NOTES
PENILE, PROSTATE, & TESTICULAR DISORDERS

GENERALLY, WHAT ARE THEY?

PATHOLOGY & CAUSES

- Disorders affecting male genitourinary tract

SIGNS & SYMPTOMS

- See indiviudal disorders

DIAGNOSIS

DIAGNOSTIC IMAGING

- Ultrasound

LAB RESULTS

- Urinalysis, urine culture

TREATMENT

- Conservative measures
  - E.g. decrease fluid intake for benign prostatic hyperplasia
- Pharmacological therapy
- Surgical therapy

BENIGN PROSTATIC HYPERPLASIA

osms.it/benign-prostatic-hyperplasia

PATHOLOGY & CAUSES

- Characterized by nodular prostatic hyperplasia
- Not premalignant
- Most common prostatic disease in biologically-male individuals > 50 years old

CAUSES

- Hyperplasia of prostatic epithelial, stromal cells → formation of nodules in periurethral (transition) zone → narrowing of urethral canal → urine flow constricted
- Testosterone, dihydrotestosterone (DHT), estrogens act on stromal, epithelial cells' androgen receptors → hyperplasia, inhibition of normal cell death
- Dysregulation of stromal growth factors → proliferation, hyperplasia of epithelium
- ↑ stem cells

RISK FACTORS

- ↑ age
- Family history of benign prostatic hyperplasia (BPH)
- Heart disease
- Beta-blocker use
- Obesity
- Diabetes
- Erectile dysfunction

COMPLICATIONS

- Chronic bladder outlet obstruction
  - Bladder hypertrophy → formation of bladder diverticula
  - Urinary retention → bladder calculi
  - Residual urine can be infection source → recurrent UTIs
  - Hydronephrosis → renal failure

SIGNS & SYMPTOMS

- Urinary
  - Frequency
  - Urgency
  - Nocturia
  - Dysuria
  - Emptying bladder feels incomplete
  - Difficulty starting, stopping urine flow
  - Weak stream → small amounts of urine lost

DIAGNOSIS

DIAGNOSTIC IMAGING

Ultrasound

- Evaluate bladder size, prostate size, degree of hydronephrosis

Cystoscopy

- Reveal bladder diverticula/calculi before scheduled invasive treatment

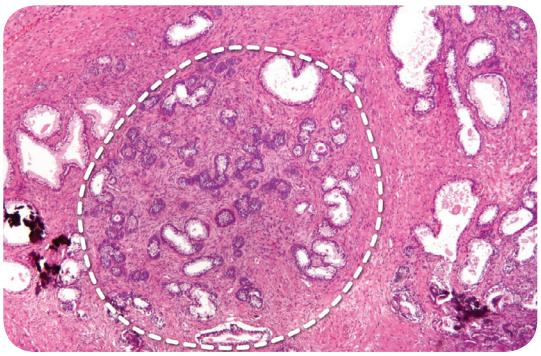

Figure 130.2 The histological appearance of benign prostatic hyperplasia. There is a nodule of hyerplastic stromal tissue surrounded by hyperplastic smooth muscle.

Figure 130.1 An MRI scan of the abdomen and pelvis in the coronal plane demonstrating massive prostatic hypertrophy. The prostate extends past the pelvic brim and into the abdominal cavity.

LAB RESULTS

- Urinalysis
  - Microscopic hematuria may be present
  - Pyuria, bacteriuria in case of concomitant UTIs
- Urine culture
  - Exclude UTIs
- Blood tests
  - Often ↑ prostate specific antigen (PSA)
  - Electrolytes, blood urea nitrogen (BUN), and creatinine to evaluate for renal impairment

OTHER DIAGNOSTICS

- Digital rectal examination
  - Enlarged, nodular prostate

TREATMENT

MEDICATIONS

- Alpha-adrenergic receptor blockers (terazosin, tamsulosin) → decrease prostate, bladder, urethral muscle tone
- 5-alpha reductase inhibitors (finasteride) decrease DHT synthesis → reduce prostate gland size
- Phosphodiesterase-5 enzyme inhibitors (e.g., tadalafil) → induce smooth muscle relaxation

