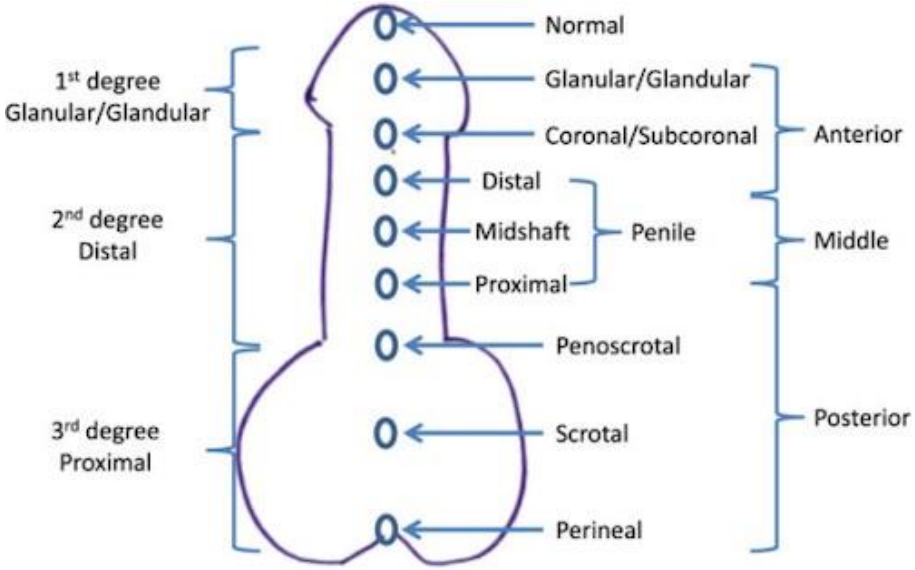


Fig. 32. Classification of hypospadias

Treatment. Urethroplasty is performed around 12 months of age.

Epispadias. Urethra opens onto the dorsal surface of the penis. Epispadias is associated with severe dorsal chordee causing a dorsal curvature of the penis (Fig. 33).

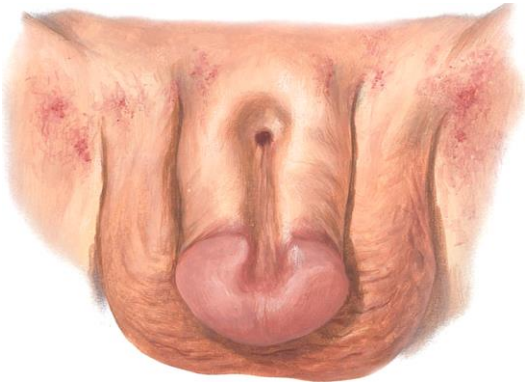


Fig. 33. Epispadias

Classification is based on urethra position: *glandular*, *penile*, *penopubic* epispadias (occur with bladder exstrophy — exstrophy-epispadias complex).

Presentation. In penopubic epispadias, the defect usually leads to absence of the normal sphincter mechanisms, resulting in urinary incontinence.

Management. Surgery is required to correct the incontinence, remove the chordee to straighten the penis, and extend the urethra out onto the glans penis.

Posterior urethral valve. Abnormal mucosal folds in the distal urethra — the most common cause of congenital urinary tract obstruction (Fig. 34).

Symptoms of obstruction: poor, intermittent, dribbling urinary stream, urinary infection, hydronephrosis.

Treatment. Transurethral fulguration (removal) of the valves.

