EXTERNAL GENERATIVE ORGANS OF FEMALE

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Vulva

The pudenda—commonly designated the vulva

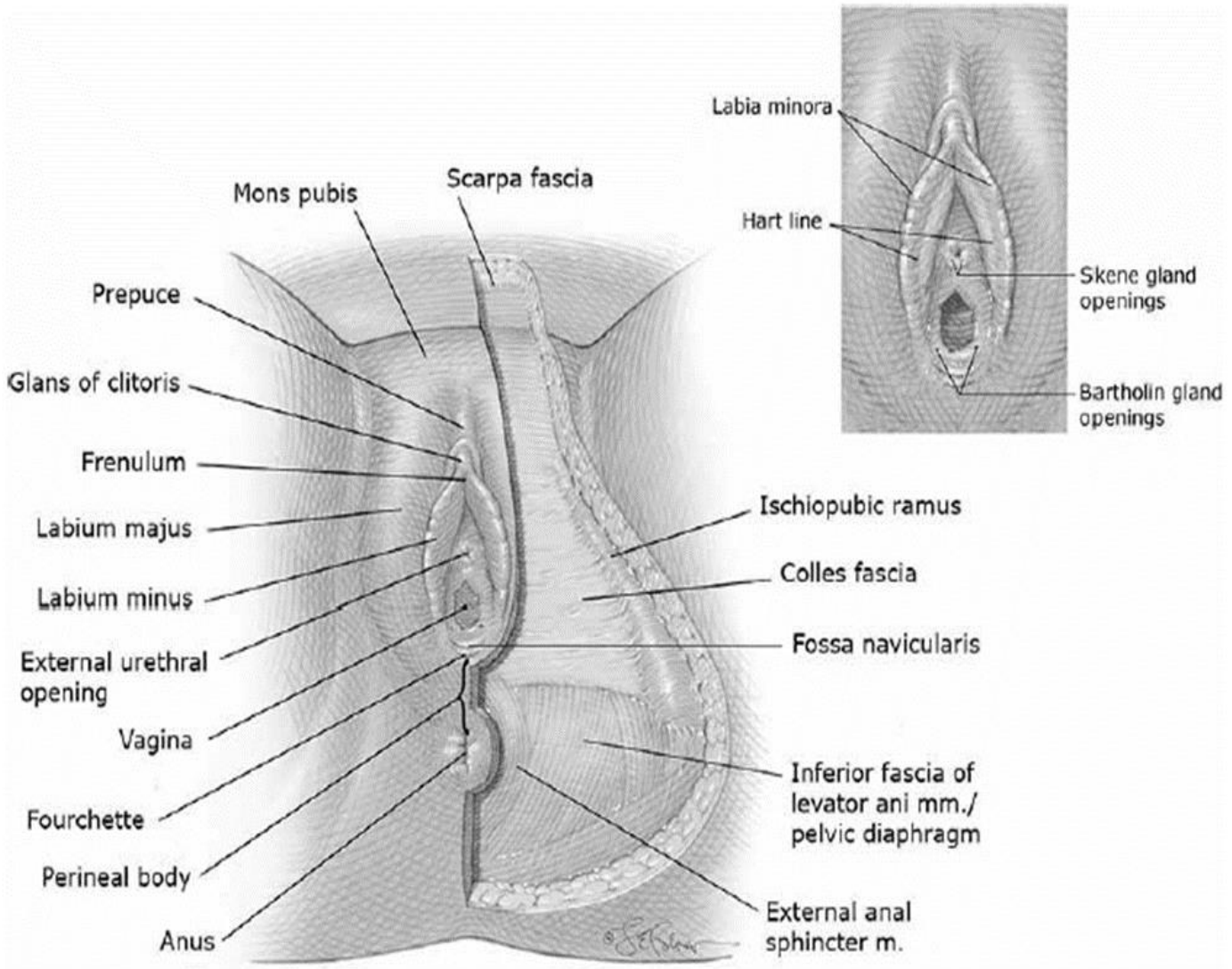
Includes all structures

Visible externally from the symphysis pubis to the perineal body

- ❑ Mons pubis
- ❑ Labia majora and minora
- ❑ Clitoris
- ❑ Hymen
- ❑ Vestibule
- ❑ Urethral opening
- ❑ Greater vestibular or Bartholin glands
- ❑ Minor vestibular glands
- ❑ Paraurethral glands

The vulva receives innervations and vascular support from the **pudendal** nerve

VULVAR STRUCTURES



Corton
MM: Anatomy. In Hoffman BL, Schorge JO, Bradshaw KD, et al (eds): Williams Gynecology, 3rd ed. New York, McGraw-Hill Education, 2016.)

Vulvar structures and subcutaneous layer of the anterior perineal triangle
Note the continuity of Colles and Scarpa fasciae

Inset: Vestibule
boundaries and openings
vestibular or Bartholin glands
minor vestibular glands
paraurethral glands

MONS PUBIS

- Fat-filled cushion overlying the symphysis pubis
- After puberty, the mons pubis skin is covered by curly hair that forms the triangular escutcheon, whose base aligns with the upper margin of the symphysis pubis
- In men and some hirsute women, the escutcheon extends farther onto the anterior abdominal wall toward the umbilicus

LABIA MAJORA

- Usually are **7 to 8 cm long, 2 to 3 cm wide, and 1 to 1.5 cm thick**
- Continuous directly with the mons pubis superiorly
- **Round ligaments terminate at their upper borders**
- Hair covers the labia majora
- Abundant Apocrine, eccrine, and sebaceous glands
- Beneath the skin, a dense connective tissue layer is nearly void of muscular elements
- Rich in elastic fibers and fat

LABIA MAJORA CONT--

- This fat mass provides bulk to the labia majora and is supplied with a **rich venous plexus**
- During pregnancy, this vasculature may develop varicosities, especially in multiparas, from increased venous pressure created by the enlarging uterus
- Appear as engorged tortuous veins or as small grapelike clusters
- Typically asymptomatic and require no treatment

LABIUM MINORA

- Each labium minus is a thin tissue fold that lies medial to each labium majus
- The labia minora extend superiorly, where each **divides into two lamellae**
- From each side, the **lower lamellae fuse to form the frenulum** of the clitoris
- **Upper lamellae merge to form the prepuce**
- Inferiorly, the labia minora extend to approach the midline as low ridges of tissue that join to **form the fourchette**
- Lengths from **2 to 10 cm** and widths **from 1 to 5 cm** (Lloyd, 2005)

