

Marcello Cherchi's notes for Gross Anatomy

PERINEUM and PELVIS

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(Please let me know of any errors! mchercl@uic.edu)

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Also see:

The M1 home page for anatomy: http://www2.uic.edu/stud_orgs/prof/M1/

PERINEUM (MA 186)

Muscle	Innervations	Blood supplies	Origins	Insertions	Actions
External anal sphincter	Inferior rectal n. (S4)	Internal pudendal a. (?) (MA 159)	Skin and fascia surrounding anus and coccyx via anococcygeal ligament	Perineal body	Close anal canal
Internal anal sphincter (MA 181)	pelvic splanchnic nn. (S2-S4) (MA 154) [parasympathetic]	Ditto			
Bulbospongiosus	Deep br. of perineal n. (which in turn is a br. of the pudendal n., S2-S4)	(?)	Male: median raphe, ventral surface of bulb of penis and perineal body. Female: perineal body	Male: corpus spongiosum and cavernosa and fascia of bulb of penis. Female: fascia of corpus cavernosa	Male: compress bulb of urethra and assist in erection of penis. Female: reduce lumen of vagina and assist in erection of clitoris
Ischiocavernosus	Ditto	(?)	Ischial ramus and tuberosity	Crus of penis or clitoris	Maintain erection of penis or clitoris by compression of crura
Superficial transverse perineus	Ditto	(?)	Ditto	Perineal body	Support perineal body
Deep transverse perineus	Ditto	(?)	Inner aspect of isciopubic ramus	Median raphe, perineal body, and external anal sphincter	Fix perineal body
Sphincter urethrae (external sphincter)	Ditto	(?)	Inferior pubic ramus	Surround urethra; in females, some fibers also enclose vagina	Compress urethra (also compresses vagina in females)

PELVIS (MA 151)

Muscle	Innervations	Blood supplies	Origins	Insertions	Actions
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Obturator internus	N. to obturator internus (L5, S1, S2)	Inferior gluteal a. (MA 245)	Pelvic surface of ilium and ischium; obturator membrane	Greater trochanter of femur	Rotate thigh laterally; assist in holding head of femur in acetabulum
Piriformis	Branches of ventral rami of S1, S2	• Inferior gluteal a. • Lateral sacral a. (superior and inferior) (MA 159)	Pelvic surface of Sv2 to Sv4; superior margin of greater sciatic notch and sacrotuberous ligament	Superior border of greater trochanter of femur	Rotate thigh laterally; abduct thigh; assist in holding head of femur in acetabulum
Coccygeus (ischiococcygeus)	Branches of S4, S5	Ditto	Ischial spine	Inferior end of sacrum	Form small part of pelvic diaphragm that supports pelvic viscera; flex coccyx
Levator ani (see NE 367) consists of three parts:	Branches of S4 and pudendal n. (S2-S4)	Inferior gluteal a. (MA 159)	Body of pubis, tendinous arch of obturator fascia, and ischial spine	Perineal body, coccyx, anococcygeal ligament, walls of prostate or vagina, rectum, anal canal	Help to support pelvic viscera and resist increases in intraabdominal pressure. The pubococcygeus relaxes in defecation, micturation and (in females) parturition.
(1) Pubococcygeus	Ditto	Ditto	Anterior half of the white line; posterior surface of the body of the pubis		This is the main part of the levator ani (MA 151). The pubococcygeus relaxes in defecation, micturation and (in females) parturition.
(2) Puborectalis	Ditto	Ditto			The puborectalis forms a U-shaped muscular “sling” around the anorectal junction (MA 151).
(3) Iliococcygeus	Ditto	Ditto	Posterior half of the tendinous arch of the levator ani (white line), and the pelvic surface of the ischial spine	Side of coccyx and the anococcygeal ligament and raphe	The iliococcygeus is often poorly developed (MA 151).

Notes

The **urogenital diaphragm** consists of the deep transverse perineus mm. and the sphincter urethrae m. (MA 176-7; CL 272). Anteriorly the UG diaphragm ends in the transverse perineal ligament (which is posterior to the pubic symphysis) (NE 333, 335). The **urogenital hiatus** is the space (left by the puborectalis m.) anterior to the rectum, posterior to the pubis (MA 180).