SURGERY

- Transurethral resection of prostate (TURP)
- Open prostatectomy

OTHER INTERVENTIONS

- Mild cases
  - Conservative measures; e.g. decrease fluid intake before bedtime/going out; avoid caffeine, alcohol (mild diuretic effects)

CRYPTORCHIDISM

osms.it/cryptorchidism

PATHOLOGY & CAUSES

- Common congenital condition characterized by incomplete/partial descent of testis into scrotal sac
- AKA undescended testes
- Most cases resolve spontaneously during first year of life

CAUSES

- Testicles normally develop in abdomen, descend into scrotal sac before birth
  - Malpositioned testis usually found in inguinal canal but can be anywhere in descent pathway
- Impaired spermatogenesis at temperatures >37°C/98.6°F
- Leydig cells remain unaffected → normal testosterone levels
- Usually unilateral; bilateral in ¼ of cases
- Associated conditions
  - Malformations of genitourinary tract (e.g. hypospadias), inguinal hernia

RISK FACTORS

- Prematurity
- ↓ birth weight
- Twining
- 1st trimester maternal exposure to estrogens
- Family history of undescended testes
- Genetic syndromes associated with cryptorchidism (e.g. Down syndrome, Klinefelter syndrome)
- Disorders of sexual development (e.g. gonadal dysgenesis, ambiguous genitalia)

COMPLICATIONS

- Testicular atrophy, dysfunction → infertility
- When malpositioned in inguinal canal → prone to trauma, testicular torsion
- Left untreated/treatment delayed → germ-cell tumors, especially seminoma, high risk; contralateral testis also at risk

SIGNS & SYMPTOMS

- Asymptomatic
- One/both testes absent from scrotal sac
- Undescended testis can be palpable in abdomen

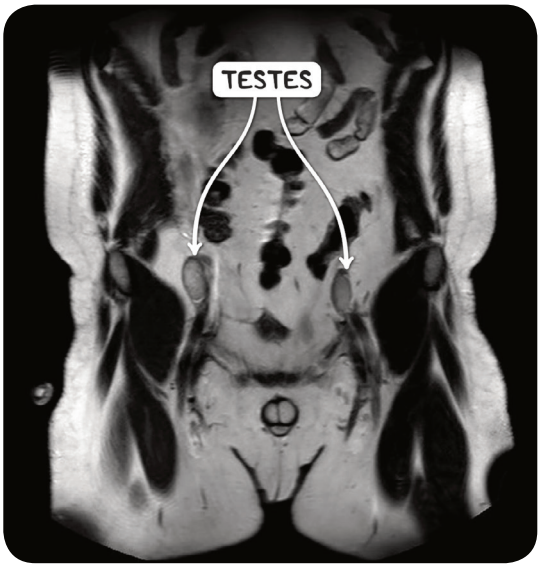

Figure 130.3 An MRI scan of the abdomen and pelvis in the coronal plane demonstrating bilateral undescended testes.

DIAGNOSIS

DIAGNOSTIC IMAGING

Ultrasound

- Used to localize testis

LAB RESULTS

- ↑ FSH
- ↑ LH
- Usually normal testosterone; ↓ in bilateral cryptorchidism

OTHER DIAGNOSTICS

- Physical examination
  - Testis absent from scrotal sac

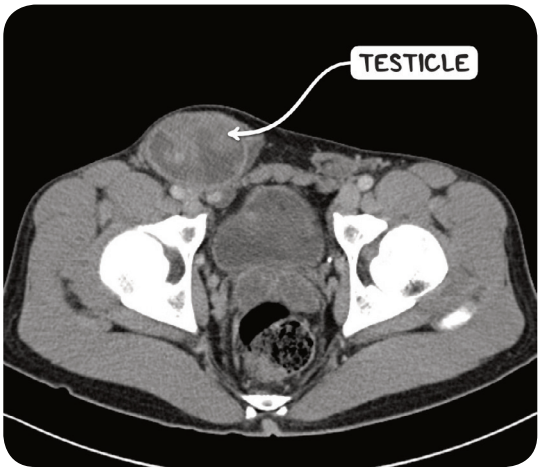

Figure 130.4 A CT scan of the pelvis in the axial plane demonstrating an undescended testicle in the right inguinal canal that has undergone malignant transformation.

