

Urinary Bladder: muscular reservoir of urine

Location: anterior part of lesser pelvis

→ immediately behind pubic symphysis

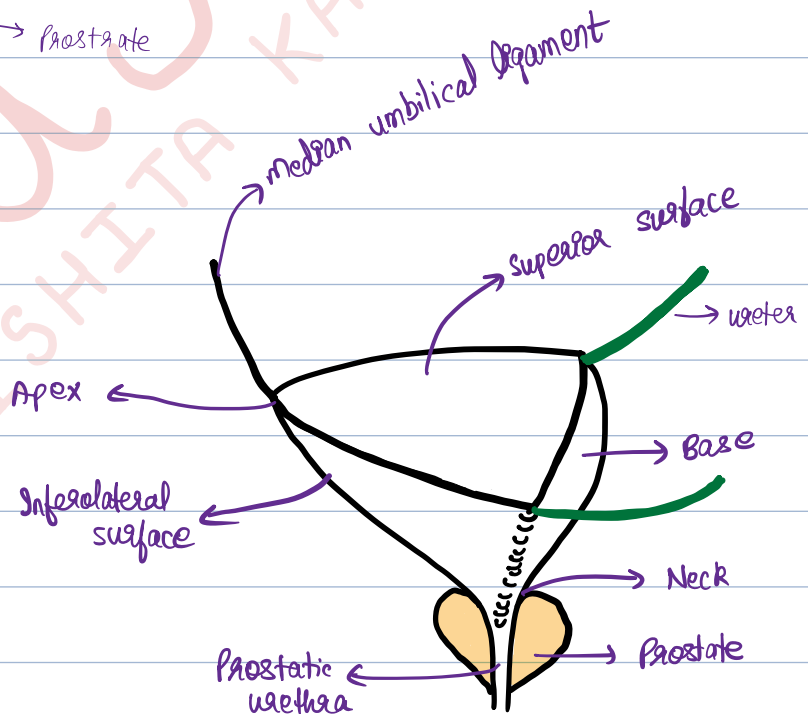
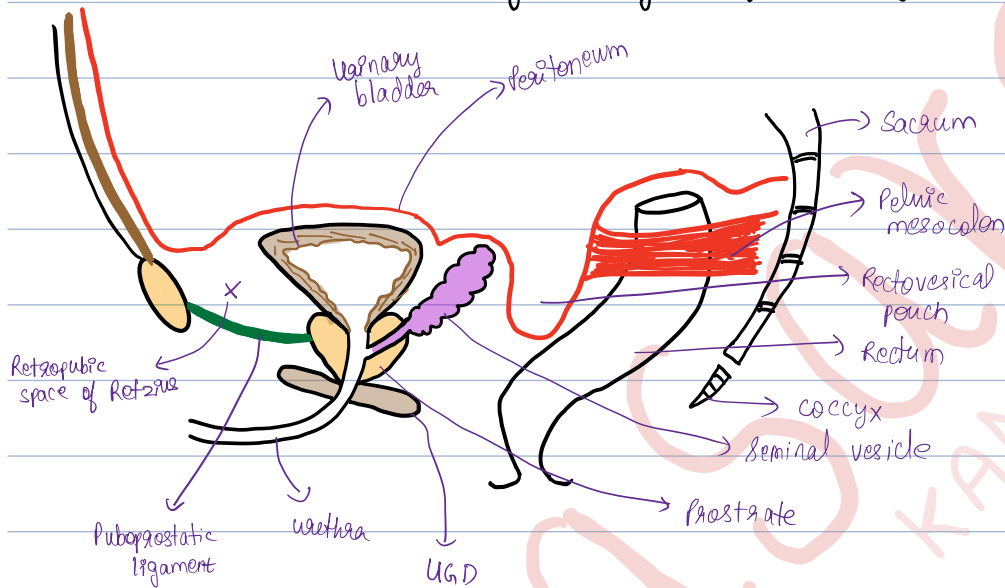
→ in front of rectum in male & uterus in female

→ When empty: entirely within lesser pelvis

When distended: expands upwards & forwards into abdominal cavity

→ In children: abdominopelvic organ

→ does not become a pelvic organ entirely until after puberty.