The **pelvic diaphragm** consists of the levator ani m. and coccygeus m. (MA 149). The pelvic diaphragm is superior to the urogenital diaphragm.

See CL 272-3 for good illustrations.

See NE 332 for illustrations of the **pelvic inlet** and **pelvic outlet**.

The **pubodanal canal (of Alcock)** is a fibrous tunnel in the obturator internus fascia that lies in the lateral wall of the ischioanal fossa (MA 181). The canal begins at the posterior border of the ischioanal fossa and runs from the lesser sciatic notch adjacent to the ischial spine to the posterior edge of the urogenital diaphragm. Through this canal there course:

1. Internal pudendal a. and v.
2. Pudendal n.
3. Nerve to the obturator internus

Clinical correlations

The prevesical **retropubic space (of Retzius)** is located posterior to the pubic symphysis and anterior to the urinary bladder in both males and females (CL 261, 283, 286, 289; NE 368).

Fascia

Note the location of peritoneum at its most inferior locations in the male and female (MA 159-61). In the female it forms several infoldings or pouches (CL 261):

- Vesicouterine pouch between the urinary bladder and the uterus
- Rectouterine pouch (of Douglas) between the uterus and the rectum

In the male there are fewer pouches (CL 286; NE 368):

- Rectovesical pouch between the urinary bladder and the rectum

The **perineal membrane** is the inferior fascia of the urogenital diaphragm (see e.g. NE 333).

Nerves

Pudendal nerve has several branches (CL 277, 301)

- I. Inferior rectal n.
- II. Perineal n.
 - A. Dorsal n. of penis/clitoris
 - B. Posterior scrotal/labial n.

Arteries

The iliac artery is an important supply to the pelvic viscera and to the perineum. There are differences between the male and female (the differences between the two are boldfaced in the outlines below), and there is also a degree of anatomic variation within each (see e.g. CL 266).

Male (CL 287; NE 247, 369, 374)

- I. Common iliac a.
 - A. External iliac a. (NE 247) (continues as the femoral a. in the thigh)
 1. Deep circumflex iliac a.
 2. Inferior epigastric a. (anastomoses with superior epigastric a.)
 - B. Internal iliac a.
 1. Anterior division
 - a. Umbilical a.
 - i. Superior vesical a.
 - ii. Umbilical a. continues as obliterated umbilical a.
 - b. Obturator a.
 - c. Inferior vesical a.
 - i. Middle rectal a.

ii. **Prostatic a.**

d. Inferior gluteal a.

e. Inferior rectal a.

f. Internal pudendal a.

i. Perineal a.

• **Posterior scrotal a.**

• Transverse perineal branches

ii. Artery of bulb (of penis)

iii. Urethral a.

iv. Dorsal aa. (of penis)

iv. Deep dorsal aa. (of penis) are the terminal branches of the internal pudendal a. (CH 202)

2. Posterior division

a. Iliolumbar a.

i. Iliac branch (supplies iliacus m., ilium)

ii. Lumbar branch (supplies psoas major m., quadratus lumborum m.)

b. Lateral sacral a. (gives off spinal branches which supply the sacrum)

c. Superior gluteal a.

i. Superficial branch (supplies the gluteus maximus m.)

ii. Deep branch (supplies the gluteus maximus, medius and minimus mm., and the tensor fasciae latae m.)

Female (CL 266; NE 247, 369, 371, 373)

I. Common iliac a.

A. External iliac a. (NE 247) (continues as the femoral a. in the thigh)

1. Deep circumflex iliac a.

2. Inferior epigastric a. (anastomoses with superior epigastric a.)

B. Internal iliac a.

1. Anterior division

a. Umbilical a.

i. Superior vesical a.

ii. Umbilical a. continues as obliterated umbilical a.

b. Obturator a.

c. **Uterine a.**

i. **Vaginal a.**

d. Inferior vesical a.

i. Middle rectal a.

e. Inferior gluteal a.

f. Inferior rectal a.

g. Internal pudendal a.

i. Perineal a.