TREATMENT

SURGERY

- Treatment of choice
  - Orchiopexy, preferably at 9–15 months
  - Testis does not spontaneously descend → placed in scrotal sac

EPIDIDYMITIS

osms.it/epididymitis

PATHOLOGY & CAUSES

- Inflammation of epididymis
  - Due to infectious/non-infectious etiologies
- AKA epididymo-orchitis when testicle involved

TYPES

- Infectious
- Non-infectious
- Idiopathic
- Acute
  - < six weeks
- Chronic
  - > six weeks

CAUSES

Mechanism of disease

- Urinary tract infection → vas deferens/lymphatics of spermatic cord → epididymitis
- Hematogenous spread (rarely)

Infectious

- Children
  - Gram negative pathogens (e.g. *E. coli*)
- Adults (<35 years of age)
  - *Chlamydia trachomatis*, *Neisseria gonorrhoeae*, *Paramyxovirus* (mumps)
- Adults (>35 years of age)
  - Common urinary tract pathogens (e.g. *E.coli*, *P. aeruginosa*), tuberculosis

Non-infectious

- Trauma
- Autoimmune diseases
- Vasculitis
- Medications (e.g. amiodarone)

Idiopathic

- Cause unknown

RISK FACTORS

- Congenital abnormalities of urinary tract
- ↑ sexual activity
- Anal intercourse
- Urinary tract obstruction

COMPLICATIONS

- Hydrocele
- Abscess
- Fistulization
- Necrosis
- Chronic epididymitis
- Infertility

SIGNS & SYMPTOMS

- Gradual onset
  - Scrotal pain usually unilateral; sometimes radiates to lower abdomen with/without swelling
  - Fever, chills
  - Lower urinary tract symptoms (e.g. frequency, urgency, dysuria)
- Less common
  - Urethral discharge, hematuria, hematospermia
- Normal cremasteric reflex
  - Cremasteric muscle contraction → ipsilateral elevation of testicle
- Prehn sign
  - Elevating scrotum relieves pain
- Reactive hydrocele can be present

DIAGNOSIS

DIAGNOSTIC IMAGING

Color Doppler

- Enlarged, thickened epididymis with increased blood flow; excludes testicular torsion

LAB RESULTS

- Leukocytosis
- Pyuria, bacteriuria
- Positive urine culture
- Gram staining of urethral discharge
- Culture,nucleic acid amplification testing (NAAT) of first-catch urine/urethral swab specimens for *C. trachomatis*, *N. gonorrhoeae*

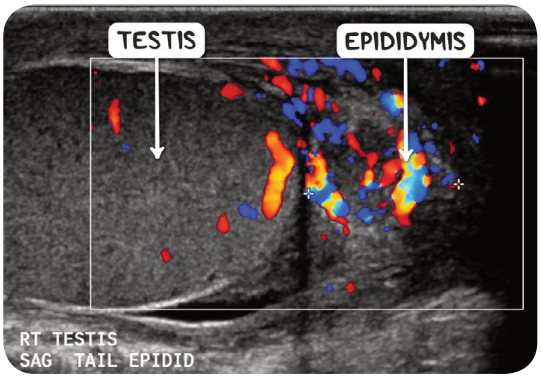

Figure 130.5 An ultrasound scan of the scrotum demonstrating increased bloodflow in the epididymis, consistent with epididymitis.

TREATMENT

MEDICATIONS

Infectious epididymitis

- Antimicrobial therapy
- Ceftriaxone, doxycycline to cover *C. trachomatis*, *N. gonorrhoeae*
- Ceftriaxone, quinolone for > 35 years old, individuals that have anal intercourse

SURGERY

- Performed when findings are equivocal, testicular torsion cannot be ruled out

OTHER INTERVENTIONS

Infectious, non-infectious epididymitis

- Rest
- Analgesia
  - Hot or cold packs and/or analgesics (e.g. NSAIDs)
- Scrotal elevation

Non-infectious epididymitis

- Treat underlying cause

HYPOSPADIAS & EPISPADIAS

osmosis.org/learn/hypospadias
osmosis.org/learn/epispadias

PATHOLOGY & CAUSES

- Congenital malformations characterized by abnormal urethral opening found ventrally (hypospadias), dorsally (epispadias)
- Hypospadias more common