Size & Shape:

→ Empty: tetrahedral

Distended: ovoid

Capacity: In adult male $\Rightarrow$ 120 - 320 mL (avg = 220 mL)

- Beyond 220 mL $\Rightarrow$ desire to micturate
- 250 - 300 mL $\Rightarrow$ bladder is emptied

- up to 500 mL $\Rightarrow$ may be tolerated, but beyond this, it causes pain
- about 800 mL $\Rightarrow$ micturition is beyond one's voluntary control.

External Features & Relations:

- Apex
- Base (posterior surface)
- 3 surfaces (superior, 2 inferolateral)
- 4 borders (anterior, posterior, 2 lateral)

Apex: provides attachment to median umbilical ligament (remnant of allantois (urachus)).

Base: superolateral angles are joined by ureters
 $\hookrightarrow$ inferior angle gives rise to urethra.

Relations In male: Upper part $\Rightarrow$ separated from rectum by rectovesical pouch

Lower part $\Rightarrow$ separated from rectum by terminal parts of vasa deferentia & seminal vesicles

$\rightarrow$ Triangular area between vasa deferentia is separated from rectum by rectovesical fascia (fascia of Denonvilliers)

In female: separated from cervix of uterus by rectovesical pouch.

Neck: most fixed part of the bladder

$\hookrightarrow$ inferolateral & posterior surfaces meet.

$\rightarrow$ pierced by urethra.

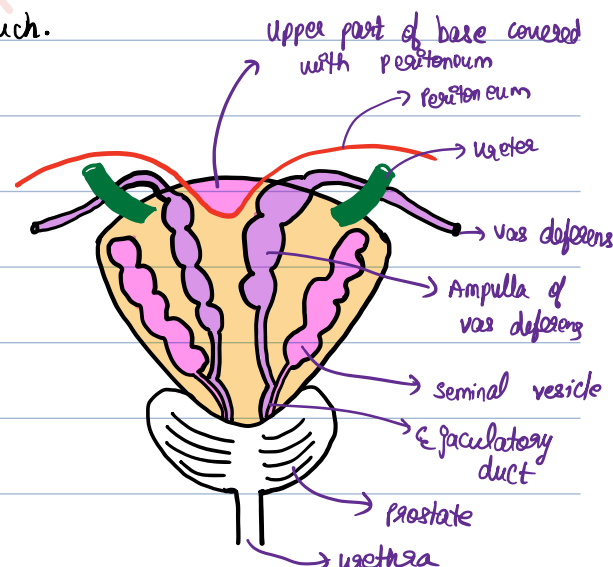
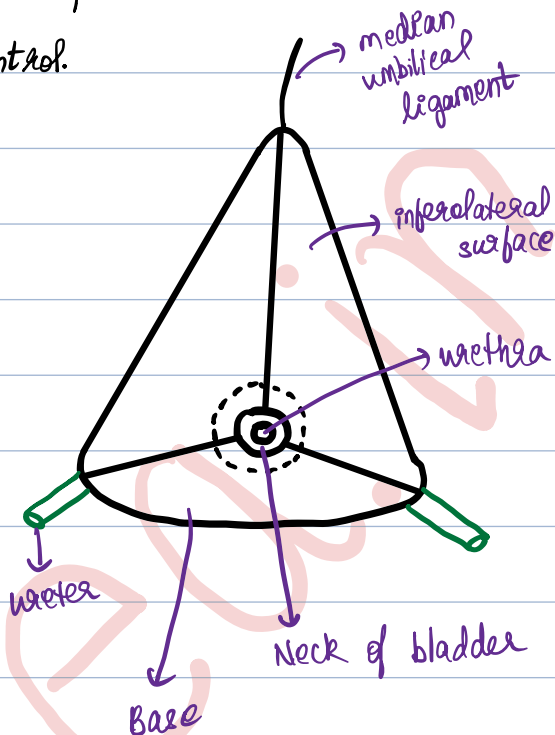
In male: rests on upper surface of prostate

In female: rests on urogenital diaphragm (UGD).