LABIA MINORA CONTD…

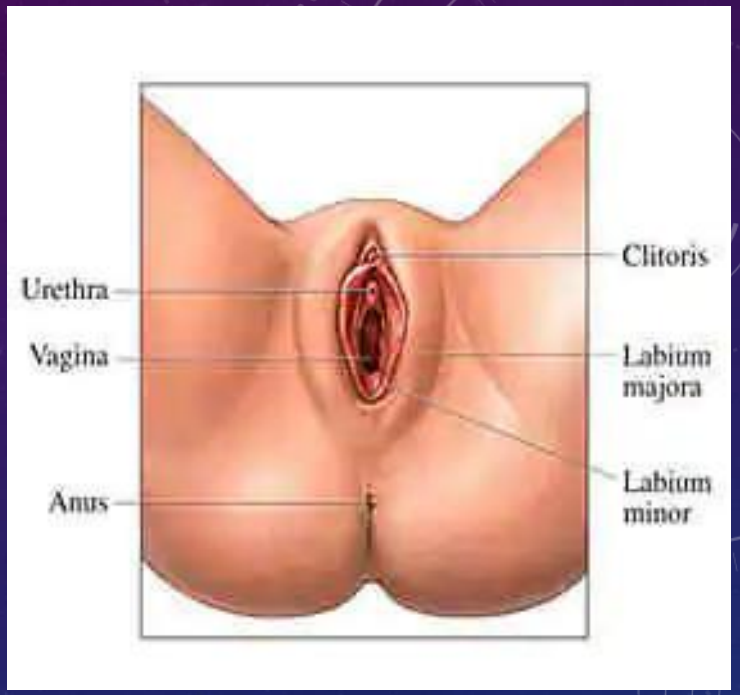
- Structurally, composed of connective tissue with numerous vessels, elastin fibers, and very few smooth muscle fibers
- Supplied with many nerve endings and are extremely sensitive (Ginger, 2011a; Schober, 2015)
- The epithelia of the labia minora differ with location
- Thinly keratinized stratified squamous epithelium covers the outer surface of each labium

LABIA MINORA CONTD…

- On their inner surface, the lateral portion is covered by this same epithelium up to a demarcating line, **termed Hart line**
- Medial to this line, each labium is covered by squamous epithelium that is nonkeratinized
- The labia minora **lack hair follicles, eccrine glands, and apocrine** glands
- Sebaceous glands are numerous (Wilkinson,2011)

CLITORIS

- Principal female erogenous organ
- Located beneath the prepuce, above the frenulum and urethra
- Projects downward and inward toward the vaginal opening
- 2 cm long
- Composed of a glans, a corpus or body, and two crura (Verkauf, 1992)
- The glans is usually less than 0.5 cm in diameter Covered by stratified squamous epithelium
- Richly innervated



BODY OF CLITORIS

- Contains **two corpora cavernosa**
- Extending from the clitoral body, each corpus cavernosum diverges laterally to form a long, **narrow crus**
- Each crus lies along the inferior surface of its respective ischiopubic ramus and deep to the ischiocavernosus muscle

BLOOD SUPPLY OF CLITORIS

- Internal pudendal artery
- The deep artery of the clitoris supplies the clitoral body
- The dorsal artery of the clitoris supplies the glans and prepuce

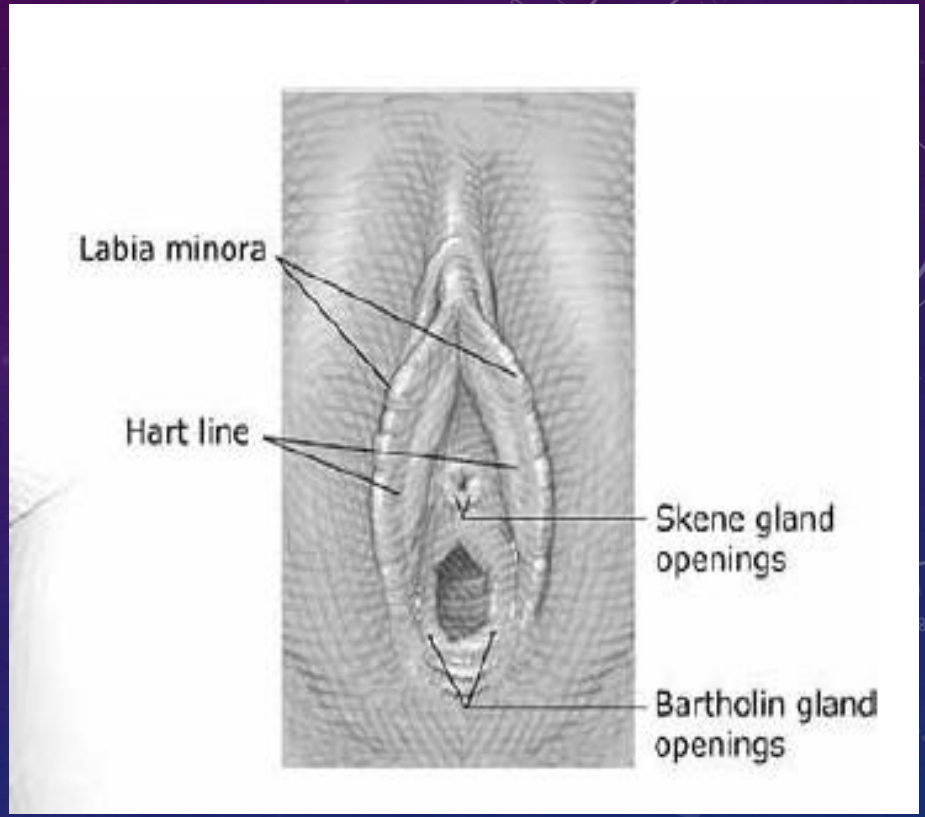
VESTIBULE

In adult women

Vestibule is an almond-shaped area

Enclosed by

- Hart line laterally
- The external surface of the hymen medially
- The clitoral frenulum anteriorly
- The fourchette posteriorly



VESTIBULAR OPENINGS

The vestibule is usually **perforated by six openings:**

- Urethra
- vagina
- **Two Bartholin gland** ducts
- **Two ducts of the largest paraurethral glands**—the Skene glands
- The posterior portion of the vestibule between the fourchette and the vaginal opening is called the fossa navicularis
- It is usually observed only in nulliparas

THE BILATERAL BARTHOLIN GLANDS(GREATER VESTIBULAR GLANDS)

- 0.5 to 1 cm in diameter
- On their respective side, each lies inferior to the vestibular bulb and deep to the inferior end of the bulbospongiosus muscle (former bulbocavernosus muscle)
- A duct extends medially from each gland, measures 1.5 to 2 cm long
- Opens distal to the hymeneal ring-one at 5 and the other at 7 o'clock on the vestibule

CLINICAL SIGNIFICANCE

- Following trauma or infection, either duct may swell and obstruct to form a cyst or, if infected, an abscess
- In contrast, the minor vestibular glands are shallow glands lined by simple mucin-secreting epithelium and open along Hart line

THE PARAURETHRAL GLANDS

- Collective arborization of glands whose numerous small ducts open predominantly along the entire inferior aspect of the urethra
- The **two largest are called Skene glands**
- Their ducts typically lie distally and near the urethral meatus

CLINICAL SIGNIFICANCE

- Clinically, inflammation and duct obstruction of any of the **paraurethral glands** can lead to **urethral diverticulum formation**
- The urethral opening or meatus is in the midline of the vestibule
- **1 to 1.5 cm below the pubic arch**, and a short distance above the vaginal opening