TYPES

Hyposadias

- *Glanular:* least severe
- *Midshaft:* moderately severe
- *Penoscrotal:* most severe

Epispadias

- *Granular:* least severe
- *Penile:* moderately severe
- *Penopubic:* most severe

CAUSES

Hyposadias

- Urethral folds along penile urethra do not close properly → abnormal opening along penile shaft's ventral surface

Epispadias

- Genital tubercle grows in posterior direction

instead of cranial direction → opening along penis' dorsal surface

RISK FACTORS

- Family history of hypospadias/epispadias
- Genetic factors causing hormonal disturbances
- ↓ androgens
- Maternal age > 35 years old
- Maternal exposure to environmental toxins (e.g., pesticides on fruits and vegetables)

COMPLICATIONS

- Constriction of abnormal opening → urinary tract obstruction
- High risk of ascending urinary tract infections
- If orifices are situated near base of penis → abnormal ejaculation and insemination → infertility
- Psychosocial problems

SIGNS & SYMPTOMS

- Depends on location of abnormal urethral opening
- Difficulty urinating/incontinence

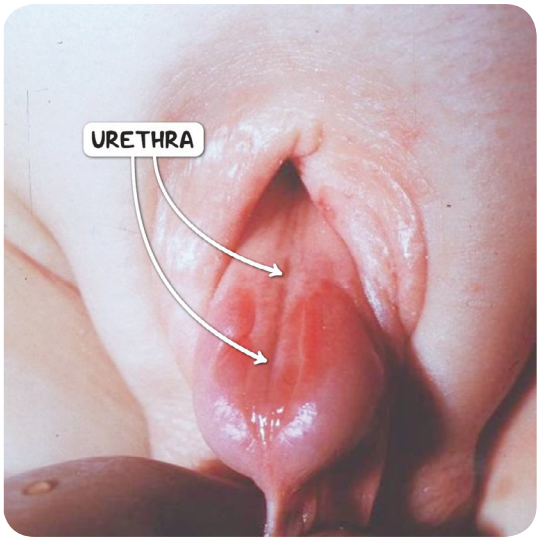

Figure 130.7 A male neonate with epispadias due to non closure of the urethral plate during development. There is also congenital malformation of the external genitalia.

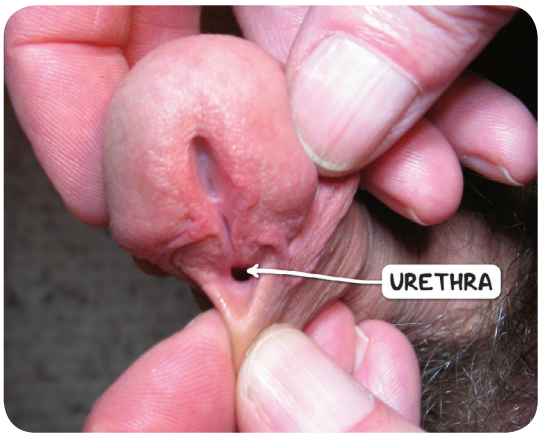

Figure 130.6 The appearance of subcoronal hypospadias.

DIAGNOSIS

DIAGNOSTIC IMAGING

Excretory urogram

- Series of X-rays used to visualize substances passing through kidneys, bladder, urethra

OTHER DIAGNOSTICS

- Clinical examination of newborn infants to reveal abnormal urethral opening

TREATMENT

MEDICATIONS

- Hormone therapy for additional problems (e.g. low androgen levels → micropenis)

SURGERY

- Reconstruction of urethra within first two years of life
- Infants with hypospadias should not undergo circumcision → foreskin may be useful for reconstruction

ERECTILE DYSFUNCTION

osms.it/erectile-dysfunction

PATHOLOGY & CAUSES

- Sexual arousal disorder characterized by inability to obtain, maintain erection during sexual intercourse
- AKA impotence

CAUSES

- Cardiovascular disease/peripheral artery disease → abnormal penile vasculature
- Drug side effects
  - Antihypertensives, selective serotonin reuptake inhibitors (SSRIs), antipsychotics, nicotine, ethanol, beta-blockers, statins
- Psychogenic
  - Performance anxiety, depression
- Neurological problems
  - Prostatectomy surgery trauma, multiple sclerosis
- Penile disorders
  - Peyronie's disease, priapism