Superior Surface: bounded on each side by lateral borders

In male: completely covered by peritoneum which separates it from:

- coils of ileum
- sigmoid colon.



In female: covered by peritoneum except for a small area near posterior border which is

related to supravaginal part of uterine cavity. Here, peritoneum is reflected on uterus to form uterovesical pouch.

Inferolateral Surfaces:

→ devoid of peritoneum

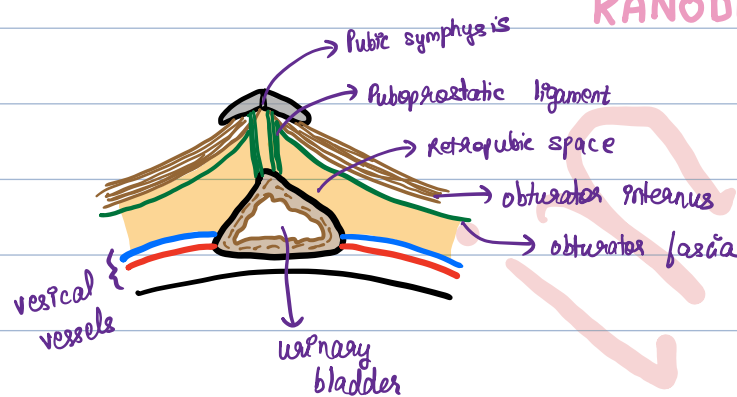
Relations: In front to: retropubic space of Retzius

: pubic symphysis

: puboprostatic ligaments

Behind to: obturator internus above

: levator ani below.



Retropubic Space of Retzius:

Bounded: anteriorly ⇒ posterior aspect of pubic symphysis, adjoining posterior wall of rectus sheath

posteriorly ⇒ inferolateral surfaces of urinary bladder

superiorly ⇒ reflection of peritoneum from superior surface of urinary bladder.

inferiorly ⇒ puboprostatic / pubovesical ligaments.

True Ligaments: condensation of pelvic fascia

Lateral ligaments: inferolateral surface of bladder to tendinous arch of pelvic fascia.

Puboprostatic ligaments: 4 (2 lateral, 2 medial)

Lateral: anterior end of tendinous arch of pelvic fascia to upper part of prostatic sheath.

Medial: pubic symphysis to prostatic sheath.

In females: called pubovesical ligaments

↳ end around neck of urinary bladder.

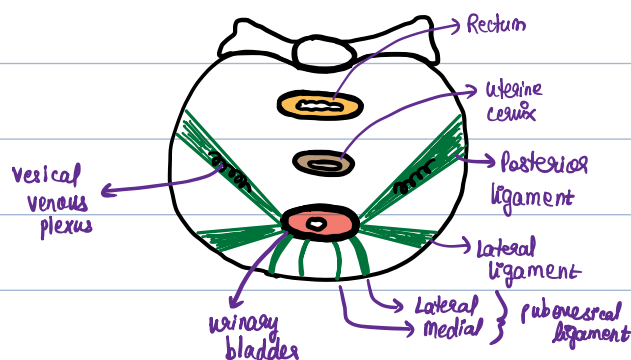
Median Umbilical Ligament: remnant of urachus (allantois)

↳ extends from apex of bladder to umbilicus

Posterior ligament: 2 (right, left)

↳ from side of base of bladder to lateral pelvic wall

→ encloses vesical venous plexus.



False Ligaments: peritoneal folds

Anteriorly: Median umbilical fold

2 medial umbilical folds

Laterally: reflection of peritoneum from bladder to side wall of pelvis forms floor of paravesical fossae

Posteriorly: Sacrogenital folds: folds of peritoneum extending from side of bladder, on either side of rectum, to 3rd sacral vertebra.

Microscopic Structure: within outward:

- (i) mucous membrane
- (ii) muscular coat
- (iii) adventitia.