VAGINA AND HYMEN

- In adult women, the hymen is a **membrane of varying thickness**
- Surrounds the vaginal opening more or less completely
- Composed mainly of **elastic and collagenous** connective tissue
- Both outer and inner surfaces are covered by **nonkeratinized** stratified squamous epithelium.
- The aperture of the intact hymen ranges in diameter from **pinpoint** to one that admits one or **even two fingertips**

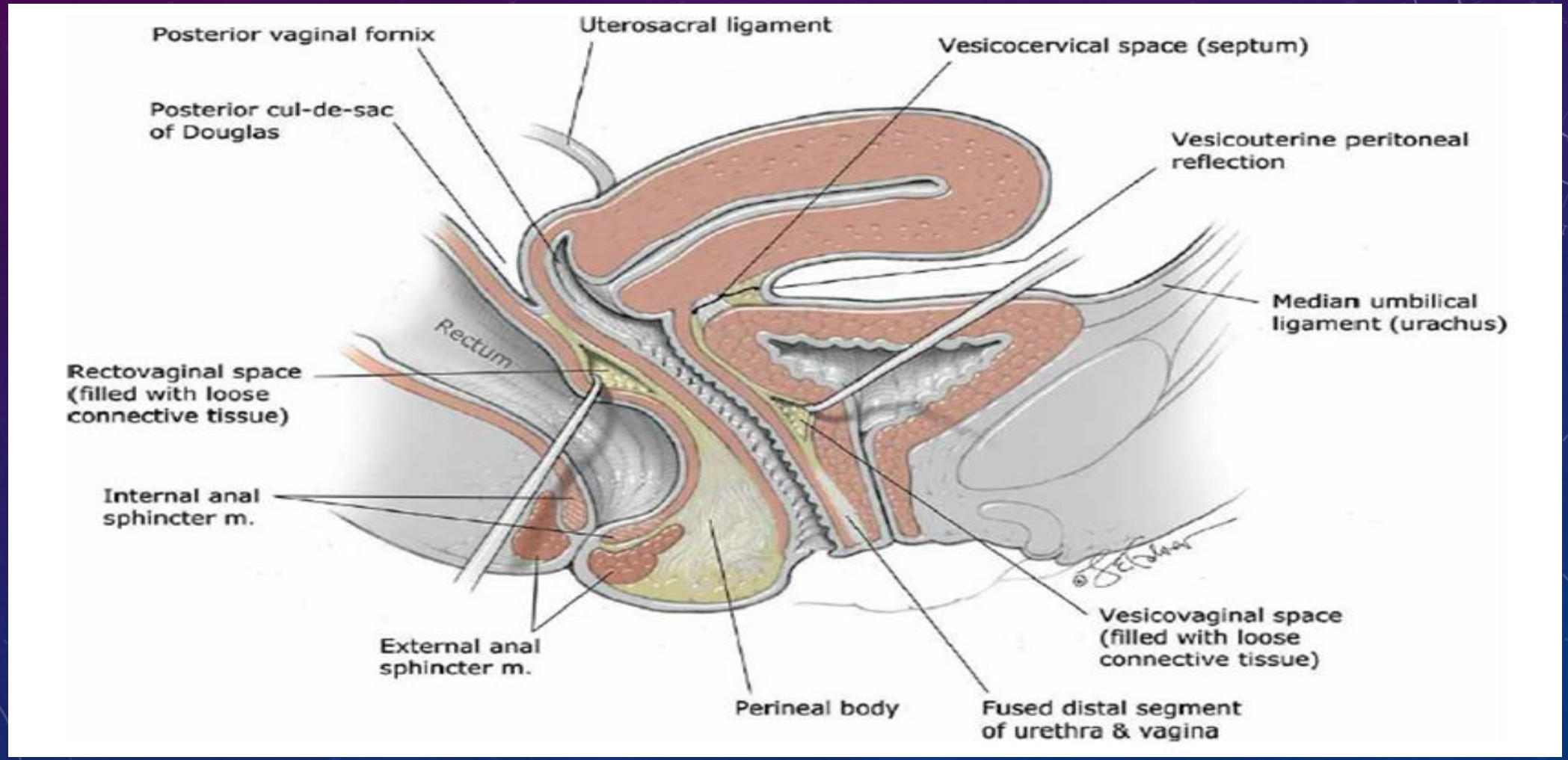
- As a rule, the hymen is torn **at several sites during first coitus**
- However, identical tears may form by other penetration, for example, by tampons used during menstruation
- The edges of the torn tissue soon reepithelialize

CHANGES WITH PREGNANCY

- In pregnant women, the hymeneal epithelium is thick and rich in glycogen
- Changes produced in the hymen by childbirth are usually readily recognizable
- Over time, the hymen transforms into several nodules of various sizes, termed **hymeneal or myrtiform caruncles**

VAGINA AND SURROUNDING ANATOMY

(CORTON MM: ANATOMY. IN HOFFMAN BL, SCHORGE JO, BRADSHAW KD, ET AL (EDS): WILLIAMS GYNECOLOGY, 3RD ED. NEW YORK, MCGRAW-HILL EDUCATION, 2016)



VAGINA AND SURROUNDING ANATOMY

- Proximal to the hymen, the vagina is a **musculomembranous** tube that extends to the uterus and is interposed lengthwise between the bladder and the rectum
- Anteriorly, the vagina is separated from the bladder and urethra by connective tissue—**the vesicovaginal septum**

VAGINA AND SURROUNDING ANATOMY

- Posteriorly, between the lower portion of the vagina and the rectum, similar tissues together form the **rectovaginal septum**
- The upper fourth of the vagina is separated from the rectum by the rectouterine pouch,also called the **cul-de-sac or pouch of Douglas**

- Normally, the anterior and posterior walls of the vaginal lumen lie in contact, with only a slight space intervening at the lateral margins
- **The anterior wall measures 6 to 8 cm**
- **Posterior vaginal wall is 7 to 10 cm**
- The upper end of the vaginal vault is subdivided by the cervix into **anterior, posterior, and two lateral fornices**
- Clinically, the internal pelvic organs usually can be palpated through the thin walls of these fornices

VAGINA CONTD…

- The vaginal lining is composed of **nonkeratinized stratified squamous** epithelium and underlying lamina propria
- In premenopausal women, this lining is thrown into numerous thin transverse ridges, known as **rugae,** which line the anterior and posterior vaginal walls along their length
- Deep to this, a muscular layer contains smooth muscle, collagen, and elastin
- Beneath this muscularis lies an adventitial layer consisting of collagen and elastin (Weber, 1997)

VAGINA CONTD…

- **The vagina lacks glands**
- It is lubricated by a transudate that originates from the vaginal subepithelial capillary plexus and crosses the permeable epithelium (Kim, 2011)
- Due to increased vascularity during pregnancy, vaginal secretions are notably increased
- At times, this may be confused with amnionic fluid leakage

CLINICAL SIGNIFICANCE

- After birth-related epithelial trauma and healing, fragments of stratified epithelium occasionally are embedded beneath the vaginal surface
- Similar to its native tissue, this buried epithelium continues to shed degenerated cells and keratin
- As a result, **epidermal inclusion cysts**, which are filled with keratin debris, may form
- These are **common vaginal cyst**