RISK FACTORS

- ↑ age
- Hypertension
- Smoking
- Hyperlipidemia
- Diabetes
- Alcohol/drug abuse
- Hypogonadism (↓ testosterone levels)

COMPLICATIONS

- ↓ sexual activity
- Inability to satisfy sexual partner(s)
- Psychosocial problems
- Infertility

SIGNS & SYMPTOMS

- Inability to achieve erection suitable for penetration
- ↓ libido
- ↓ erection rigidity
- Inability to achieve orgasm and/or ejaculation
- Early ejaculation
- ↓ peripheral pulses
- ↓ sensation
- Small testicles
- Penile abnormalities (e.g. Peyronie's disease, hypospadias)
- Nocturnal erections present in psychogenic erectile dysfunction (ED), absent in organic ED

DIAGNOSIS

DIAGNOSTIC IMAGING

Duplex ultrasound

- Measures blood flow before and after injection of vasodilators

LAB RESULTS

Hormonal blood tests

- ↓ serum testosterone → hypogonadism
- Luteinizing hormone (LH)
  - ↑ LH along with ↓ testosterone → testicular deficit
  - ↓ LH along with ↓ testosterone → CNS deficit
  - ↓ prolactin → pituitary dysfunction

Other blood tests

- Detect risk factors for cardiovascular disease (e.g. glucose, lipids)

OTHER DIAGNOSTICS

- Nocturnal penile tumescence testing to detect nocturnal erections
- Intracavernosal injection of prostaglandin E1
  - If adequate vasculature → erection in several minutes
- Detailed medical, drug history
- Physical examination
- Psychological testing

TREATMENT

MEDICATIONS

- First line
  - Phosphodiesterase (PDE) type 5 inhibitors (e.g. sildenafil citrate)
  - 30–60 minutes before sexual intercourse
  - *Mechanism of action*: inhibitions PDE5 → ↑ cGMP levels → ↑ nitric oxide release → penile smooth muscles relax → ↑ penile blood flow → erection
- Intracavernosal injections of vasodilators agents
- Hormonal replacement (e.g. androgens) in individuals with hypogonadism

SURGERY

- Revascularization
- Implantation of prosthetic devices

PSYCHOTHERAPY

- Reduce performance anxiety

OTHER INTERVENTIONS

- External facilitating devices (e.g. vacuum/constriction devices) help obtain, maintain erection
- Treat underlying causes

ORCHITIS

osms.it/orchitis

PATHOLOGY & CAUSES

- Inflammation of testicle secondary to infection
- May occur with epididymitis (epididymo-orchitis)

CAUSES

- Most cases of isolated orchitis seen in children with viral mumps infection
- Viral causes may also include coxsackie B virus
- May also be caused by bacterial infections
  - E.g. *E. coli*

COMPLICATIONS

- Atrophy
- Infertility
- Reactive hydrocele

SIGNS & SYMPTOMS

- Unilateral/bilateral testicular tenderness, pain, scrotal swelling
- Fever
- Reactive hydrocele
- Inguinal lymphadenopathy

DIAGNOSIS

DIAGNOSTIC IMAGING

Color Doppler ultrasound

- Exclude testicular torsion

LAB RESULTS

- Serum immunofluorescence antibody testing → establish diagnosis

OTHER DIAGNOSTICS

- Suggestive clinical findings of mumps/other infections

TREATMENT

OTHER INTERVENTIONS

- Usually resolves spontaneously after 3–10 days
- Conservative measures (e.g. rest, analgesics)

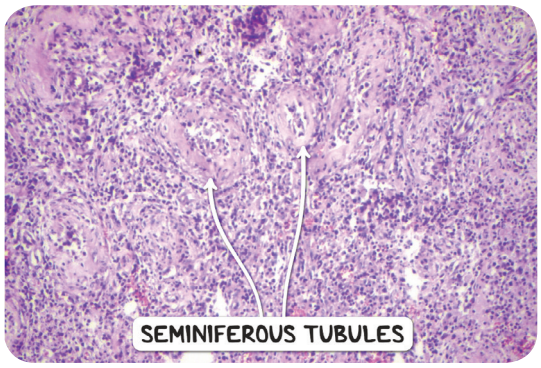

Figure 130.8 The histological appearance of the testicular parenchyma in a case of suppurative orchitis. The seminiferous tubules have been almost completely destroyed and there is a massive neutrophilic infiltrate.