Mucous membrane: pale pink ; transitional epithelium

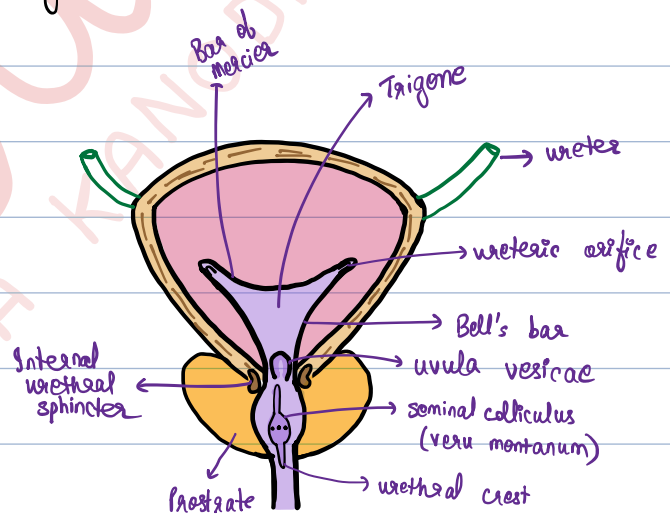
↳ rugae present when bladder is empty

→ mucosal area covering internal surface of base of bladder $\Rightarrow$ Trigone

Muscular coat: detrusor muscle which consists of 3 layers:

- (i) outer longitudinal layer
- (ii) middle circular layer
- (iii) inner longitudinal layer.

Adventitia: fibroelastic tissue



Interior of Bladder:

→ empty bladder shows irregular folds (rugae)

Trigone: mucous membrane is firmly bound to muscular coat & is thus, smooth.

→ Limits of trigone: Superiorly $\Rightarrow$ opening of ureters
inferiorly $\Rightarrow$ urethra

Anteroinferior angle: internal orifice of urethra

& posteriosuperior angles: openings of ureters

Uvula vesicae: slight elevation in mucous membrane produced by median lobe of prostate

Interureteric Ridge / Bar of Meckel: between the 2 ureteric orifices

2 uretero-urethral ridges / Bell's Bar: from ureteric to urethral orifice

Arterial Supply: • superior & inferior vesical arteries (branches of anterior division of internal iliac arteries)

- obturator & inferior gluteal arteries
- uterine & vaginal arteries in females.

Venous Drainage: do not follow arteries

↳ vesical venous plexus

→ plexus passes backward in posterior ligaments of urinary bladder to drain into internal iliac veins

→ communicates: — in male with prostatic venous plexus

— in female with veins at base of broad ligament.

Lymphatic Drainage: external iliac lymph nodes

(some into internal iliac lymph nodes).

Nerve Supply:

Parasympathetic (Nerve Erigentes): S2, S3, S4

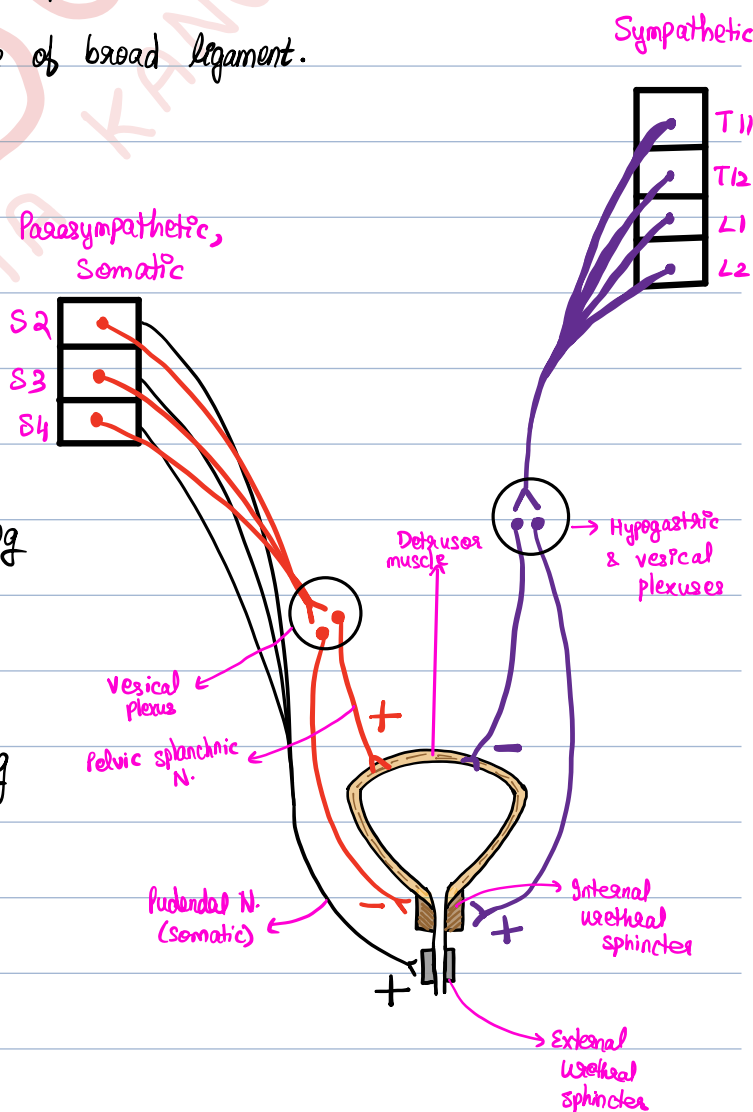
- ↳ motor to detrusor muscle
 - inhibitory to sphincter vesicae
- } emptying