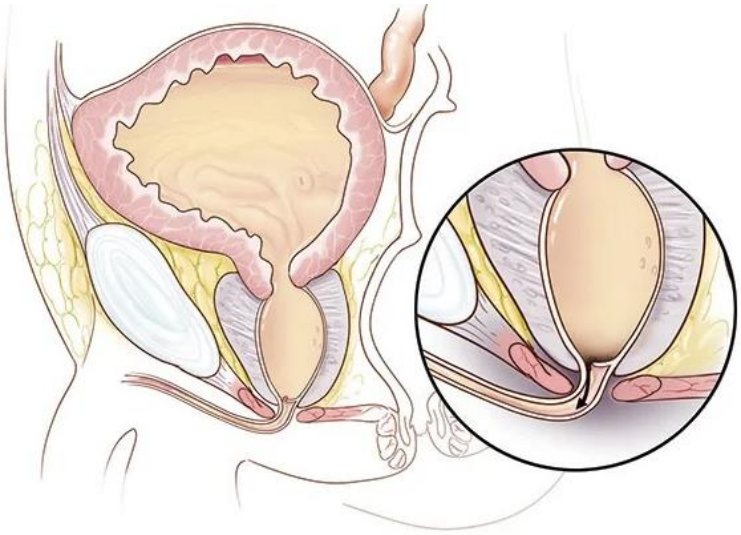


Fig. 34. Posterior urethral valve

Other urethral abnormalities: **congenital urethral stricture, urethrorectal and vesicorectal fistulas**.

Phimosis. Physiological phimosis. At birth, > 95 % of foreskins are non-retractile, majority of foreskins become fully retractile by the age of 16. It does not require treatment. **Pathological phimosis.** Scarring of the foreskin opening leading to symptoms and non-retractibility of the prepuce.

Presentation. Irritation, infections, abnormal urinary stream, and urinary retention.

Treatment. Circumcision (Fig. 35).

Fig. 35. Circumcision

Other abnormalities of the penis: **micropenis, curvature of the penis**.

CLINICAL TESTS

1. A 27-year-old man developed sudden onset of pain in the penis during vigorous sexual intercourse. He heard a "pop" sound which was followed by a swelling of the penis, ecchymosis and distortion of the right side of the penis at mid-shaft. An urethrogram performed was normal. What diagnosis will you make? The preferred management plan should be:

a) suprapubic catheter and pressure dressing of penile shaft;
b) Foley urethral catheter and ice pack;
c) pressure dressing and allow home for review after 48 hours;
d) exploration and repair of the corpora;
e) ice pack and delayed exploration if the swelling persists.

2. The single most important sign of urethral injury after pelvic trauma is:

a) pelvic fracture;
b) blood in the urethral meatus;
c) inability to void;
d) haematuria;
e) pelvic haematoma.

Are there indications for bladder catheterization in this case?

3. A girl of 14 is kicked by her horse and suffers a rupture of her kidney. Correct initial management is likely to be:

a) resuscitation followed by cystoscopy and retrograde ureterography as soon as stable;
b) renal arteriography followed by immediate exploration;
c) resuscitation, intravenous urography and initial observation in ITU;
d) renal ultrasound and percutaneous nephrostomy drainage of the kidney;
e) immediate exploration of the kidney.

4. A 17-year-old male presents to the emergency room 3 hours following a rugby match. He reports sustaining a large collision with another player and the onset of right-sided flank pain and one episode of "pink urine". He is afebrile and hemodynamically stable. CT scan with IV contrast in the emergency room reveals a large right-sided perinephric fluid collection that does not enhance on delayed imaging and a 2.5 cm laceration of the right renal parenchyma.

1) The first step in management of the patient should be:

a) Repeat CT scan in 1 hour;
b) Placement of percutaneous drainage tube;
c) Open surgical repair of parenchymal laceration;
d) Advanced trauma life support trauma survey;
e) Right total nephrectomy.

2) According to Severity scale for the kidney trauma, this patient has what grade of renal injury?

a) Grade I; b) Grade II; c) Grade III; d) Grade IV; e) Grade V.

3) Ultimate repair and salvage of the injured kidney is best achieved by:
a) Percutaneous drainage of perinephric fluid;
b) Initial bed rest followed by expectant management;
c) Placement of ipsilateral percutaneous nephrostomy tube;
d) Placement of ipsilateral ureteral stent;
e) Partial nephrectomy of injured renal segment.