BLOOD SUPPLY OF VAGINA

- The proximal portion - by the cervical branch of the uterine artery and by the vaginal artery
- The **latter** may variably arise from the uterine or inferior vesical artery or directly from the internal iliac artery
- The **middle rectal artery** contributes supply to the **posterior vaginal wall**
- **D**istal walls receive contributions from the internal pudendal artery
- At each level, vessels supplying each side of the vagina course medially across the anterior or posterior vaginal wall and **form midline anastomoses**

- An extensive venous plexus also surrounds the vagina and follows the course of the arteries.
- Lymphatics from **the lower third**, along with those of the vulva, drain primarily into the **inguinal lymph nodes**
- From the middle third drain into the **internal iliac nodes**
- From the **upper third** drain into the external, i**nternal**,and common iliac nodes

PERINEUM

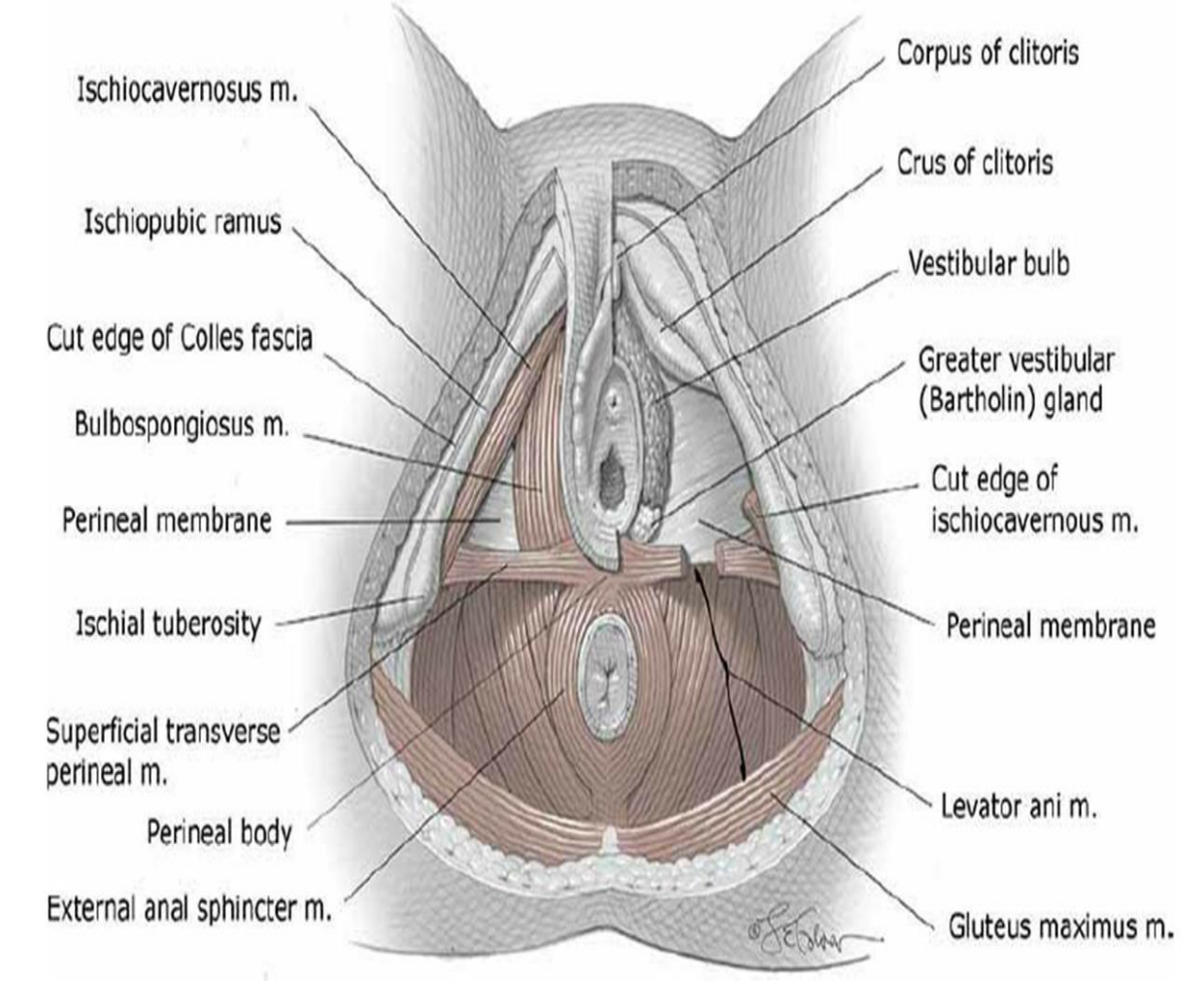
This **diamond-shaped** area between the thighs has boundaries that mirror those of the bony pelvic outlet:

- ❑ Pubic symphysis anteriorly
- ❑ Ischiopubic rami and ischial tuberosities anterolaterally
- ❑ Sacro tuberous ligaments poster laterally
- ❑ Coccyx posteriorly

An arbitrary line joining the ischial tuberosities divides the perineum into two triangles

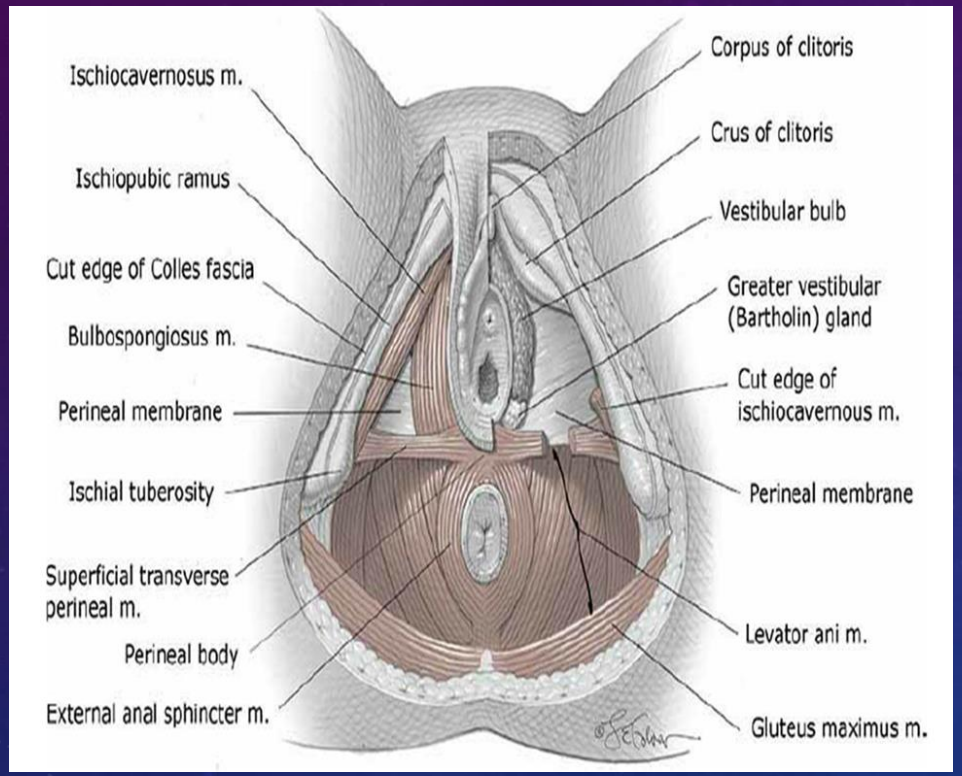
- Anterior triangle, also called the urogenital triangle
- Posterior triangle termed the anal triangle