Sympathetic fibres: T11, T12, L1, L2

- ↳ inhibitory to detrusor muscle
 - motor to sphincter vesicae
- } filling

Somatic fibres (Pudendal N.): S2, S3, S4

- ↳ motor to external urethral sphincter.



Sensory: pelvic splanchnic nerves / Nervi erigentes (S2, S3, S4)

→ Two kinds of fibres are recognised:

- fibres concerned with pain $\Rightarrow$ anterolateral white columns of spinal cord
- fibres concerned with conscious awareness of filling of bladder $\Rightarrow$ posterior columns
- $\therefore$ awareness of bladder being filled & desire to micturate remain normal after bilateral anterolateral cordotomy to relieve pain.

Mechanism of Micturition:

- initially when urine falls in bladder $\Rightarrow$ no rise of intravesical pressure due to accommodation potential of bladder.
- $> 220 \text{ mL}$ $\Rightarrow$ stretch receptors are stimulated & desire to micturate
- if this is denied $\Rightarrow$ reflex contractions of detrusor muscle starts & the contractions become more powerful as the amount of urine increases $\Rightarrow$ gives feeling of fullness of bladder & pain
- stretch receptors are again stimulated



spinal micturition centre (S2, S3, S4)



parasympathetic fibres



- contraction of detrusor
 - relaxation of internal & external urethral sphincters.
- signals from paracentral lobule of cerebral cortex (cortical micturition centre) control spinal centre of micturition.

Applied Aspect:

Trabeculated Bladder: due to chronic obstruction of outflow of urine by enlarged prostate or stricture of urethra.

↳ bladder musculature hypertrophies

→ open wave appearance of bladder.

Suprapubic Cystostomy: extra-peritoneal approach to open the cavity of urinary bladder

↳ for draining purposes.

→ when bladder is distended, anterior aspect of bladder comes in direct contact with AAW

∴ bladder can be approached through AAW without entering peritoneal cavity.

Neurogenic Bladder: defect in neural mechanism

Automatic Reflex Bladder: complete transection of cord above S2-S4 involving pyramidal tracts (UMNs)

→ Clinical presentation: - voluntary inhibition & initiation of micturition are lost

- bladder empties reflexly every 1-4 h.

Autonomous Bladder: destruction of S2-S4 segments of spinal cord

→ Clinical presentation: - reflex & nervous control of micturition are lost

- bladder wall becomes flaccid

- continuous dribbling of urine

Development of Urinary Bladder:

→ whole bladder (except apex) ⇒ develops from upper part of urogenital sinus (vesico-urethral canal)

→ Apex of bladder ⇒ from proximal part of allantoic diverticulum.

→ Mucous membrane of trigonum vesicae ⇒ mesoderm of incorporated lower end of mesonephalic ducts

→ Mucous membrane in rest of bladder ⇒ endoderm of vesicourethral part of cloaca

→ muscle & serous coat ⇒ splanchnic layer of lateral plate mesoderm.