5. When examining the boy's external genitalia, it was revealed that the external opening of the urethra is located in the area of the penoscrotal angle. What type of anomaly does the child have?
a) epispadias;
b) hypospadias;
c) exstrophy of the bladder;
d) phimosis;
e) paraphimosis.

6. A 3-year-old child is admitted with complaints of difficulty urinating and swelling of the foreskin when urinating. Upon examination, the head of the penis is not exposed due to a sharp narrowing of the external opening of the foreskin. What is your diagnosis?
a) acute ballanoposthitis;
b) stricture of the external urethral opening;
c) phimosis;
d) paraphimosis;
e) stone of the pendulous urethra.

7. When examining a 6-year-old child, you discovered that the testicle in the right half of the scrotum is not palpable, but is palpated under the skin in the right groin area. What is the diagnosis? Treatment tactics?

8. When examining a patient, you palpate a non-displaceable, painless formation in the abdomen on both sides of the spine. The patient has no complaints. What kidney abnormality do you suspect? What examination methods will you prescribe?

9. A 10-year-old girl has come to you, whose parents note that she has had urinary incontinence along with normal urination since birth. She was repeatedly treated conservatively for urinary incontinence, but without success. What malformation should we think about in this case, what is the plan for diagnostic and treatment measures?

10. The patient underwent supravaginal amputation of the uterus yesterday. By evening it was discovered that the patient did not urinate. What's the first thing you think about? What will you do?

11. A 6-year-old child was brought to the emergency room from school. During a physical education lesson, a friend accidentally kneed him in the lower abdomen. The child complains of abdominal pain that gets worse when lying down. On examination, the abdomen is board-shaped tense in all parts, especially above the pubis, sharp pain on palpation. Has not urinated independently for 4 hours. During catheterization of the bladder, about 20 ml of urine with scarlet blood was released. What is your diagnosis and treatment strategy?

12. When examining the newborn child, the doctor discovered a defect in the anterior abdominal wall below the navel with the absence of the anterior wall of the bladder and prolapse of its posterior wall. The orifices of the ureters are visible, urine flows from them, pouring onto the skin of the pubis.

1) What is your diagnosis?
   a) exstrophy of the bladder;
   b) ectopia of the ureter;
   c) cleft urachus;
   d) umbilical hernia;
   e) hypospadias.
2) When is surgical treatment indicated?
a) during the first year of the child's life;
b) within 3–5 years;
c) in adolescence;
d) upon the appearance of menstruation or the first sexual characteristics;
e) upon reaching puberty.

13. A 23-year-old man was brought to the emergency room with complaints of severe pain in the left testicle and enlargement of the left half of the scrotum. An hour ago, while riding a bicycle quickly, he hit his crotch on the bicycle frame and felt severe pain in his left testicle. Upon examination, the left half of the scrotum is enlarged, bluish in color, palpation reveals a doughy consistency, a sharply painful formation in the left half of the scrotum. The right testicle is unchanged. What is your diagnosis, treatment tactics?

ANSWERS

1. Penile fracture. d.
2. b. Urethral catheterization for urethrorrhagia is contraindicated.
3. c.
4. 1) d. 2) c. 3) b.
5. b.
6. c.
7. Ectopia of the right testicle. The operation is orchiopexy.
8. Horseshoe kidney. Excretory urography, scintigraphy.
9. One should think about congenital dystopia of the ureteral orifice into the urethra, the vestibule of the vagina, or into the vagina. Most often, this

malformation occurs with complete duplication of the kidney and ureter. The diagnosis is clarified after excretory urography. Surgical treatment: transplantation of the dystopic ureter using an antireflux technique into the bladder.

10. About postrenal anuria as a result of ligation of the ureters. Urgently perform ureteral catheterization and retrograde pyelography.

11. Intraperitoneal rupture of the bladder. Laparotomy and suturing of the bladder wall are indicated.

12. 1) a. 2) a.

13. The mechanism of injury and clinical manifestations suggest a rupture of the left testicle. The patient is indicated for urgent surgical intervention — testicular revision. If a rupture is confirmed, the tunica albuginea is sutured to preserve the testicle.

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