



NEET SS



UROLOGY



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SURGICAL ANATOMY : BONY PELVIS, PELVIC FLOOR & PELVIC ORGANS

Importance of pelvis and pelvic floor anatomy :

- Symptoms of lower urinary tract pathology and gynaecological conditions are often overlapping and confusing.
- Coexistent urinary issues in female patients with vaginitis and recurrent urinary tract infections.
- Coexistent pelvic organ prolapse contributing to female urinary issues and voiding dysfunction.
- Pelvic floor dysfunction can be a cause as well as result of a pelvic organ condition and can lead to secondary sexual issues :
- Endometriosis of urinary bladder, untreated pelvic inflammatory disease can cause lower urinary tract symptoms (LUTS).
- Bladder pain syndrome/interstitial cystitis can cause pelvic floor spasms leading to painful intercourse (dyspareunia and secondary vaginismus).
- Fecal and urinary incontinence often coexist and may have underlying neurogenic causes and may cause failure of surgery if not evaluated correctly.

Bony pelvis

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Structure :

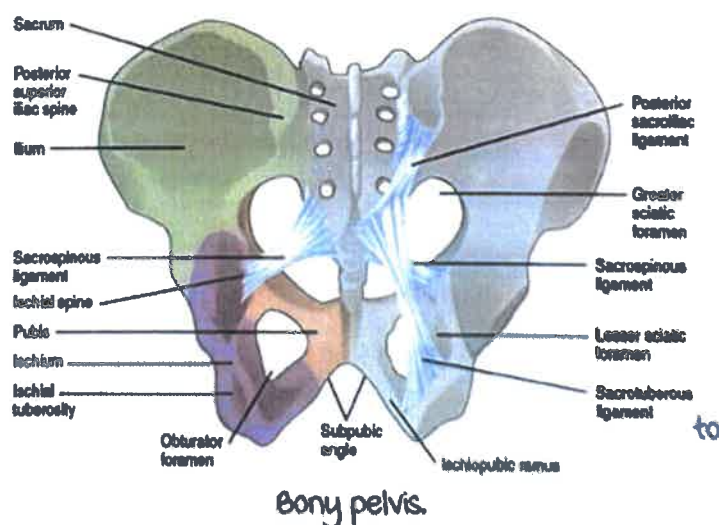
a hip bones :

- Ilium.
- Ischium
- Pubis.

1 sacrum.

1 coccyx

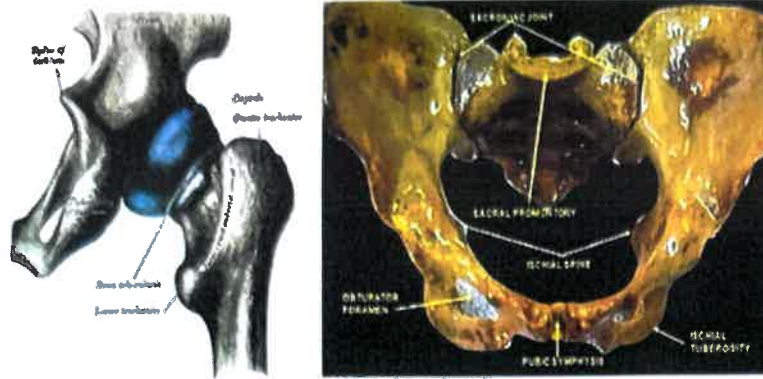
4 bones held at 4 joints
maintain balance and
stability.



Joints :

- 2 Sacroiliac joints.
- 1 Pubic symphysis.
- 1 Sacrococcygeal joint.

Surgical landmarks ischial spine & ischial tuberosity :



Ischial spine and ischial tuberosity.

Ischial spine : Gives rise to sacrospinous ligament.

Ischial tuberosity : Gives rise to sacrotuberous ligament.

Surgical importance : mark the boundaries of greater and lesser sciatic foramen.

Interspinous & intertuberos diameter : Dimensions of pelvic outlet.



2 : Interspinous diameter.

3 : Intertuberos diameter.

Feasibility of Non Descent vaginal Hysterectomy (NDVH) :

- Can be assessed by interspinous and intertuberos space.
- Availability of vaginal space.



Availability of vaginal space.

Sciatic foramina :

Exit gate of true pelvis.

Greater sciatic foramen :

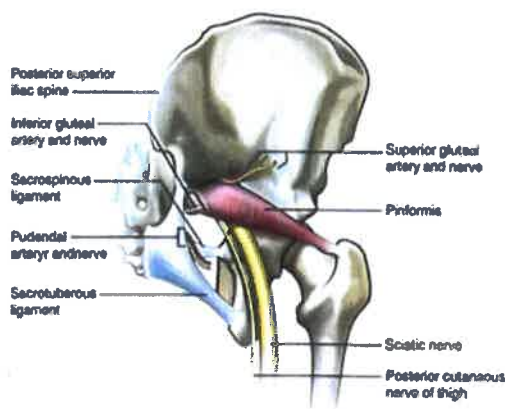
Piriformis muscle : From transverse process and spine and attaches to greater trochanter of femur.

Structures passing above piriformis : Superior gluteal nerves and vessels.

Structures passing below piriformis :

- Inferior gluteal nerves and vessels.
- Sciatic nerve.
- Pudendal nerve and internal pudendal vessels : Exit from greater sciatic foramen, hook around ischial spine and re-enters lesser sciatic foramen.
- Nerve to obturator internus : Exit from greater sciatic foramen and re-enters lesser sciatic foramen.
- Nerve to quadratus femoris.
- Posterior cutaneous nerve of thigh.

Structures passing through greater and lesser sciatic foramina



Lesser sciatic foramen :

- Pudendal nerve and internal pudendal vessels.
- Nerve to obturator internus.

Surgical importance : During sacrospinous fixation for vault prolapse, stitches are avoided in the neurovascular bundle within sacrospinous ligament.