THE PERINEAL BODY



- Fibromuscular pyramidal mass in the midline at the junction between these ant and posterior triangles
- Also called the **central tendon of the perineum**
- Sonographically measures 8 mm tall and 14 mm wide and thick (Santoro, 2016)
- Serves as the junction for several structures and provides significant perineal support (Shafik, 2007)
- Superficially, the bulbospongiosus, superficial transverse perineal, and external anal sphincter muscles converge on the perineal body
- More deeply, the perineal membrane,portions of the pubococcygeus muscle, and internal anal sphincter contribute (Larson, 2010).
- The perineal body is incised by an episiotomy incision and is torn with second-, third-, and fourth-degree lacerations.

SUPERFICIAL SPACE OF THE ANTERIOR PERINEAL TRIANGLE AND POSTERIOR PERINEAL TRIANGLE



- Structures on the left side of the image can be seen after removal of Colles fascia.
- Those on the right side are noted after removal of the superficial muscles of the anterior triangle.

(Modified with permission from Corton MM:Anatomy. In Hoffman BL, Schorge JO, Bradshaw KD, et al (eds): WilliamsGynecology, 3rd ed. New York, McGraw-Hill Education, 2016)

SUPERFICIAL SPACE OF THE ANTERIOR TRIANGLE

This triangle is bounded by

- The pubic rami superiorly
- Ischial tuberosities laterally
- superficial transverse perineal muscles posteriorly

It is divided into superficial and deep spaces by the perineal membrane

- This membranous partition is a dense fibrous sheet that was previously known as the inferior fascia of the urogenital diaphragm

THE PERINEAL MEMBRANE

Attaches

- ❑ Laterally to the ischiopubic rami
- ❑ Medially to the distal third of the urethra and vagina
- ❑ Posteriorly to the perineal body
- ❑ Anteriorly to the arcuate ligament of the pubis

THE SUPERFICIAL SPACE OF THE ANTERIOR TRIANGLE

Boundaries

- ❑ Deeply by the perineal membrane
- ❑ Superficially by Colles fascia

Colles fascia is the continuation of Scarpa fascia onto the perineum

On the perineum, Colles fascia securely attaches

- ❑ Laterally to the pubic rami and fascia lata of the thigh
- ❑ Inferiorly to the superficial transverse perineal muscle and inferior border of the perineal membrane
- ❑ Medially to the urethra, clitoris, and vagina

As such, the **superficial space of the anterior triangle** is a relatively closed compartment

CONTENTS OF THE SUPERFICIAL POUCH

- ❑Bartholin glands
- ❑Vestibular bulbs
- ❑Clitoral body and crura
- ❑ Branches of the pudendal vessels and nerve
- ❑ Ischiocavernosus
- ❑Bulbospongiosus
- ❑superficial transverse perineal muscles

.

- The ischiocavernosus muscles each attach on their respective side to the medial aspect of the ischial tuberosity inferiorly and the ischiopubic ramus laterally
- Anteriorly, each attaches to a clitoral crus and may help maintain clitoral erection by compressing the crus to obstruct venous drainage

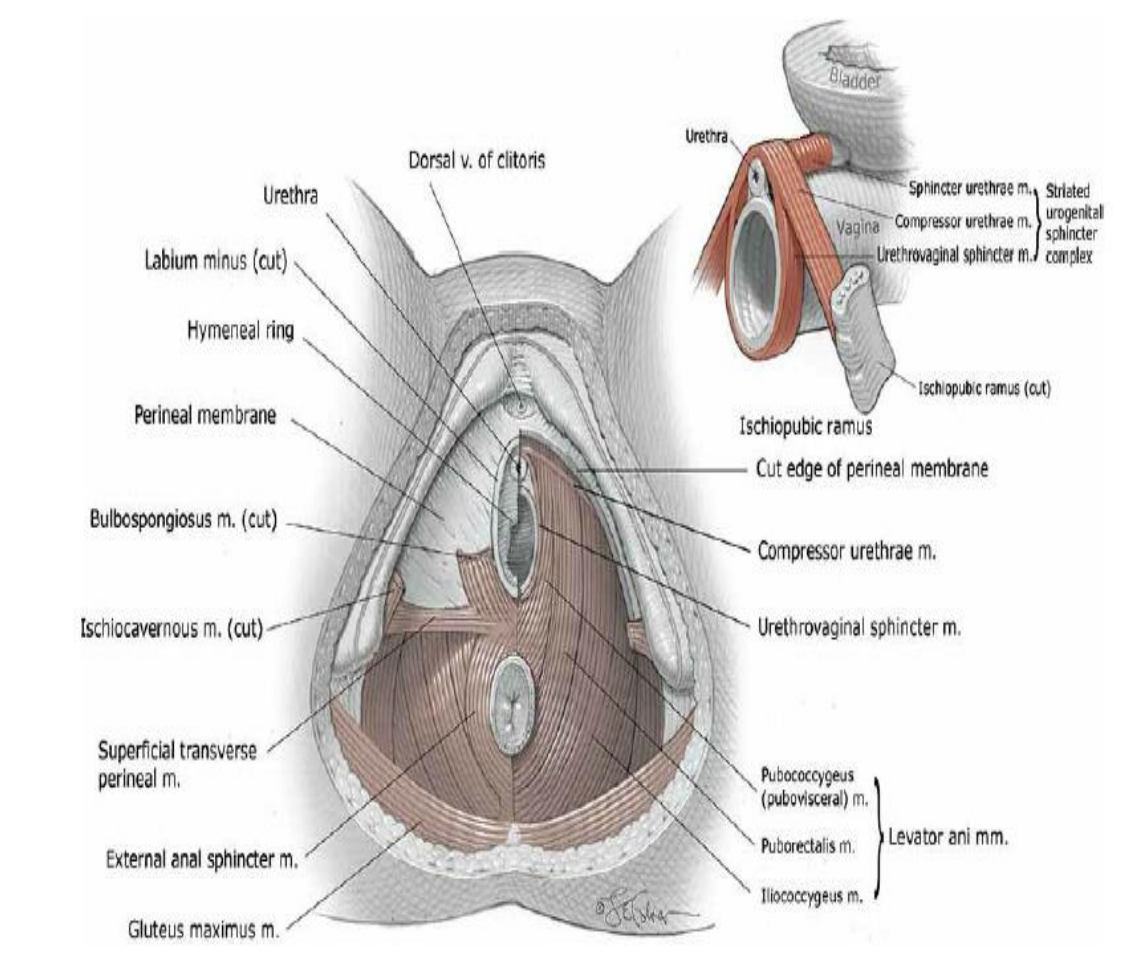
- The bilateral bulbospongiosus muscles overlie the vestibular bulbs and Bartholin glands
- They attach to the body of the clitoris anteriorly and the perineal body posteriorly
- The muscles constrict the vaginal lumen and aid release of secretions from the Bartholin glands
- They also may contribute to clitoral erection by compressing the deep dorsal vein of the clitoris
- The bulbospongiosus and ischiocavernosus muscles also pull the clitoris downward