- **Posterior labial a.** (CL 176, 177, 177)

- transverse perineal branches

ii. Artery of bulb (of clitoris)

iii. Urethral a.

iv. Dorsal aa. (of clitoris)

iv. Deep dorsal aa. (of clitoris) are the terminal branches of the internal pudendal a. (CH 202)

2. Posterior division

a. Iliolumbar a.

i. Iliac branch (supplies iliacus m., ilium)

ii. Lumbar branch (supplies psoas major m., quadratus lumborum m.)

b. Lateral sacral a. (gives off spinal branches which supply the sacrum)

c. Superior gluteal a.

i. Superficial branch (supplies the gluteus maximus m.)

ii. Deep branch (supplies the gluteus maximus, medius and minimus mm., and the tensor fasciae latae m.)

On anatomy practical exams a frequently tagged structure is the **superior gluteal a.** (which arises from posterior division of the internal iliac a.). This can be identified because it **passes between the lumbosacral trunk and the first sacral nerve**, entering the buttock through the greater sciatic foramen above the piriformis m. (CH 93; GR 723). To get an idea of what the lumbosacral trunk will look like, see the illustrations in NE 250, 381, 462; CL 266; RY 432. For illustrations depicting the superior gluteal a. passing between the lumbosacral trunk and the first sacral nerve see MA 158; NE 465; RY 319; GR 1111 fig. 7.214.

The **inferior gluteal a.** (which arises from the anterior division of the internal iliac a.) **passes between S1 and S2** (MA 158; NE 465).

Osteology

Note differences between male and female pelves (MA 147; CL 252-3).

The piriformis m. takes origin in a “three-fingered glove” formation around the 2nd and 3rd sacral foramina (according to Dr. Ashiru; also see CL 271; NE 333).

The **auricular surface** (Dr. Lieska’s term) is the articulation between the sacrum and each hemipelvis (CL 428; NE 145, 147). (Clemente p. 250 also calls this the “articular surface.”)

Various nerves pass through the dorsal and ventral foramina of the sacrum.

Ligaments

The **sacrotuberous lig.** connects the sacrum and the ischial tuberosity, forming the **greater sciatic foramen** (whose bony part is the greater sciatic notch). Through the greater sciatic foramen there pass numerous structures:

- Piriformis m. (CL 330)
- Major branches of the sacral plexus (MA 152)
- Sciatic n. (MA 239)
- Posterior femoral cutaneous n. (MA 243)
- Pudendal n. (MA 243)
- N. to quadratus femoris (MA 243)
- N. to obturator internus (MA 243)
- Superior and inferior gluteal n. (MA 243)
- Superior and inferior gluteal vv. (MA 242)
- Superior and inferior gluteal aa. (MA 242, 245)
- Internal pudendal a. and v. (MA 245)

The **sacrospinous lig.** connects the sacrum and the ischial spine, forming the **lesser sciatic foramen** (whose bony part is the lesser sciatic notch). Through the lesser sciatic foramen there pass only:

- Obturator internus m. (MA 149)
- Pudendal n. (MA 239) (Yes, it passes through *both* the greater and lesser sciatic foramina)
- Internal pudendal a. and v. (CL 331) (Yes, it passes through *both* the greater and lesser sciatic foramina)

On the anterior side of the sacrospinous ligament there lies the coccygeus m. The dorsal side of the sacrospinous lig. is a whitish fibrous tissue; in other mammals this is the beginning of the tail.

Landmarks

The **pelvic brim** (or **linea terminalis**, CL 253) divides the **major (or false) pelvis** (superiorly) from the **minor (true) pelvis** (inferiorly). The linea terminalis consists of the sacral promontory (posteriorly), the arcuate lines (laterally), and the iliopectineal lines (anterolaterally).

The **walls of the pelvis** are formed by the obturator internus m. (=lateral wall), the piriformis m. (=posterior wall) and the pubic bone and pubic symphysis (=anterior wall).