Congenital Developmental Anomalies of Urachus: defective obliteration of urachus

Urachal fistula: urachus remains patent

↳ discharge of urine through umbilicus

Urachal cyst: intermediate part of urachus fails to obliterate

Urachal sinus: distal part of urachus fails to fibrose.

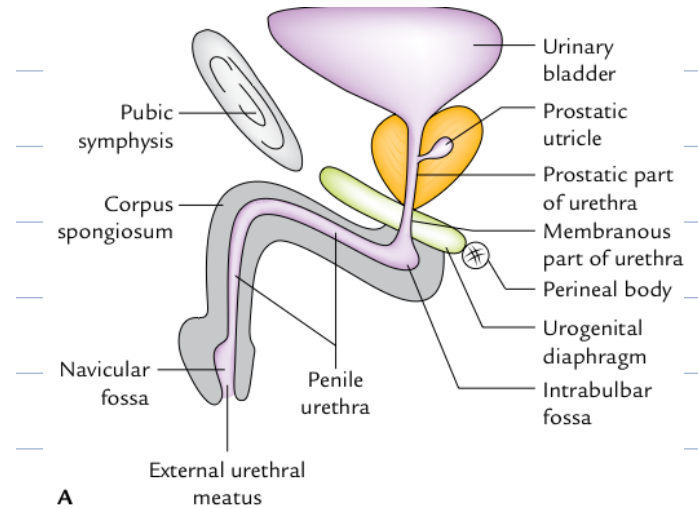
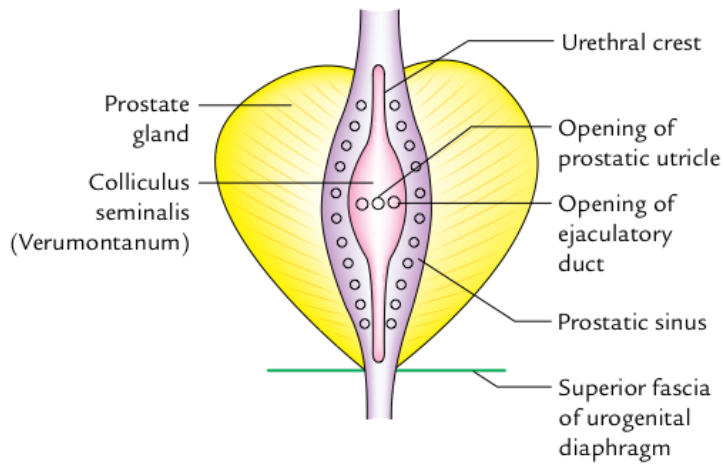
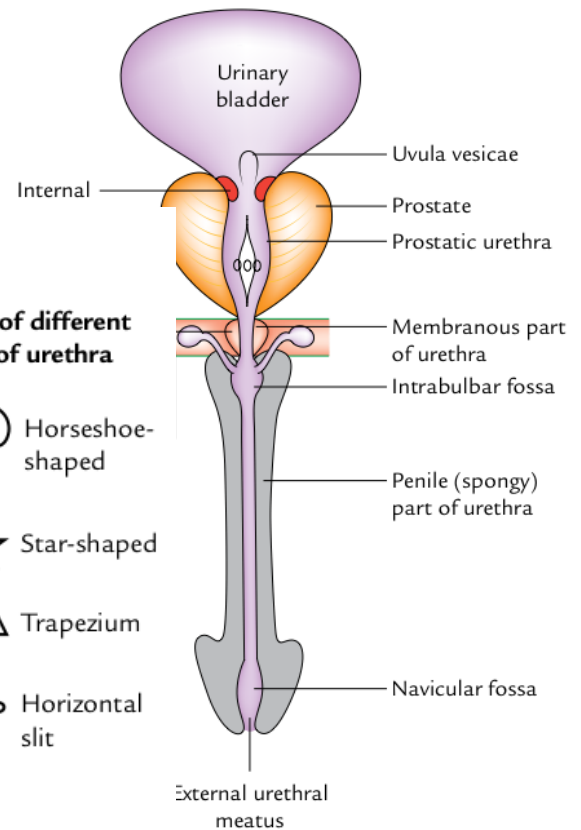
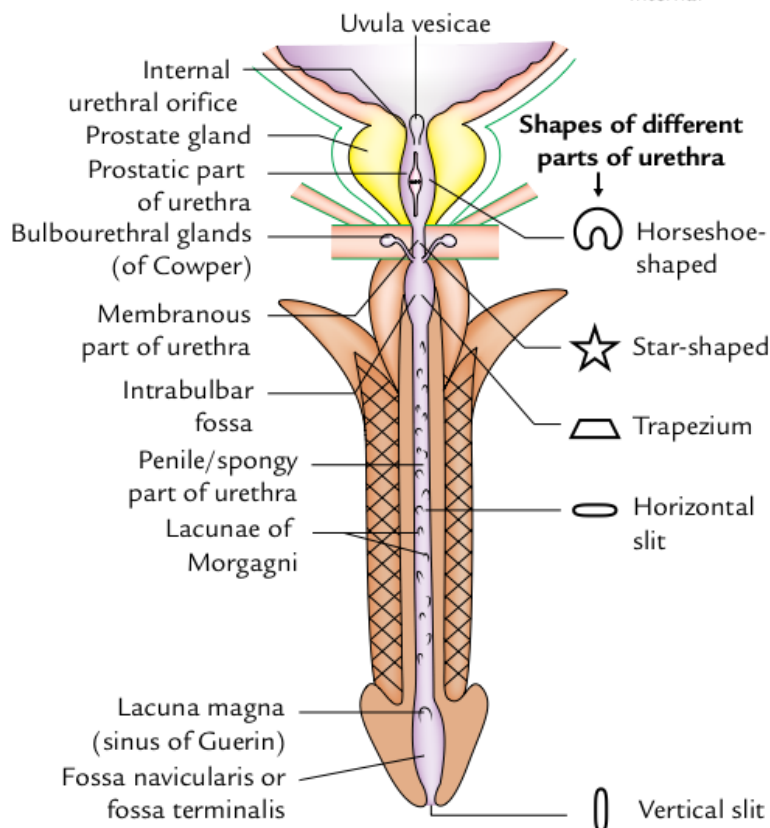
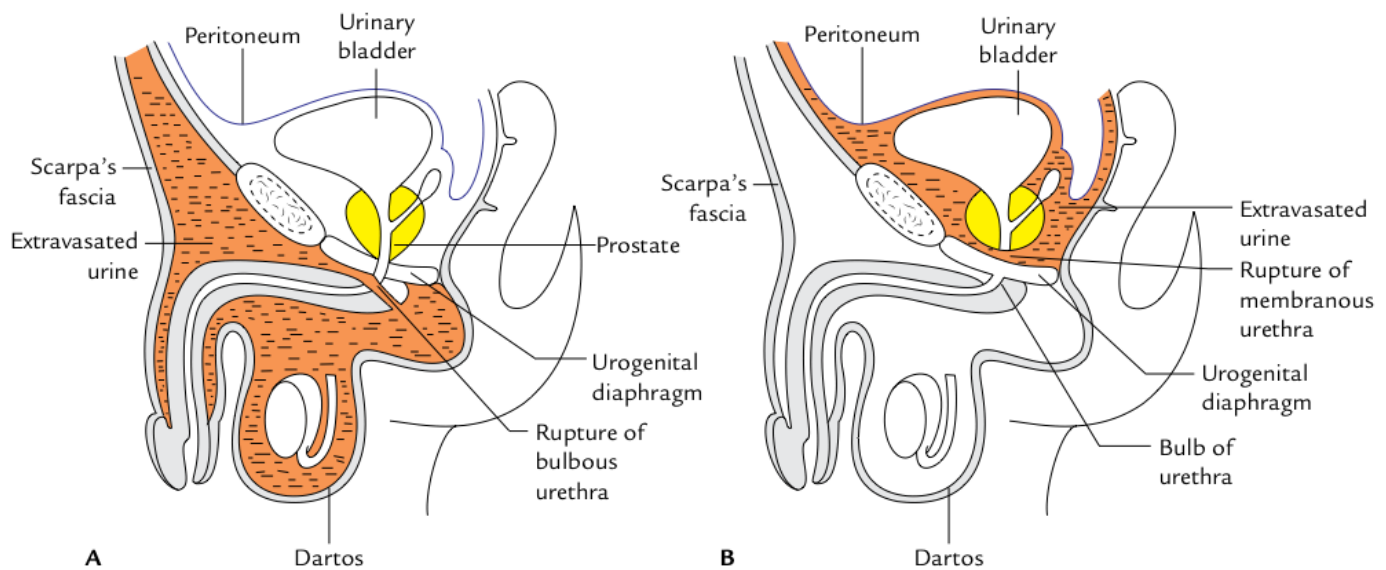