- Last, the superficial transverse perineal muscles are narrow strips that attach to the ischial tuberosities laterally and the perineal body medially.
- They may be attenuated or even absent, but when present, they contribute to the perineal body (Corton, 2016)

THE VESTIBULAR BULBS

- Almond-shaped aggregations of veins that lie beneath the bulbospongiosus muscle on either side of the vestibule.
- They measure 3 to 4 cm long, 1 to 2 cm wide, and 0.5 to 1 cm thick
- The bulbs terminate inferiorly at approximately the middle of the vaginal opening and extend upward toward the clitoris.
- Their anterior extensions merge in the midline, below the clitoral body.
- During childbirth, veins in the vestibular bulbs may be lacerated or even rupture to create a vulvar hematoma enclosed within the superficial space of the anterior triangle

DEEP SPACE OF THE ANTERIOR TRIANGLE

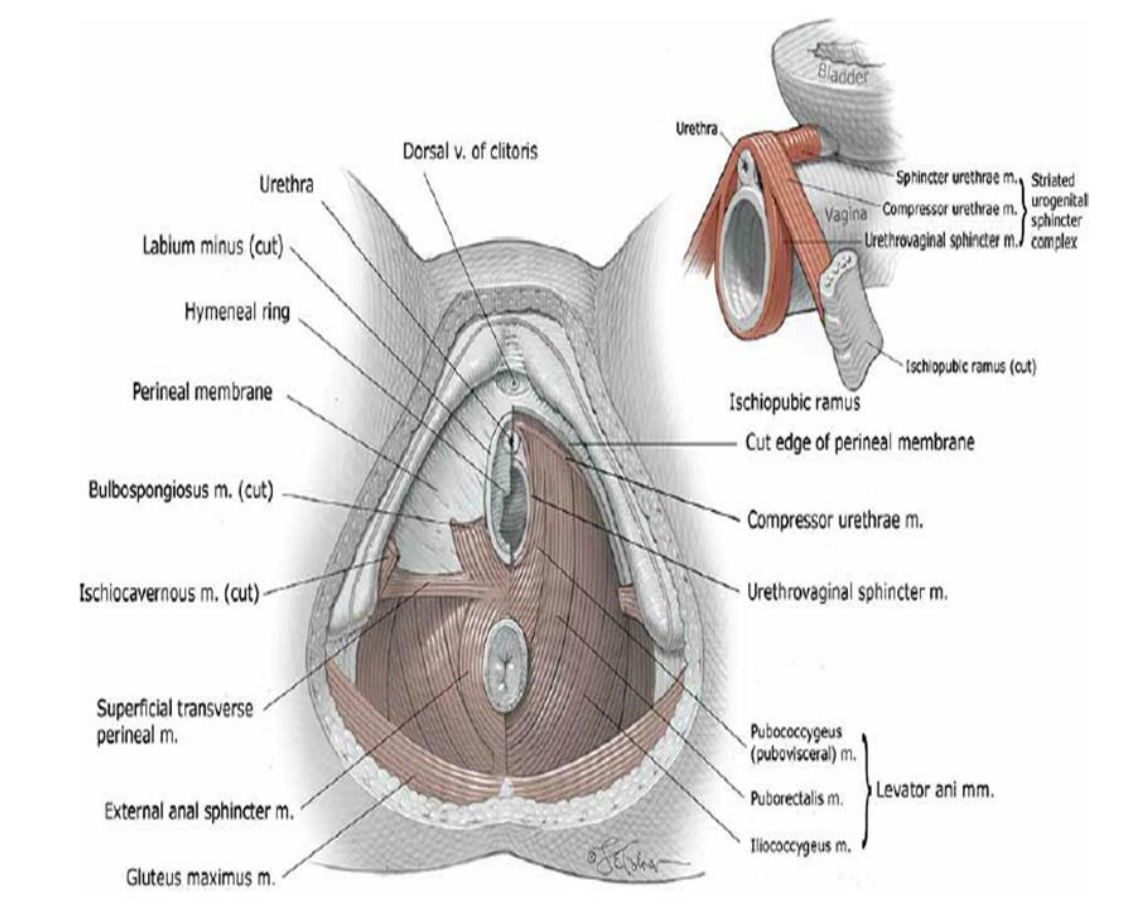


- This space lies deep to the perineal membrane and extends up into the pelvis (Mirilas, 2004)
- Continuous superiorly with the pelvic cavity (Corton, 2005)

Contents

- Portions of urethra and vagina certain portions of internal pudendal artery branches
- Muscles of the striated urogenital sphincter complex

DEEP SPACE OF ANTERIOR TRIANGLE OF THE PERINEUM



Structures on the right side of the image can be seen after removal of the perineal membrane. Also shown are structures that attach to the perineal body:

- ❑ Bulbospongiosus
- ❑ Superficial transverse perineal
- ❑ External anal sphincter, and
- ❑ Puboperinealis muscles
- ❑ Perineal membrane

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URETHRA

- Female urethra measures 3 to 4 cm and originates within the bladder trigone
- The distal two thirds of the urethra are fused with the anterior vaginal wall
- The epithelial lining of the urethra changes from transitional epithelium proximally to nonkeratinized stratified squamous epithelium distally
- The walls consist of two layers of smooth muscle, an **inner longitudinal** and an **outer circular**
- Surrounded by a circular layer of skeletal muscle referred to as the sphincter urethrae or **rhabdosphincter**

- Approx. at the junction of the middle and lower third of the urethra, and just above or deep to the perineal membrane, two strap skeletal muscles called the urethrovaginal sphincter and compressor urethrae are found
- Together with the sphincter urethrae, these constitute the **striated urogenital sphincter complex.**
- This complex supplies constant tonus and provides emergency reflex contraction to sustain continence

- Distal to the level of the perineal membrane, the walls of the urethra consist of fibrous tissue, serving as the nozzle that directs the urine stream.
- Here, the urethra has a prominent submucosal layer that is lined by hormonally sensitive stratified squamous epithelium.
- Within the submucosal layer on the dorsal (vaginal) surface of the urethra lie the paraurethral glands

BLOOD AND NERVE SUPPLY OF URETHRA

Blood supply

- Inferior vesical
- Vaginal
- Internal pudendal arteries

Although still controversial, the pudendal nerve is believed to innervate the most distal part of the striated urogenitalsphincter complex.

Somatic efferent branches from **S2–S4** that course along the inferior hypogastric plexus variably innervate the sphincter urethrae.