The **ischioanal fossae** (or **ischiorectal fossae**) at the sides of the anal canal are large fascia-lined, wedge-shaped spaces between the skin of the anal region and the pelvic diaphragm (MA 178). Pathological processes can extend through the anterior recess of these fossae (NE 368).

URINARY BLADDER

Muscle	Innervations	Blood supplies	Origins	Insertions	Actions
External urethral sphincter (sphincter urethrae)	Deep branch of perineal n. (which in turn is a branch of the pudendal n., S2-S4)	Vesical a. (?)	Inferior pubic ramus	Surround urethra; in females, some fibers also enclose vagina	Compress urethra (also compresses vagina in females)
Internal urethral sphincter (sphincter vesicae, CH 210) (which is part of the detrusor m.; MA 158)	Pelvic splanchnic nn. (S2-S4) (MA 154) [parasympathetic] Sympathetic fibers from T11-L2 (MA 161)	(?)			

Notes

The four sides of the urinary bladder (viz. one superior, one posterior, and two inferolateral) give it the shape of a three-sided pyramid (in theory), though it is always more or less rounded (MA 156-7).

The **trigone** is the smooth triangular area at the base of the urinary bladder. At the “angles” of this triangle are the two orifices of the ureters (posterolaterally) and the internal urethral orifice (inferoposteriorly) (CL 262, 288; CH 209).

In the male the **urethra** consists of three segments: (1) prostatic urethra, (2) membranous urethra, (3) bulbar (or spongy or penile) urethra. The female urethra only consists of a short membranous portion.

Clinical correlations

Ureteric calculi (kidney stones) can cause complete or intermittent **obstruction of urinary flow** (MA 156).

If the urethra is obstructed and cannot pass urine, the urine can be aspirated by inserting a needle immediately superior to the pubic symphysis. If done properly, the needle will avoid piercing the peritoneum (CL 286), since the distended bladder expands superiorly (above the pubic symphysis) and pushes the peritoneum upwards (MA 157).

In the male, the juncture of the membranous urethra and the spongy urethra is subject to injury by shearing forces (e.g. in “straddle” injuries; MA 184).

The significance of the prevesical **retropubic space (of Retzius)** (CL 261, 283, 286, 289; NE 368) lies in the fact that an effusion of fluid (extravasation) into it, as from a **rupture of the bladder**, can spread laterally as far as the internal iliac arteries and upward into the extraperitoneal space at the sides of the pelvic and abdominal cavities (SH 187). (Note that the symptomatology differs from that of a ruptured urethra!)

Fascia

Peritoneum is applied to the superior surface of the urinary bladder.

Nerves

Main motor innervation: parasympathetic, from pelvic splanchnic nn. (S2, S3, S4). Most of the bladder consists of the **detrusor m.** whose fibers form (at the neck of the bladder) the involuntary **internal sphincter**. Micturation is carried out by a reflex contraction of the detrusor m. (MA 158; CH 209).

Arteries

The urinary bladder is supplied by **superior vesical aa.** (from the anterior division of the internal iliac aa.) (MA 161).

In the male, the urinary bladder is also supplied by the **inferior vesical a.** (also from the anterior division of the internal iliac aa.). (This is homologous to the uterine a. in females.)

In females the uterine a. and the ureter course together. At the point at which the ureter enters the bladder, the uterine a. is superior while the ureter is inferior (CL 265).

Ligaments

The neck of the urinary bladder is held firmly by the **puboprostatic ligaments** (in the male) or the **pubovesical ligaments** (in the female) (MA 157; CL 286).

Landmarks

When empty, the urinary bladder lies flat against the pubis and does not extend above the pubis. When distended, the urinary bladder extends superiorly, pushing up the peritoneum which overlies it.

Mnemonics

Concerning the relative positions of the uterine a. and ureter when the ureter enters the bladder in females: “(Uterine) artery is above, ureter is underneath.”

TESTIS

Notes

Clinical correlations

A **deferentectomy** (vasectomy) sterilizes the male by severing or ligating the vas deferens (MA 93, 164).