Fig. 16.12 Features of the posterior wall of the prostatic urethra.



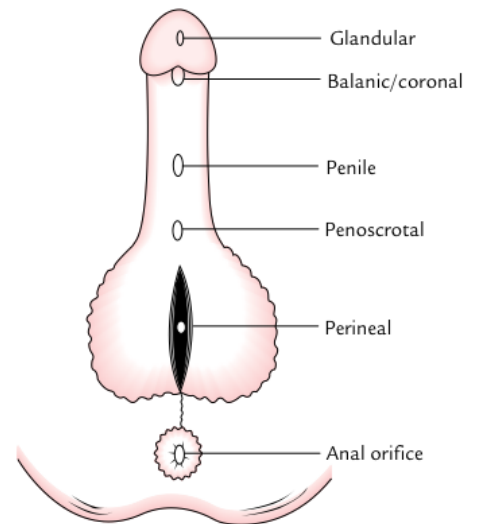
urethra: A, left view in the sagittal section
urethra straightened and cut open).

- **Rupture of the urethra:** The rupture of the urethra leads to extravasation of urine. The commonest site of rupture is bulb of the penis, just below the urogenital diaphragm following a fall astride a sharp object. The urethra is crushed against the edge of the pubic bones. The urine extravasates into the superficial perineal pouch and passes forward over the scrotum, penis, and anterior part of the anterior abdominal wall deep to membranous layer of the superficial fascia (**superficial extravasation**; Fig. 16.14A). If the urethra ruptures above urogenital diaphragm urine escapes above the deep perineal pouch and may pass upward around the prostate and bladder in the extraperitoneal space (**deep extravasation**; Fig. 16.14B).
- **Catheterization of the male urethra:** It is done in the patients who are unable to pass urine and their bladders are distended due to retention of urine leading to severe discomfort and pain in the hypogastric region. While passing the catheter one should remember the normal curvatures of the urethra. Further one should know that immediately above the external urethral meatus the urethra presents a large mucosal recess guarded by a mucosal fold, which may catch the tip of catheter. The catheter/iron bougie should therefore always be introduced into the urethra with its beak turned downward. Otherwise the forceful insertion of catheter may create a false passage in urethra or rupture it.



• **Hypospadias:** It is a congenital anomaly in which external urethral orifice is located on the inferior/ventral aspect of penis instead at the tip of the glans penis. It occurs due to failure of the fusion of urethral folds. Depending upon the location of external urethral orifice (EUO), the hypospadias are classified into 5 types (Fig. 16.15):

1. *Glandular:* If external urethral orifice opens on the under surface of the glans.
2. *Balanic:* If urethral orifice opens at the base of glans penis.
3. *Penile:* If urethral orifice opens on ventral aspect of the body of penis.
4. *Penioscrotal:* If urethral orifice opens at the junction of penis and scrotum.
5. *Perineal:* If urethral orifice opens as sagittal slit on ventral aspect of scrotum.



Shape of the Female Urethra

In cross section, the shape of female urethra differs in different parts:

1. *In the upper part, it is crescentic with convexity directed forward.*
2. *In the middle part, it is star-shaped (stellate-shaped).*
3. *In the lower part, it is a transverse slit.*
4. *At the external urethral orifice, it is a sagittal slit.*

[SOURCE: VISHRAM SINGH ANATOMY]