PELVIC DIAPHRAGM

- Found deep to the anterior and posterior triangles
- This broad muscular sling provides substantial support to the pelvic viscera

THE PELVIC DIAPHRAGM

Composed of the

Levator ani and the **coccygeus** muscles

The **levator ani,** in turn, contains the

- ❑ Pubococcygeus
- ❑Puborectalis
- ❑ Iliococcygeus muscles

PUBOCOCCYGEUS MUSCLE

The pubococcygeus muscle is also termed the pubovisceral muscle and is subdivided based on points of insertion and function.

These include the

- ❑ Pubovaginalis
- ❑ Puboperinealis
- ❑Puboanalis muscles

- These insert into the vagina, perineal body, and anus, respectively (Kearney, 2004)

CLINICAL SIGNIFICANCE OF LEVATOR ANI

- Vaginal birth conveys significant risk for damage to the levator ani or to its innervation (DeLancey, 2003; Weidner, 2006).
- Evidence supports that levator ani avulsion may predispose women to greater risk of pelvic organ prolapse (Dietz,2008; Schwertner-Tiepelmann, 2012).
- For this reason, current research efforts are aimed at minimizing these injuries

POSTERIOR TRIANGLE

Contains the

- ❑Ischioanal fossae
- ❑ Anal canal
- ❑Anal sphincter complex
- ❑ Branches of the pudendal nerve and internal pudendal vessels

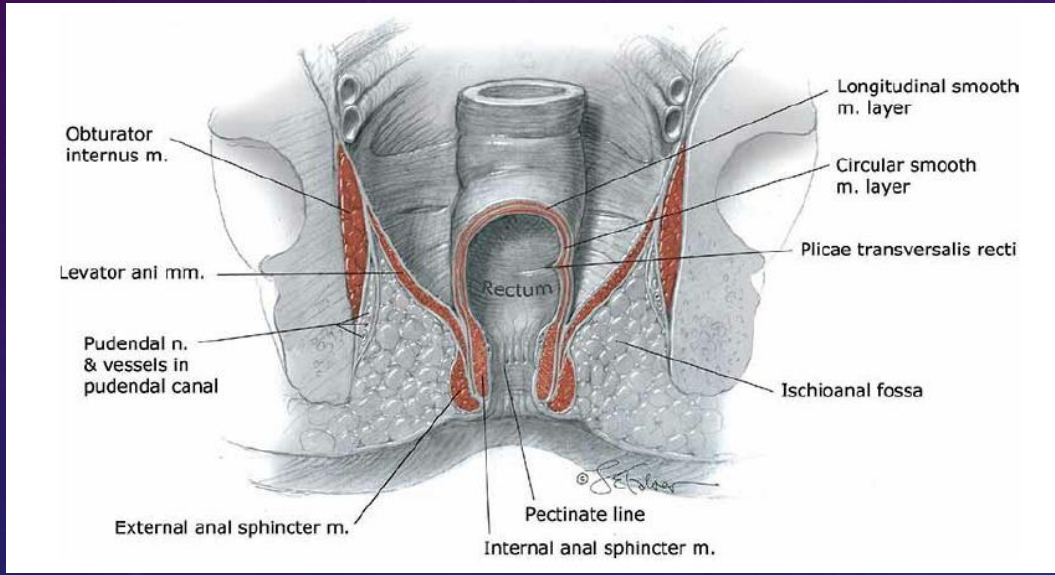
ANAL SPHINCTER COMPLEX

Consists of the

- ❑Internal anal sphincter
- ❑ External anal sphincter
- ❑Puborectalis muscle

ISCHIOANAL FOSSAE(ISCHIORECTAL FOSSAE)

TWO FAT-FILLED WEDGE-SHAPED SPACES



Anal canal and ischioanal fossa.

- Found on either side of the anal canal
- Comprise the bulk of the posterior triangle
- Each fossa has skin as its superficial base
- Its deep apex is formed by the junction of the levator ani and obturator internus muscles.

Other borders include:

- Laterally, the obturator internus muscle fascia and ischial tuberosity
- Inferomedially, the anal canal and sphincter complex
- Superomedially, the inferior fascia of the downwardly sloping levator ani
- Posteriorly, the gluteus maximus muscle and sacrotuberous ligament
- Anteriorly, the inferior border of the anterior triangle

FUNCTIONS

- The fat found within each fossa provides support to surrounding organs
- Allows rectal distention during defecation and vaginal stretching during delivery.
- Clinically, injury to vessels in the posterior triangle can lead to hematoma

formation in the ischioanal fossa, and the potential for large accumulation in these easily distensible spaces.

- The two fossae communicate dorsally, behind the anal canal.
- This can be especially important because an episiotomy infection or hematoma may extend from one fossa into the other

ANAL CANAL

- This distal continuation of the rectum begins at the level of levator ani attachment to the rectum and ends at the anal skin
- Along this **4- to 5-cm length**,the mucosa consists of columnar epithelium in the uppermost portion
- However, at the **pectinate line, also termed dentate line**, simple stratified squamous epithelium begins and continues to the anal verge
- At the verge, keratin and skin adnexa join the squamous epithelium.

TISSUE LAYERS OF ANAL CANAL

Inner layers include the

- Anal mucosa
- Internal anal sphincter
- Intersphincteric space that contains continuation of the rectum's longitudinal smooth muscle layer.

An outer layer contains the

- Puborectalis muscle as its cephalad component
- External anal sphincter caudally

WITHIN THE ANAL CANAL

3 highly vascularized submucosal arteriovenous plexuses are found

termed anal cushions

Aid complete closure of the canal and fecal continence when apposed

Increasing uterine size, excessive straining, and hard stool create increased pressure that ultimately leads to degeneration and subsequent laxity of the cushion's supportive connective tissue base.

These cushions then protrude into and downward through the anal canal

This leads to **venous engorgement** within the cushions—now termed **hemorrhoids**

Venous stasis results in inflammation, erosion of the cushion's epithelium, and then bleeding

ANAL SPHINCTER COMPLEX

Two sphincters surround the anal canal to provide fecal continence—

The external and internal anal sphincters

Both lie near the vagina and may be torn during vaginal delivery

The internal anal sphincter (IAS) is a distal continuation of the rectal circular smooth muscle layer.

Nerve supply

Predominantly parasympathetic fibers, through the pelvic splanchnic nerves

Blood supply

Along its length, supplied by the superior, middle, and inferior rectal arteries

INTERNAL ANAL SPHINCTER (IAS) CONTD…

- The IAS contributes the bulk of anal canal resting pressure for fecal continence and relaxes prior to defecation
- 3 to 4 cm in length,and at its distal margin, it overlaps the external sphincter for 1 to 2 cm (DeLancey,1997)
- The distal site at which this overlap ends, called the **intersphincteric groove**
- It is palpable on digital examination

EXTERNAL ANAL SPHINCTER (EAS)

- It is a striated muscle ring that anteriorly attaches to the perineal body and posteriorly connects to the coccyx via the anococcygeal ligament.
- The EAS maintains a constant resting contraction to aid continence, provides additional squeeze pressure when continence is threatened, yet relaxes for defecation.