A **varicocele** is a condition in which there is an enlargement (varicosity) of the veins of the spermatic cord, resulting in the “bag of worms” appearance of the scrotum (CH 203; CIBA 68).

Fascia

The **tunica albuginea** (NE 362).

Arteries

Testicular aa. (paired branches from the abdominal aorta).

Veins

The left testicular v. is tributary to the left renal v. The right testicular v. is tributary to the inferior vena cava (NE 372; MA 128).

Ligaments

The descent of the testes during fetal development is guided by the **gubernaculum** (SA 306). This is homologous to the round ligament of the uterus and the proper ovarian ligament in the female.

PENIS

Muscle	Innervations	Blood supplies	Origins	Insertions	Actions
Ischiocavernosus (CL 281)	Perineal br. of the pudendal n. (S2-4)	(?)	Inner surface of the ischial tuberosity behind the crus penis and from the ramus of the ischium on each side of the crus	Fibers end in an aponeurosis attached to the sides and under surface of the corpus cavernosum on each side as they join to form the body of the penis	Compress the crus penis and thereby helps to maintain erection
Bulbospongiosus	Ditto	(?)	From the perineal body and the ventral extension of the perineal body that forms a median raphe between the two bulbocavernosus mm.	<i>Posterior fibers:</i> end in connective tissue of the fascia of the UG diaphragm. <i>Middle fibers:</i> encircle the bulb of the penis and the corpus spongiosum. <i>Anterior fibers:</i> spread over the side of the corpus cavernosum and extend anteriorly as a tendinous expansion over the dorsal vessels	Aid in emptying the urethra at end of urination; by compressing the dorsal vein, it also helps maintain penile erection; contracts during ejaculation

Notes

The erectile tissue consists of the bilateral **corpora cavernosa** (into which blood can be forced by contraction of the ischiocavernosus mm.) and the **corpus spongiosum** (through which passes the urethra) (NE 355; CL 300-1, 308). The **glans penis** is a continuation of the corpus spongiosum (CL 305). The glans penis is homologous to the clitoris (NE 389).

The proximal continuation of the corpora cavernosa are the **crura**, which are attached to the rami of the ischium and pubis (CL 305).

The **bulbourethral glands** are pea-sized structures located in the urogenital diaphragm. The duct of each gland passes through the inferior fascia of the urogenital diaphragm and joins the initial portion of the penile urethra. Its secretions serve as a lubricant of the penile urethra during coitus (RRK 664). They are homologous to the greater vestibular glands (of Bartholin) in the female.

During coitus the following events occur (MA 185-6):

1. **Erection**, in response to erotic stimulation, results when the smooth muscle in the fibrous trabeculae and coiled arteries relaxes due to *parasympathetic stimulation* (S2-S4 nerves). As a result the arteries dilate and their lumina enlarge, allowing blood to flow into the erectile tissues (corpora cavernosa and corpus spongiosum).
2. **Emission** is a *parasympathetic response* (L1 and L2 nerves). Semen is delivered (sperms and glandular secretions) to the prostatic urethra through the ejaculatory ducts after peristalsis of the ductus deferentes and seminal vesicles. Prostatic fluid is added to the seminal fluid as the smooth muscle in the prostate contracts.
3. **Ejaculation** is the expulsion of semen from the urethra through the external urethral orifice. This involves three processes:
 - a. Closure of the vesical sphincter at the neck of the bladder so that urine will not pass (*sympathetic response*, L1 and L2).
 - b. Contraction of the urethral muscle (*parasympathetic response*, S2-S4 nerves).
 - c. Spasmodic contraction of the bulbospongiosus muscles (pudendal nerves, S2-S4).

Fascia

The **tunica albuginea** envelops both the corpora cavernosa and the corpus spongiosum (CH 199).

The **deep fascia of the penis (Buck's fascia)** encloses the erectile tissues (and their tunica albuginea), as well as the deep dorsal v., the dorsal aa. and dorsal nn.

Nerves

Dorsal n. of the penis is a branch of the pudendal n. (MA 181).