PRIAPISM

osms.it/priapism

PATHOLOGY & CAUSES

- Involuntary, persistent erection unrelated to sexual stimulation, unrelieved by ejaculation
- Urologic emergency

TYPES

Low flow (ischemic)

- Decreased venous outflow; most common

High flow (nonischemic)

- Increased arterial inflow

CAUSES

- Often idiopathic/secondary

Low flow

- Hypercoagulable state (e.g. sickle cell anemia, thalassemia)
- Neurologic disease (e.g. spinal cord stenosis)
- Metastatic disease (e.g. prostate cancer, bladder cancer)
- Medications relaxing smooth muscles (e.g. prostaglandin, hydralazine)

High flow

- Penile/perineum trauma → rupture of cavernous artery rupture → fistulas between cavernosal artery, corpus cavernosum

COMPLICATIONS

- Hypoxic damage → penile necrosis
- Erectile dysfunction
- Corporeal fibrosis → loss of penile length

SIGNS & SYMPTOMS

- Persistent erection usually lasting 30 minutes to three hours

Low flow

- Usually painful
- Rigid erection
- Corporeal aspiration → dark blood

High flow
- Not painful
- May be episodic
- Trauma evidence

DIAGNOSIS

DIAGNOSTIC IMAGING

Doppler ultrasound
- Differentiate low/high flow priapism, reveal fistulas

CT scan
- Detect malignancies

LAB RESULTS
- Penile blood gas measurement
  - *Low flow*: increased pCO_2, decreased pO_2, pH less than 7.0
- Complete blood count (CBC)
  - Detect sickle cell anemia
- Selective angiography
  - Identify exact location of fistulas

TREATMENT

MEDICATIONS

Low flow
- Intracavernosal injection of sympathomimetic agent
  - Phenylephrine → pure alpha agonist effects

SURGERY

Low flow
- If other measures fail → surgical decompression

High flow
- Identification, obliteration of fistulas with selective arterial embolization

OTHER INTERVENTIONS

Low flow
- Treat underlying condition
- Corporal aspiration with/without saline irrigation

PROSTATITIS

osms.it/prostatitis

PATHOLOGY & CAUSES

- Prostate gland inflammation; usually → Gram-negative bacterial infection

TYPES

Acute bacterial prostatitis
- Usually occurs in younger individuals
- More serious condition

Chronic bacterial prostatitis
- Can be bacterial/abacterial
- Usually occurs in individuals aged 40–70 years
- Chronic bacterial is the most common form of prostatitis

Granulomatous prostatitis
- Infectious
- Bladder injections of Bacillus Calmette–Guérin (BCG) for treatment of bladder cancer (most common cause)
- Fungi in immunocompromised individuals
- Noninfectious
- Reaction to secretions from prostatic ducts and acini
- Acute granulomatous prostatitis
  - *Older adults*: Gram bacteria—E.coli (most common), *Klebsiella*, *Proteus*, *Pseudomonas*, *Enterobacter*, *Serratia*
  - Enterococci

- Staphylococci
- *Young adults*: *Chlamydia trachomatis*, *Neisseria gonorrhoeae*

- Chronic granulomatous prostatitis
  - *Infectious*: same causes as acute granulomatous prostatitis
  - *Noninfectious*: chemical irritation; secondary to previous infections, nerve problems

CAUSES

- Ascending urinary tract infection
- Spread from rectum (direct/via lymphatics)
- Hematogenous (rare)
- May follow catheterization, cystoscopy, urethral dilation, prostate resection procedures

COMPLICATIONS

- Urinary retention
- Recurrent exacerbations in chronic prostatitis are common
- Prostatic abscess; usually in immunocompromised individuals
- Urosepsis; can be fatal
- Pyelonephritis
- Infertility