THE EXTERNAL SPHINCTER

Blood supply

Inferior rectal artery, branch of the internal pudendal artery

Nerve supply

Somatic motor fibers from the inferior rectal branch of the pudendal nerve

Clinical significance

The IAS and EAS may be involved in third- and fourth degree lacerations during vaginal delivery, and reunion of these rings is integral to defect repair

PUDENDAL NERVE

- This is formed from the **anterior rami of S2–4 spinal nerves**
- It courses between the piriformis and coccygeus muscles and exits through the greater sciatic foramen at a location posterior to the sacrospinous ligament and just medial to the ischial spine

(Barber, 2002; Maldonado, 2015)

- Thus, when injecting local anesthetic for a pudendal nerve block, the **ischial spine serves an identifiable landmark**
- It runs beneath the sacrospinous ligament and above the sacrotuberous ligament as it reenters the lesser sciatic foramen to course along the obturator internus muscle.

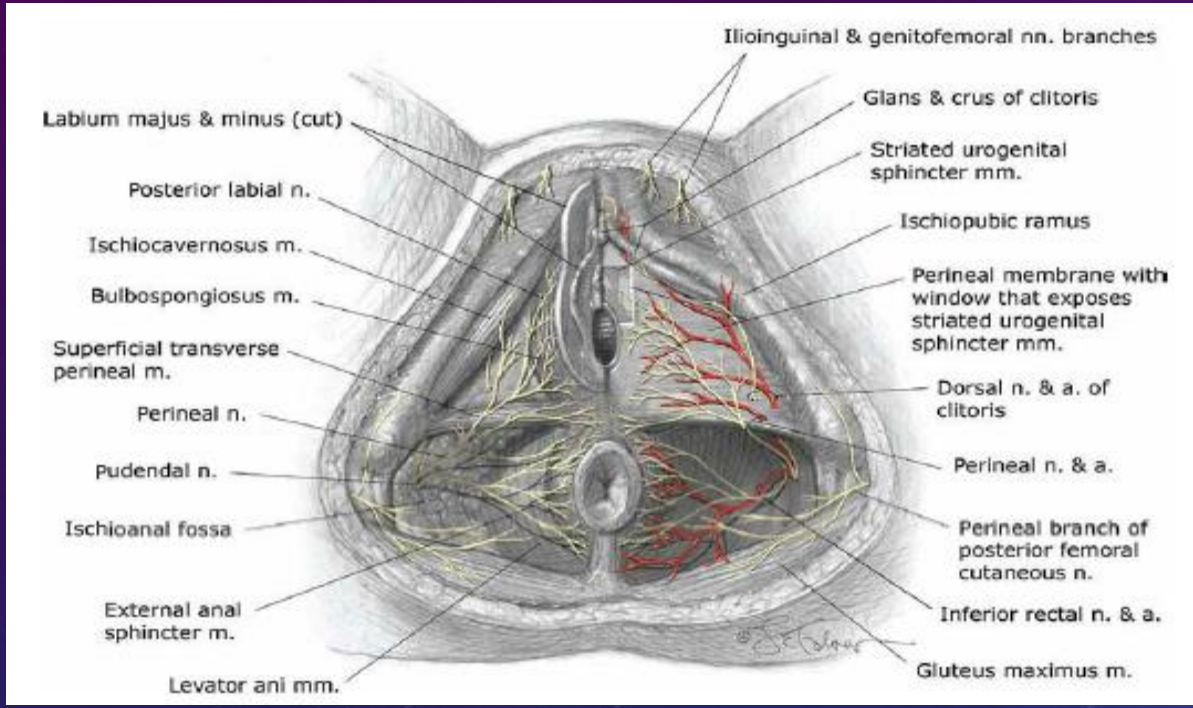
PUDENDAL CANAL

Atop this muscle, the nerve lies within the **pudendal canal, also** known as **Alcock canal**

Alcock’ s canal formed by

- Splitting of the obturator internus investing fascia (Shafik, 1999)
- Pudendal nerve is relatively fixed as it courses behind the sacrospinous ligament and within the pudendal canal.
- It may be at risk of stretch injury during downward displacement of the pelvic floor during childbirth (Lien, 2005)

PUDENDAL NERVE AND VESSELS



Corton MM: Anatomy. In Hoffman BL, Schorge JO, Bradshaw KD, et al (eds): Williams Gynecology, 3rd ed. New York, McGraw-Hill Education, 2016.)

Leaves the Alcock ‘s canal to enter the perineum and divides into

3 terminal branches

1) **Dorsal nerve of the clitoris**

runs between the ischiocavernosus muscle and perineal membrane to supply the clitoral glans (Ginger, 2011b).

2) **Perineal nerve**

runs superficial to the perineal membrane (Montoya, 2011)

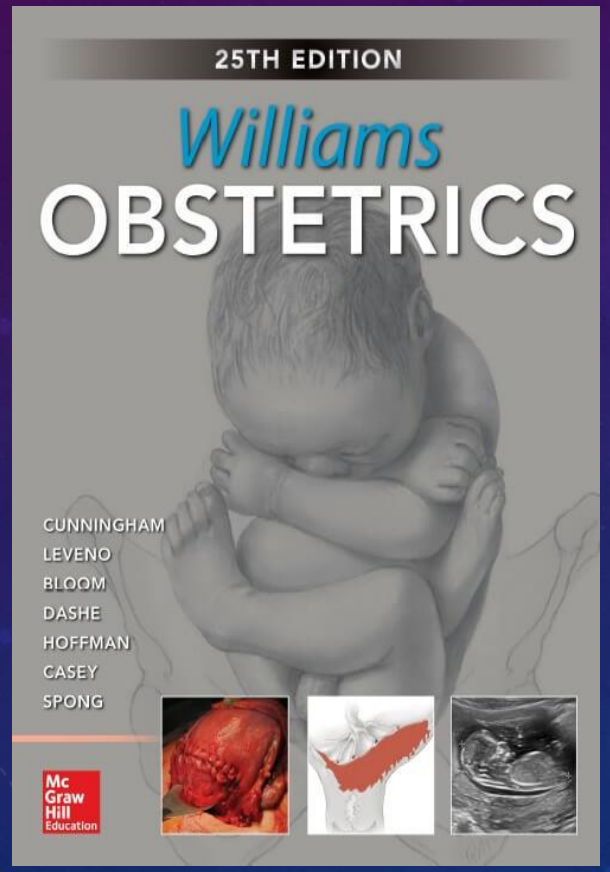
It divides into posterior labial branches and muscular branches, which serve the labial skin and the anteriormperineal triangle muscles, respectively.

3) Inferior rectal branch

runs through the ischioanal fossa to supply the external anal sphincter, the anal mucosa, and the perianal skin (Mahakkanukrauh, 2005)

MAJOR BLOOD SUPPLY TO THE PERINEUM

Internal pudendal artery, and its branches mirror the divisions of the pudendal nerve



Contents based on Williams obstetrics


THANK
YOU!