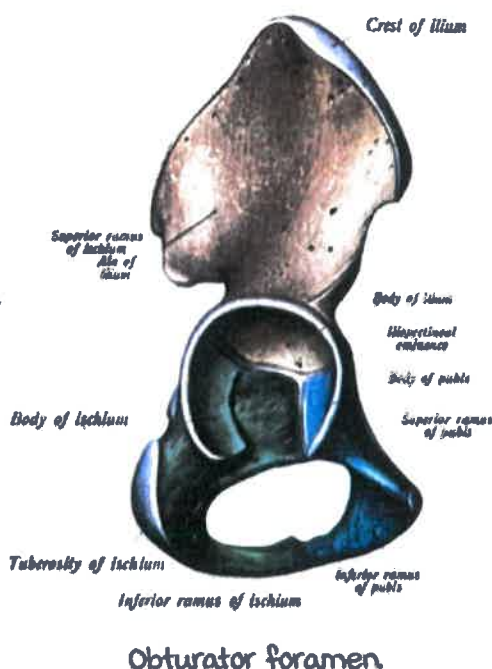
Obturator foramen :

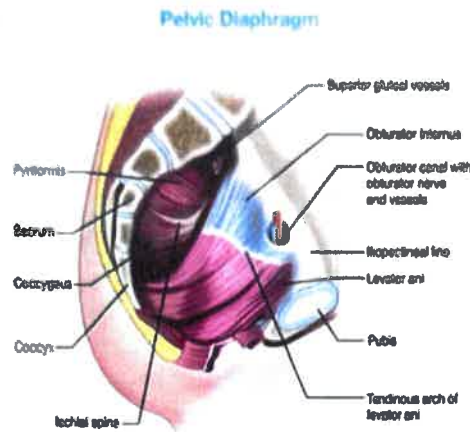
Bounded by superior and inferior pubic rami, ischiopubic ramus.

Covered by obturator membrane, obturator externus and obturator internus.

Surgical importance :

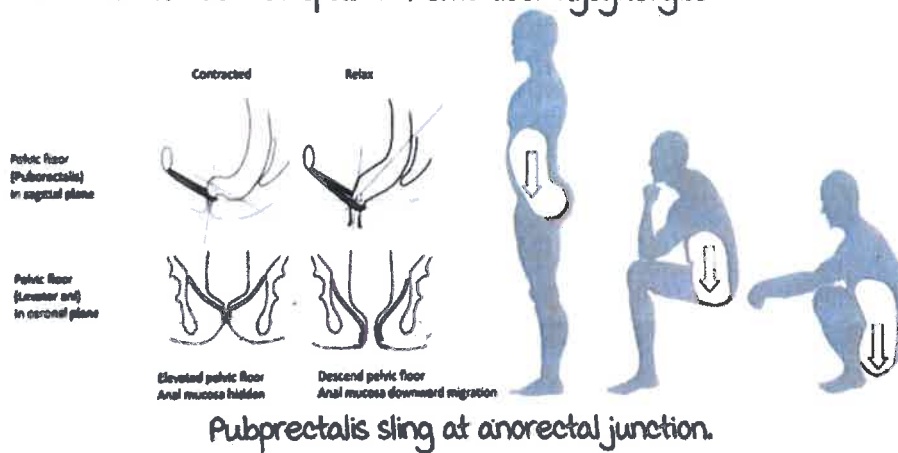
In midurethral sling surgeries, obturator membrane is perforated.



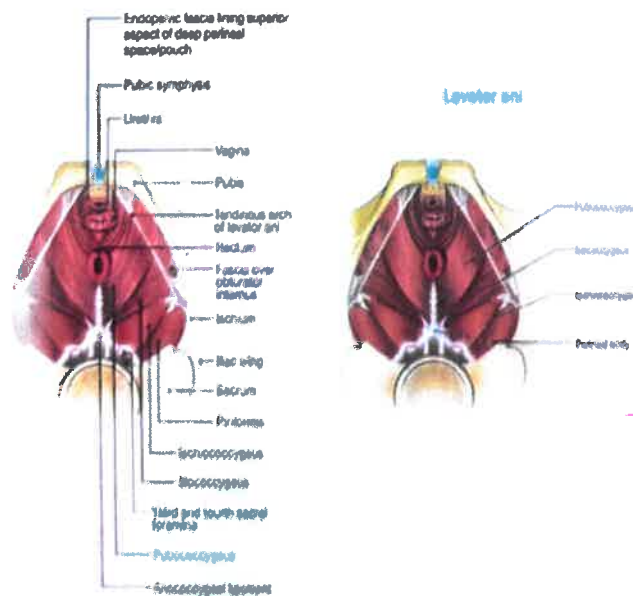


Puborectalis :

- Lowest part of levator ani muscle.
- Puborectalis sling at anorectal junction.
- maintains anorectal angle for continence.
- Puborectalis relaxes during defaecation to straighten the anorectal angle.
- Puborectalis/levator ani spasm : Pelvic floor dysynergia.



Levator ani - Perineal view :



Levator ani : Perineal view.

delancey level I :

Pericervical ring.

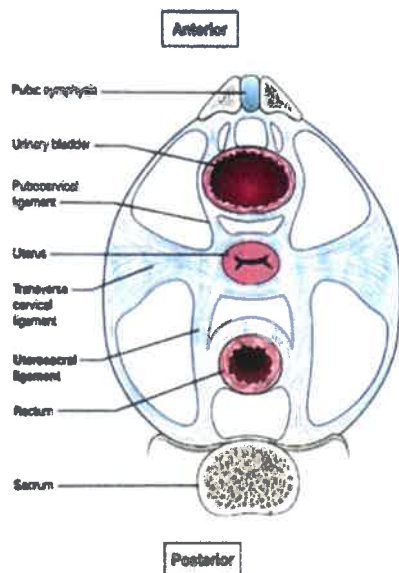
Ligaments joining uterus and cervix to lateral pelvic wall.

- uterosacral ligament.
- Cardinal ligament.
- Pubocervical ligament.