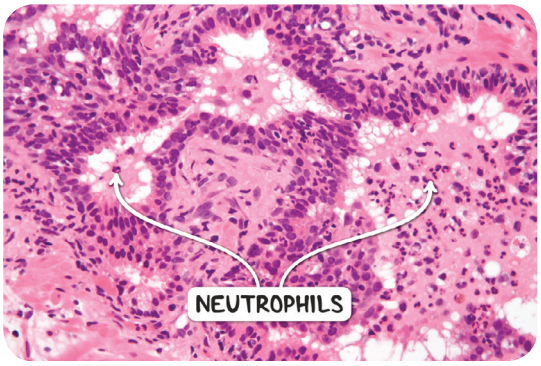

Figure 130.9 The histological appearance of acute prostatitis. There are neutrophils present within the lumina of the prostatic glands.

SIGNS & SYMPTOMS

Acute

- Fever, chills
- Malaise
- Urinary symptoms
  - Frequency, urgency, dysuria
- Perineal/low back pain
- Digital rectal exam
  - Boggy, warm, tender, enlarged prostate

Chronic

- Can be asymptomatic
- Intermittent urinary symptoms
- History of recurrent UTIs
- Perineal/low back pain; suprapubic discomfort
- Digital rectal examination
  - Enlarged, nontender prostate

DIAGNOSIS

DIAGNOSTIC IMAGING

Ultrasound/CT scan/cystoscopy

- For individuals with significant voiding dysfunction/suspected abscesses/neoplasms

LAB RESULTS

- Urinalysis
  - ↑ WBCs in acute
- Prostatic secretion
  - ↑ WBCs in acute and chronic
- Urine cultures
  - Positive in acute, chronic bacterial prostatitis
  - Negative in chronic abacterial
- Blood tests
  - CBC, blood cultures if clinical findings suggestive of bacteremia
  - Blood urea nitrogen, creatinine levels for individuals with urinary retention/obstruction
  - Serum prostate-specific antigen (PSA) may be elevated

TREATMENT

MEDICATIONS

Acute

- Antimicrobial therapy
  - IV broad-spectrum penicillin, third generation cephalosporin, aminoglycoside, quinolone
  - PO antibiotics (TMP/SMX or quinolone, doxycycline)
- Urinary retention
  - Alpha-blocking agents/suprapubic catheterization

Chronic

- Antimicrobial therapy
  - Prolonged course, usually with quinolone
- Chronic prostatitis difficult to treat because antibiotics penetrate prostate gland poorly → recurrences common

OTHER INTERVENTIONS

Acute

- Increase fluid intake
- Drain abscesses
- Prostatic massage should be avoided to prevent hematogenous spread (sepsis)

Figure 130.10 An MRI scan of the pelvis in the coronal plane demonstrating a large prostatic abscess secondary to prostatitis.

TESTICULAR TORSION

osms.it/testicular-torsion

PATHOLOGY & CAUSES

- Vascular disorder of testis characterized by rotation of testicle around spermatic cord
- Can lead to testicular infarction
- Urologic emergency
- Rotation of testicle → thick walled arteries remain patent while thin walled veins become obstructed → congestion → hemorrhagic infarction

RISK FACTORS

- Typically occurs in young adolescents; can also occur in neonates/older individuals
- Usually → testes' congenital failure to strongly attach to scrotum
- Occasionally → trauma; also → during sleep

COMPLICATIONS

- If left untreated/surgery delayed beyond six hours → testicle may not be salvageable → infertility
- Recurrent torsions
- Contralateral testicle also → torsion risk
- Infection
- Orchiectomy → cosmetic malformation → psychosocial problems

SIGNS & SYMPTOMS

- Sudden onset of acute, severe pain
- Swollen, tender, erythematous scrotum
- High riding testis
  - Moves to a higher scrotal position
- Absent cremasteric reflex
- Nontender cord

DIAGNOSIS

DIAGNOSTIC IMAGING

- Unnecessary if clinical findings are strongly suggestive; surgical detorsion should not be delayed

Color Doppler ultrasound

- Absent or decreased blood flow in affected testicle

Contrast enhanced MRI

- Torsion knot or whirlpool patterns; highly sensitive and specific

LAB RESULTS

- Can help exclude alternate diagnosis (e.g. orchiepididymitis)