The scrotum is innervated by (CH 199):

1. The anterior scrotal b. of the ilioinguinal n.
2. The genital b. of the genitofemoral n.
3. The posterior scrotal b. of the perineal b. of the pudendal n.
4. The perineal b. of the posterior femoral cutaneous n.

Arteries

Dorsal a.

Deep aa. pass through the corpora cavernosa.

See NE 374 for arterial supply to prostate

Veins

Superficial dorsal v. of the penis is tributary to the external (superficial) pudendal veins, which in turn drain into the greater saphenous v. (CH 203).

Deep dorsal v. of the penis (deep to the tunica albuginea and to Buck's fascia) drains the corpora cavernosa; it is tributary to the prostatic and pelvic venous plexuses (CH 203).

OVARY and UTERUS

Notes

The uterus is **peritonealized**: "The perimetrium is continuous with the pelvic and abdominal peritoneum" (RRK 694).

The normal position of the uterus is anteverted and anteflexed (CH 214). However, it can occupy different positions (NE 348), some of which may interfere with pregnancy. ("Ante-/retroversion" refers to the angle between the vagina and the cervix; "ante-/retroflexion" refers to the angle between the cervix and the body of the uterus.)

The ovary is located in the **ovarian fossa**.

The **fallopian tube** consists of several parts (from the ovary to the uterus): **infundibulum** (with its **fimbriae** extending towards the ovary), **ampulla** (which is the longest segment of the tube) and **isthmus** (NE 346; CL 262-4). Fertilization generally occurs in the ampulla near the junction with the isthmus (RRK 694).

The **cervix** is the distal, inferior part of the uterus; its widest part is called the **cervical canal**. The narrowing between the body of the uterus and the cervix is called the **internal os**. The narrowing between the cervix and the vagina is called the **external os** (NE 346; CH 214; MA 171).

The uterus has three layers (from external to internal): perimetrium, myometrium and endometrium.

During coitus, “vascular erectile tissue beneath the clitoris is activated by parasympathetic impulses[...] Orgasm results from spinal cord reflexes that are similar to those involved in male ejaculation. Orgasm consists of involuntary contractions of the skeletal muscle of the perineum; of the musculature of the vagina, uterus, and fallopian tubes, and of the rectal sphincter. After orgasm the cervix remains widely patent for up to 30 minutes. This permits rapid entrance of a first wave of sperm into the uterus” (BL 606-7). During orgasm, the uterus “undergoes contractions similar to labor” (ST 253 fig. 7-5C). In a pregnant woman, this does not expel the fetus because orgasm, alas, is relatively transient in comparison to the extended contractile activity of labor (which is hormonally mediated).

Clinical correlations

The **nerve to the obturator internus** courses immediately posterior to the ovary (in the ovarian fossa). During ovulation, the ovary expands and can impinge upon this nerve, causing referred pain in the medial aspect of the thigh. (RRK 692 says that the pain is conveyed through the ovarian plexus to the dorsal root ganglia of the first lumbar spinal nerves and is perceived over the cutaneous distribution of these spinal nerves.)

A **hysterectomy** (which involves making an incision immediately superior to the pubis) must be done when the bladder is empty, otherwise the incision will pierce the bladder.

Delivery by **cesarian section** must be done when the bladder is empty. Note that a cesarian section *does* go through the peritoneum, and hence entails risk of infection and peritonitis.

Weakness of the uterine ligaments can lead to **prolapse of the uterus** (through the vagina) (CH 220).

Vesical vaginal fistulae can allow urine to leak into the uterus and vagina.

The ovaries are actually in the pelvic cavity. During ovulation, the ovum must pass from the ovary into the ampulla of the fallopian tube, and hence must traverse a small space in the pelvic cavity. If fertilization occurs before the ovum reaches the ampulla, an **ectopic pregnancy** can occur (SA 48-50; RRK 685-6).

Arteries

The **ovarian aa.** (paired branches from the abdominal aorta) supply the ovaries.

The **uterine a.** (from the anterior branch of the internal iliac aa.) supplies the uterus. (This is homologous to the inferior vesical a. in males.) The uterine a. also gives off a vaginal branch.

See CL 264 for arterial supply to uterus.