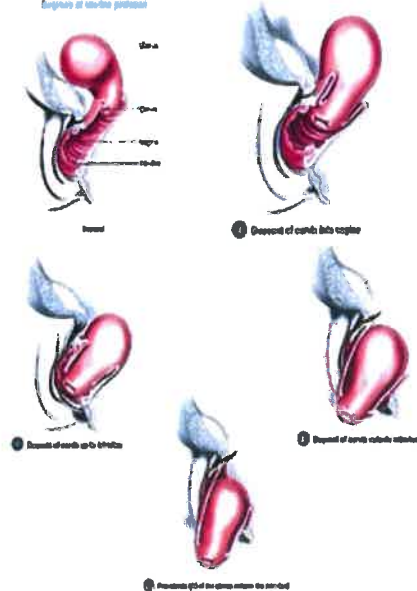
Defect in level I : uterine prolapse.

Point of reference : Ischial spine, externally hymen.

Ligaments of the uterus



Expulsion of uterine prolapse

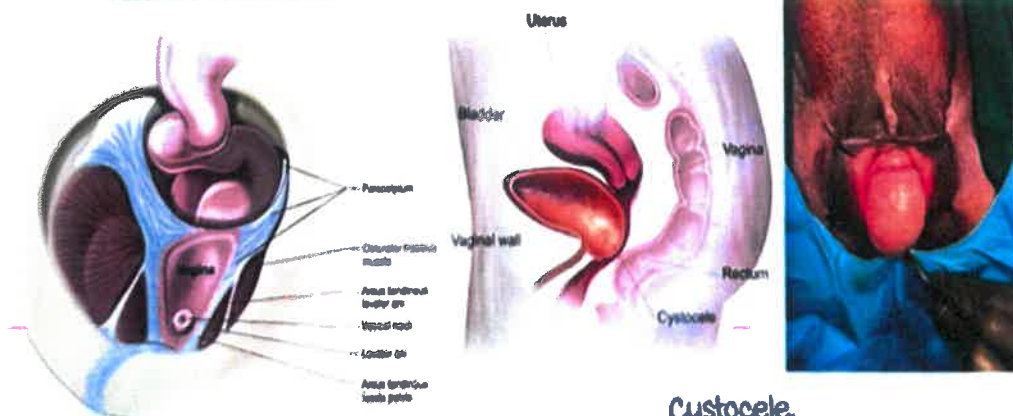


delancey level II :

Pubovesicocervical fascia.

Lateral defect : Cystocele.

Pubovesicocervical fascia



Cystocele.

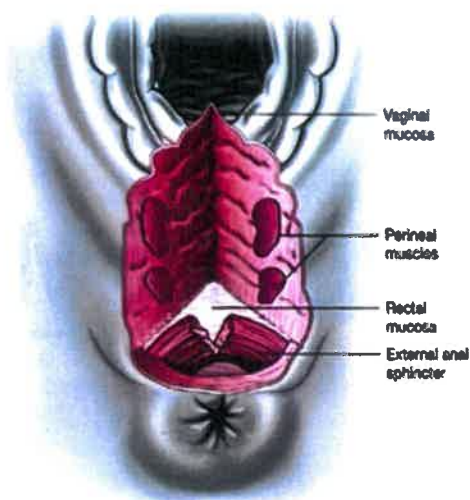
Sometimes level I and level II defects both are present.

Clinical implications of level III support :

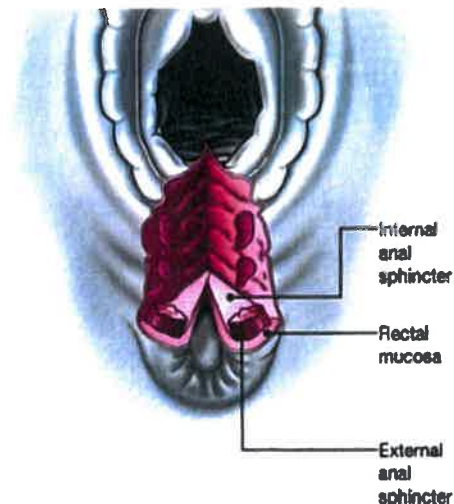
Episiotomy :

- Iatrogenic damage to level III.
- Poorly stitched episiotomy, ignored perineal tear can lead to vaginal loosening, sexual dysfunction, faecal/flatus incontinence.

Perineal body tear during childbirth: Immediate repair.



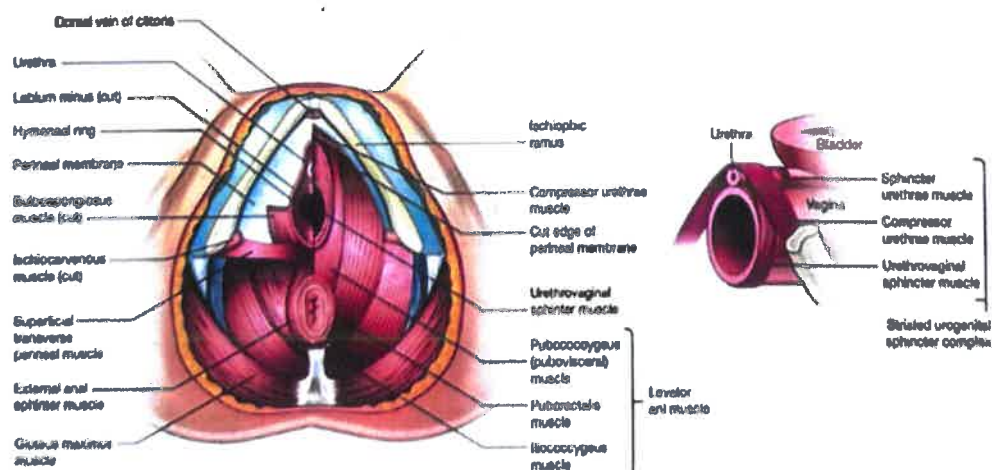
Grade 3 perineal tear.