TREATMENT

SURGERY

- Immediate surgical detorsion → best within six hours from onset of symptoms
- Orchiopexy of testis to scrotum → prevent recurrence
  - Orchiopexy of contralateral testis also indicated
- If testicle non-salvageable → orchiectomy

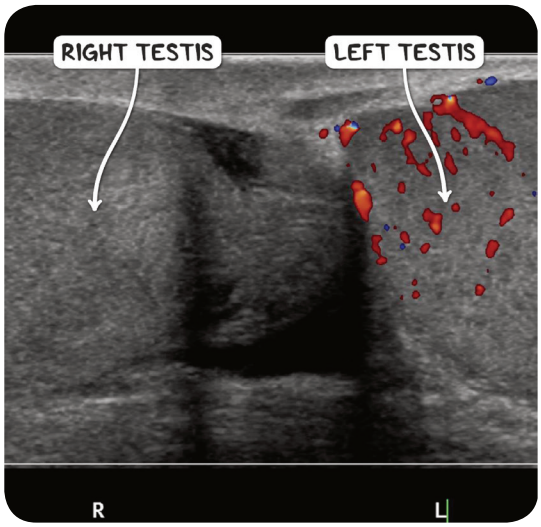

Figure 130.11 A Doppler ultrasound of the testicles demonstrating complete absence of blood flow on the right side, consistent with testicular torsion.

VARICOCELE

osms.it/varicocele

PATHOLOGY & CAUSES

- Common testicular disorder of young adults characterized by dilatation of pampiniform venous plexus, internal spermatic vein
- Most common cause of scrotal enlargement in young adults
- Impaired venous drainage → ↑ venous pressure → vein dilatation
- Usually left-sided (> 80%) due to ↑ flow resistance from left testicular vein drainage into left renal vein; right testicular vein drains directly to inferior vena cava (↓ flow resistance)

TYPES

Large

- Easily identified by inspection as distention

Moderate

- Identified by palpation as "bag of worms"

Small

- Identified only by bearing down → ↑ abdominal pressure → impeding drainage → ↑ varicocele size

CAUSES

- Idiopathic
- Retroperitoneal pathology (e.g. renal cell carcinoma) → can invade renal vein → left-sided varicocele

COMPLICATIONS

- Significant impairments in sperm production, quality due to ↑ heat, ↑ pressure, ↓ oxygen, release of toxins
  - ↓ sperm concentration
  - ↓ motility
  - Abnormal morphology of spermatozoa
- Testicular damage, atrophy, poor sperm production, quality → infertility
- Contralateral testicle can also be affected

SIGNS & SYMPTOMS

- Usually asymptomatic
- Symptomatic
  - Scrotal heaviness or scrotal pain

DIAGNOSIS

DIAGNOSTIC IMAGING

Doppler ultrasound

- Characteristic reverse blood flow

Ultrasound/ CT scan

- May be useful in right-sided varicocele → reveals retroperitoneal pathology

LAB RESULTS

- Semen analysis
  - Impairment in semen parameters (e.g. concentration, motility, morphology)

TREATMENT

SURGERY

- Indicated if varicocele associated with discomfort/pain, testicular atrophy, infertility
- Surgical ligation/embolization

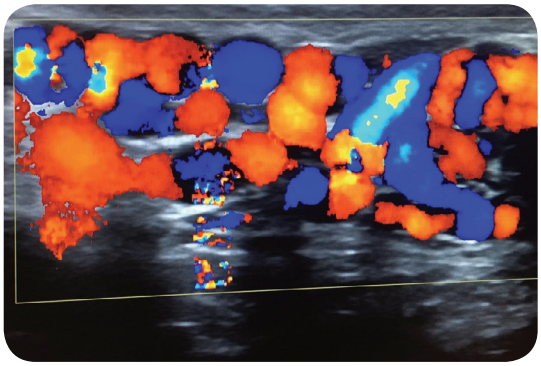

Figure 130.12 A Doppler ultrasound of the scrotum demonstrating avid flow within the spermatic cord; an appearance typical of a varicocele.

Figure 130.13 The clinical appearance of a varicocele of the right scrotum. There are dilated veins visible on the scrotal surface.