Grade 4 perineal tear.

Bladder, urethra, vagina and urethra-vesical junction :

Superficial space of the urogenital triangle and anal triangle



Female urethra :

- 4 cm long, 6 mm in diameter.
- Extends from neck of bladder to external urethral meatus.
- External orifice is situated in front of the vaginal opening, about 2.5 cm behind the glans clitoridis.

C : Cervical descent (Anterior lip of cervix).

-7 : No prolapse.

0 : Cervix at hymen (Grade 2 prolapse).

+7 : Complete procidentia.

Inferior row reflects posterior vaginal wall :

Ap : Point 3 cm away from posterior fourchette on posterior vaginal wall
(Anorectal junction).

-3 to 0 to +3.

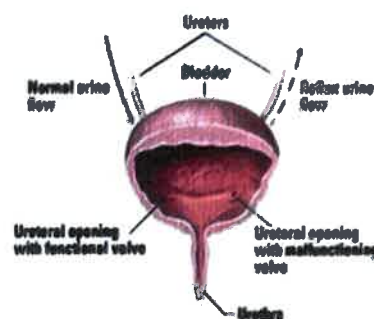
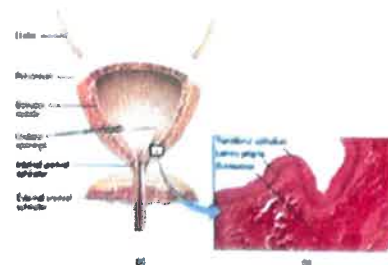
Bp : Maximum dependent position of posterior vaginal wall.

D : Posterior fornix.

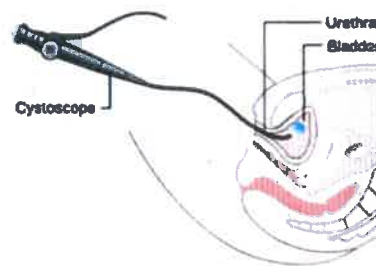
-7/-8 to +8.

Oblique entry of ureter in bladder :

- Externally, Ureteric entry is 5 cm away from another ureteric opening at the bladder.
- Internally, two ureteric orifices are 2.5 cm away at the lateral angle of the trigone.
- Creates an efficient physiological valve while there is no anatomical sphincter to prevent VUR (vesico ureteric reflux).
- Bladder filling closes the ureteric opening due to high pressure inside.
- Flow results from gravity, peristalsis & hydrostatic pressure.
- Failure of this physiological sphincter leads to VUR in a chronically High-pressure bladder in cases of neurogenic bladder.
- marked by progressive increase in Pdet during the filling phase.



Oblique entry of ureter in bladder



Cystoscopy

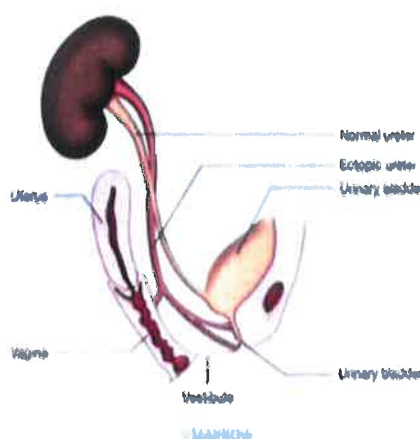
Note :

Looking at ureteric openings during cystoscopy is of utmost importance because many times in cases of recurrent UTI, you will find findings which are of clinical significance in cystoscopy. Occasionally in IVU, in CT urogram you may pick up ectopic ureters at different locations.

Ectopic ureter



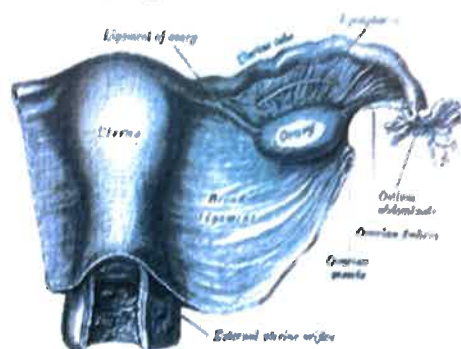
Ectopic ureter



Preventing ureteric injury during urogynaec surgery :

During prolapse surgery/NDVH Surgery :

- Always open the anterior pouch.
- Push bladder completely upwards.
- Stay medial & close to the uterus as much as possible.
- Identify ureters while doing high utero-sacral ligation for vault prolapse



3 Areas of constrictions-renal calculi & renal colic :

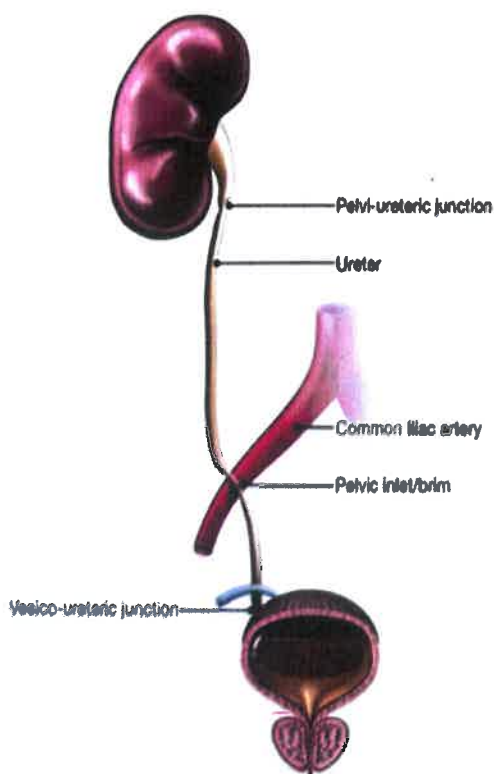
It shows three constriction along its course :

- Between ureter and pelvis.
- At crossing the external iliac artery.
- At entrance to urinary bladder.

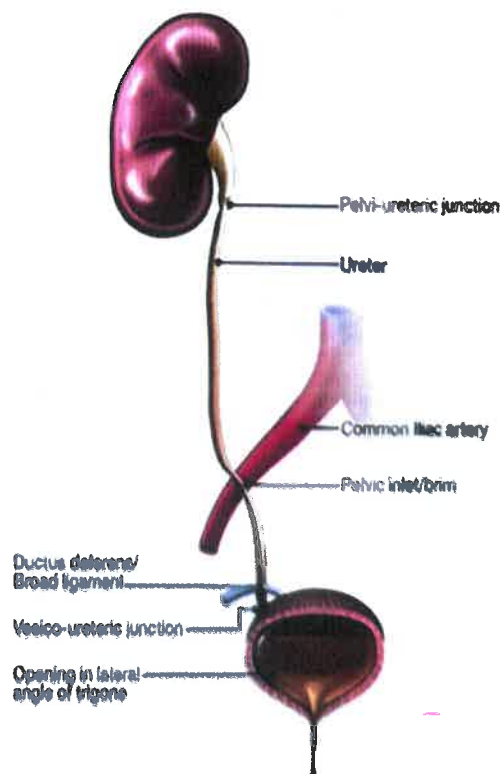
They are the sites of obstruction by renal calculi.

Constrictions of ureter

Anatomical constrictions - 3

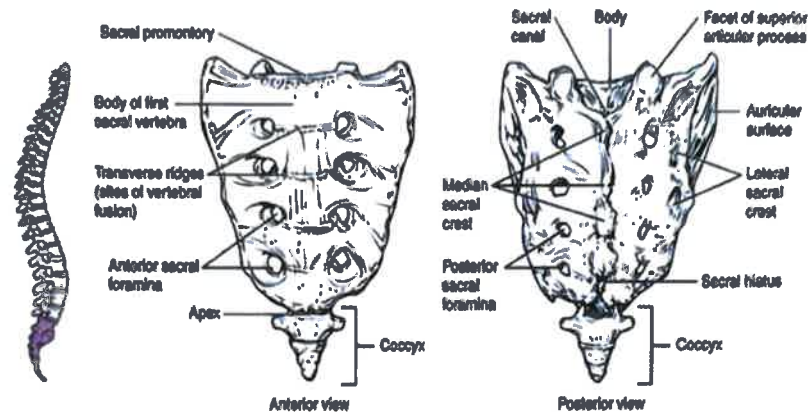


Surgical constrictions - 5



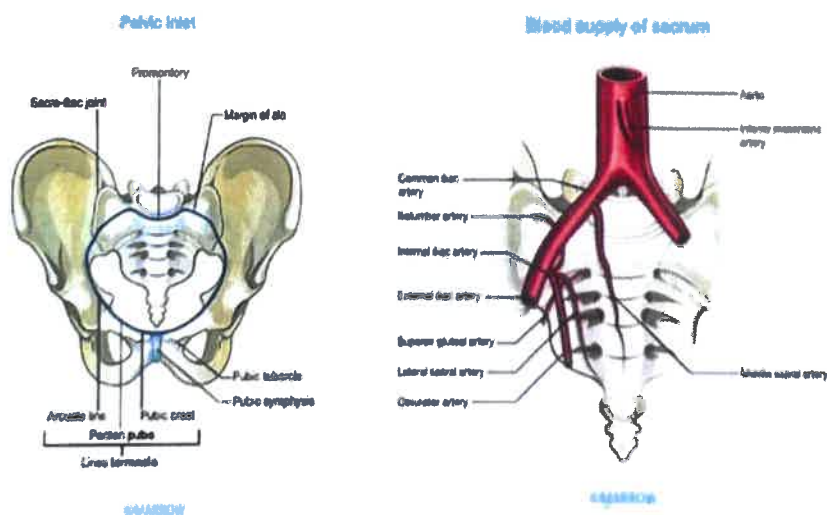
Gynec:

- Abdominal ureter becomes the pelvic ureter at this level.
- The common iliac artery bifurcates at this level.
- Psoas major muscle enters the pelvis from this area.
- Easily palpable as a surgical landmark.



Anteriorly, the lines of vertebral fusion can be seen as four transverse ridges. Posteriorly, the spinous processes are fused to form the median sacral crest.

Laparoscopic Sacrocolpopexy:



- median sacral vessels are the terminal branches of the aorta.
- while introducing a mesh towards the sacrum at the longitudinal ligament for sacral colpopexy, these vessels are addressed for injury and can bleed profusely.
- The defects in prolapse can't be corrected vaginally.
- These defects eventually need a central hinge, which can be hooked to a centralized ligament.

The significance lies in those surgeries which need extensive dissection like :
endometriosis or radical hysterectomy.

Pelvic lymph node dissection may also disrupt these chains.

Common symptom : Post operative voiding dysfunction.

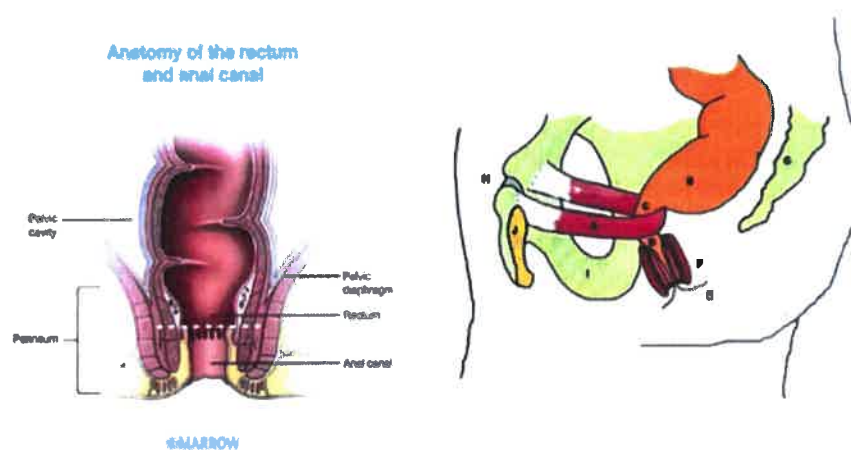
Extensive dissection disrupts balance of sympathetic & parasympathetic chain.

These patients may need extensive bladder training.

Rectum

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Rectum, anal canal, ischiorectal fossa :



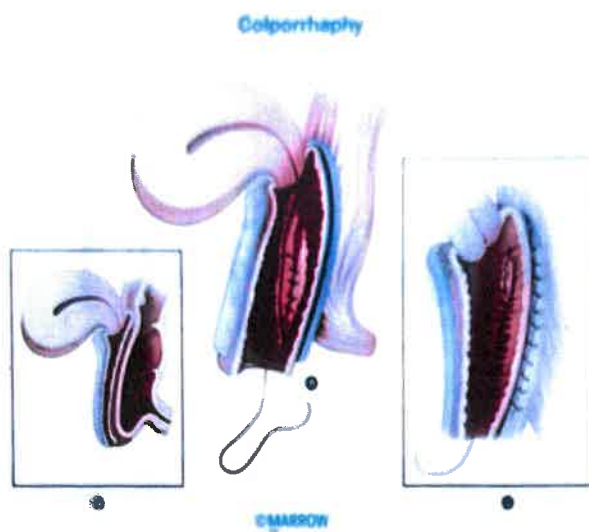
The basics :

- upper two-thirds will be rectum & the lower one third will be the anal canal
- These two segments are separated by a white line.
- This is the area where the puborectalis muscle forms a sling.

Puborectalis muscle :

- Puborectalis is a small part of the levator ani muscle.
- Goes in a U-shaped manner across the rectum and the anal canal.
- maintains the recto-anal angle so that there is maintenance of continence.
- while a person squats it straightens the angle.
- when a person standing it becomes more acute.
- Incomplete defecation disorder happens due to puborectalis spasm.
- This co-existent spasm can also cause vaginismus.

Posterior repair for rectocele :



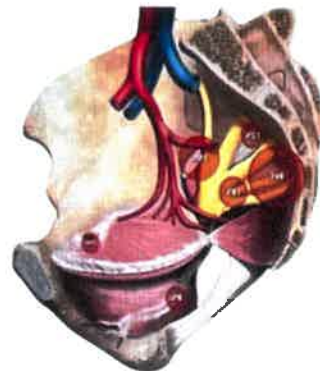
Alcock's canal & Ischiorectal fossa :

Components : Pudendal artery, vein, & nerve (Pudendal neurovascular bundle).

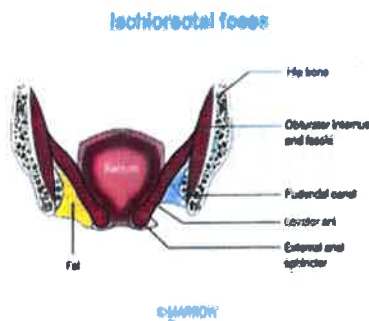
Course : Traverses through Alcock's canal over Obturator internus.

Branches :

- Inferior rectal nerve that provides innervation for the external anal sphincter and the perianal skin.
- The Perineal nerve and the Dorsal nerve of the penis/clitoris.

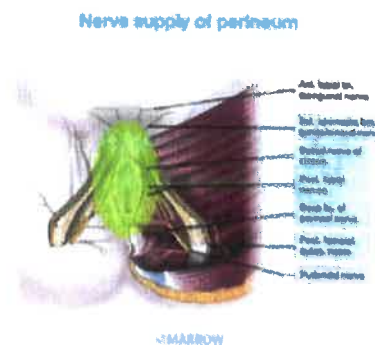
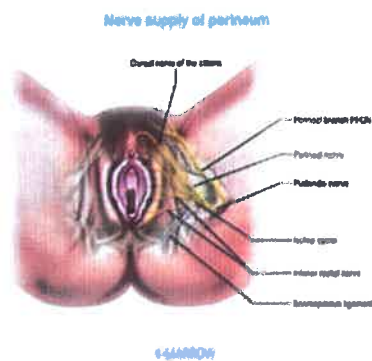


Alcock's canal &
ischioanal fossa



Pudendal nerve supply :

- Sensory supply to the external genitalia and the skin around the anus, anal canal, and perineum.
- motor supply for various pelvic muscles, the external urethral sphincter, and the external anal sphincter.



Pudendal nerve syndrome :

4 types of PNE based on their anatomy.

- Type I : Nerve entrapment around the greater sciatic notch.
- Type II : Between the sacrospinous and sacrotuberous ligaments.
- Type III : In the Alcock canal.
- Type IV : The entrapment of its terminal branches.

Pudendal nerve block :

- Local anesthetic is injected into the pudendal nerve causing the blockage of its neural transmission.
- Usually performed in order to provide perineal anesthesia during obstetric procedures.



Pudendal nerve block

Obturator nerve

00:12:29

Features :

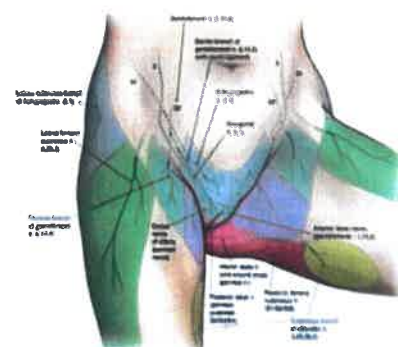
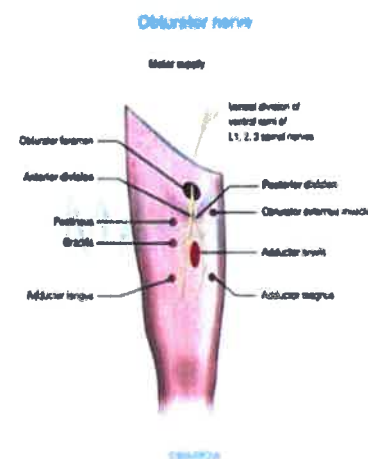
One of the largest branches of the lumbar plexus.

Type : mixed nerve.

Origin : Arises from the anterior rami of the spinal nerves L2, L3, L4—joins near Iliac crest.

Course :

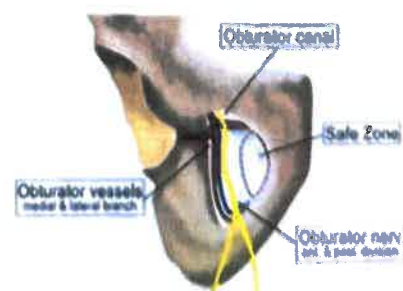
- Descends through the Psoas major muscle.
- On to lateral pelvic wall, posterior to common iliac artery.
- Enters obturator canal to exit pelvis.
- Enters medial compartment of thigh.
- The anterior branch of the obturator nerve passes deep to the adductor longus and over the surface of the adductor brevis muscle.
- The posterior branch of the obturator nerve pierces the obturator externus and then passes over the adductor magnus.
- Sensory supply is on medial side of thigh.



Obturator nerve supply

Obturator nerve injury :

- Causes : Surgery, haemorrhage, tumour compression, and sports-related trauma. Radical hysterectomy, CA cervix, Endometriosis surgery, Pelvic lymph node dissection, TDT surgery.



Obturator canal

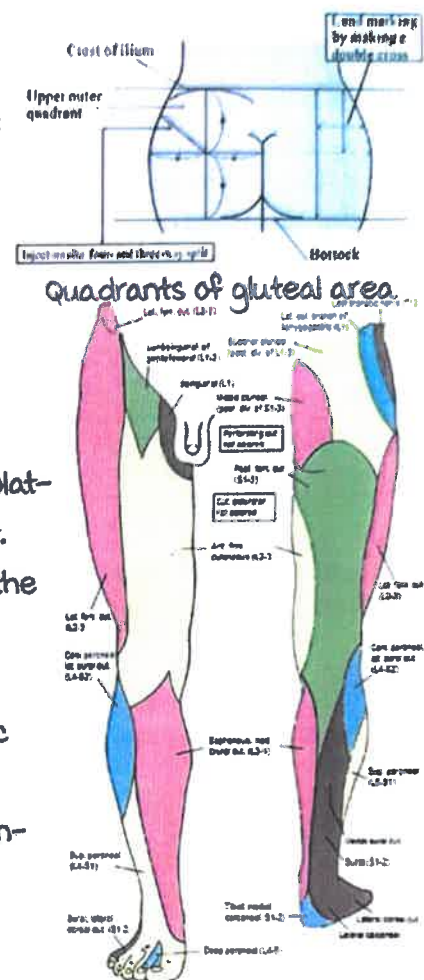
- It indirectly innervates the muscles of the posterior thigh, entire leg, and entire foot.

Tibial nerve: The muscles of the posterior leg (Calf muscles), & some of the intrinsic muscles of the foot.

Common fibular nerve: The muscles of the anterior leg, lateral leg, & the remaining intrinsic foot muscles.

Indirect sensory innervation:

- **Tibial nerve:** Supplies the skin of the posterolateral leg, lateral foot, and the sole of the foot.
- **Common fibular nerve:** Supplies the skin of the lateral leg and the dorsum of the foot.
- Piriformis muscle spasm and gluteus muscle spasm can cause symptoms related to sciatic nerve.
- Symptoms can be seen in patients who are involved in aggressive exercise.



Dermatomes of the lower limb

Gluteal region

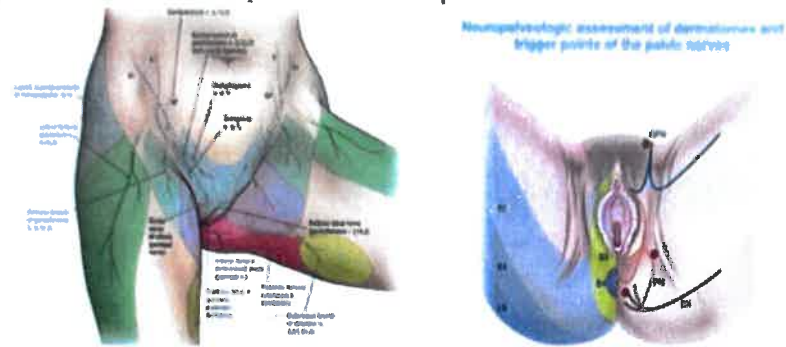


Symptom distribution

Reflexes during Urodynamics-neurogenic bladder:

- Urodynamics is the physiological assessment of bladder and bowel function.
- All the neuromuscular issues will help to figure out whether the neurogenic mechanism of bladder and bowel is intact or not.
- Picking up reflexes like a ischiocavernosus reflex, bulbocavernosus reflex, anal and the clitoral reflex will help you to pick up any underlying nerve damage.

Sensory nerve distribution of vulva and perineum :



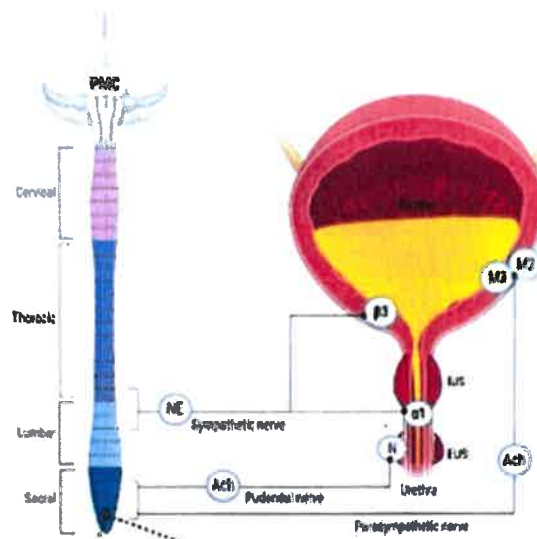
Obturator neuralgia

Three distribution in the perineal area :

- Genitofemoral nerve : Genital and femoral branch
- Pudendal nerve : Supplies perineal area.
- Sciatic nerve : Gluteal area down to the lower limb.

Obturator neuralgia : Appears in the medial aspect of the thigh.

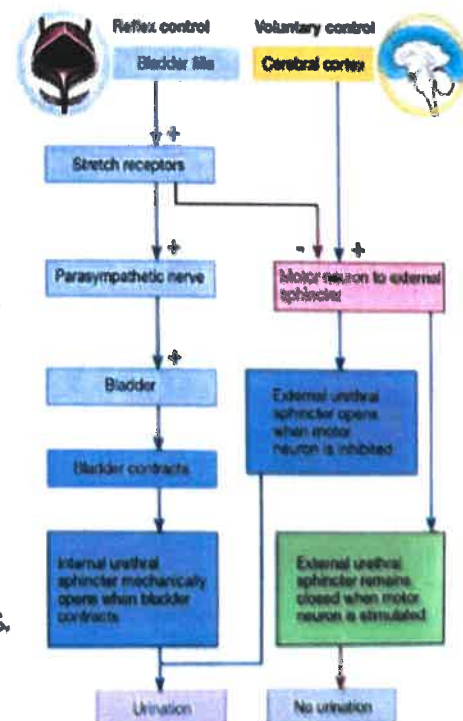
Neuroregulation of micturition and neurogenic factors affecting SUI



Voiding :

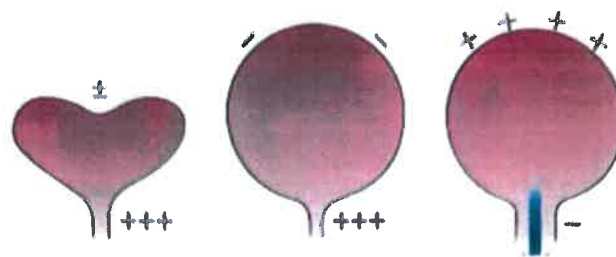
- voiding is initiated by an Interplay of Autonomic and Somatic System.
- At a suitable time/place even if bladder is not very full : Pontine signal can initiate micturition.
- Beyond A certain point when the bladder is too full : Autonomic reflex arc overrides the cortical inhibition and micturition reflex starts.
- Emotions like fear, anxiety, dreams can also initiate urinary urgency/Bed wetting even with minimal urine inside indicating a role of hypothalamus/ thalamus.

Reflex and voluntary control of micturition



Clinical observation :

- Children with a good bladder training of passing urine at regular interval have lesser chances of UTI's in later life.
- Women with recurrent UTI's in adulthood or middle age have a history of delaying voiding in younger years.



Bladder neural coordination.

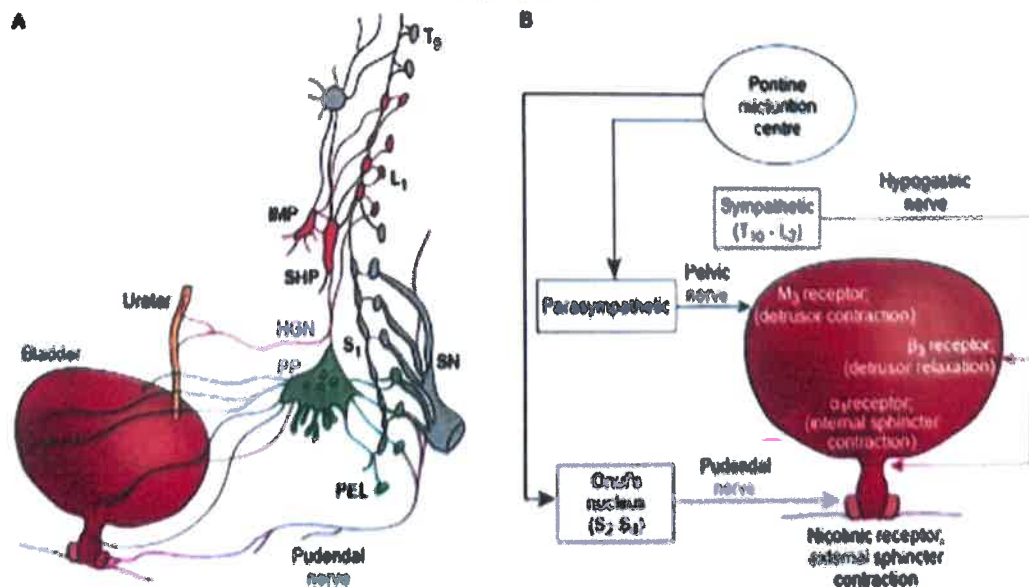
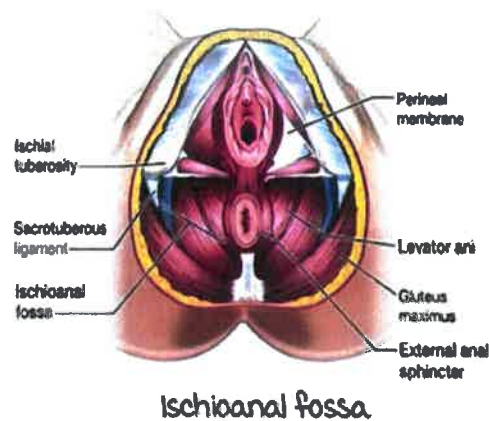
Urethra :

External urethral sphincter (voluntary) :

- Pelvic/urogenital diaphragm.
- Levator Ani (Skeletal ms).
- Nerve : Pudendal Nerve (S2,S3,S4).

Internal urethral Sphincter (Not in voluntary control) :

- Has a basal resting tone, maintained by hypogastric ganglion efferents
- Sympathetic chain.
- Alpha adrenergic.



Neurophysiology of bladder and urethra.