Veins

The left ovarian v. is tributary to the left renal v. The right ovarian v. is tributary to the inferior vena cava (NE 371).

Ligaments

Each ovary is attached to the posterior surface of the broad ligament of the uterus by a peritoneal fold, the **mesovarium** (RRK 678). The superior pole of the ovary is attached to the pelvic wall by the **suspensory ligament of the ovary** (CL 262). The inferior pole of the ovary is attached to the uterus by the **ovarian ligament** (RRK 678-9).

The embryonic **gubernaculum** gives rise to the **proper ovarian ligament** (RRK 679) and the **round ligament of the uterus** (SA 309).

The uterus is “suspended” in position by several ligaments (NE 347; CH 208-9; RRK 679; CL 262-4).

1. **Ovarian ligaments** connect the inferior pole of the ovary to the uterus.
2. **Round ligaments of the uterus** course through the inguinal canals and attach to the labia majora. It is homologous to the gubernaculum in males (SA 306)
3. **Transverse cervical ligaments (of Mackenrodt)** connect the upper vagina and uterine cervix to the lateral pelvic wall.
4. **Uterosacral ligament** connects the upper vagina and uterine cervix to sacral vertebrae Sv2-4.

The **broad ligament of the uterus** is composed of two layers of mesentery which “sandwich” the uterus. However, these layers extend beyond the uterus, and where the two layers are in direct contact they form three mesenteric areas (NE 346):

1. **Mesosalpinx** is inferior to the fallopian tube and superior to the ovary.
2. **Mesovarium** is immediately superior to the ovary.
3. **Mesometrium** is lateral to the uterus and cervix, and inferior to the ovary

Mnemonics

Concerning the relative positions of the uterine a. and the ureter: “(Uterine) artery is above, ureter is underneath.”

VAGINA

Muscle	Innervations	Blood supplies	Origins	Insertions	Actions
Ischiocavernosus (CL 281)	Perineal br. of the pudendal n. (S2-4)	(?)	Inner surface of the ischial tuberosity behind the crus clitoridis and from the adjacent part of the ramus of the ischium	Fibers end in an aponeurosis which inserts onto the sides and under surface of the crus clitoridis	Compress the crus clitoridis retarding the return of blood and thereby helping to maintain erection of the clitoridis
Bulbospongiosus	Ditto	(?)	Fibers attached posteriorly to the perineal body	Fibers pass anteriorly around the vagina and are inserted into the corpora cavernosa clitoridis	Decrease the orifice of the vagina; anterior fibers assist erection of the clitoridis by compressing the deep dorsal vein of the clitoridis

Notes

The **greater vestibular glands (of Bartholin)** lie in the superficial perineal pouch in the female under cover of or behind the vestibular bulbs. They secrete mucus that lubricates the vagina during coitus. They are homologous to the bulbourethral glands in the male (CH 196).

The **gland clitoridis** is homologous to the glans penis (NE 389).

The **fornix** is the recess between the cervix and the wall of the vagina (CH 214). The posterior **fornix reaches** superiorly to lie in front of the rectouterine pouch (of Douglas) (CL 258).

Arteries

The vagina is supplied by (CL 264):

- the **vaginal branch** of the inferior vesical a. (← anterior division of internal iliac a.)
- the **vaginal a.** (a branch from the uterine a. ← anterior division of internal iliac a.)

Veins

The **superficial dorsal v. of the clitoridis** is tributary to the greater saphenous v.

The **deep dorsal v. of the clitoridis** is tributary to vesicular v.

RECTUM and ANAL CANAL

Muscle	Innervations	Blood supplies	Origins	Insertions	Actions
External anal sphincter (MA 186)	Inferior rectal n. (S4)	Internal pudendal a. (?) (MA 159)	Skin and fascia surrounding anus and coccyx via anococcygeal ligament	Perineal body	Close anal canal
Internal anal sphincter (MA 181)	pelvic splanchnic nn. (S2-S4) (MA 154) [parasympathetic]	Ditto			

Notes

The internal anal sphincter and external anal sphincter are separated by the intermuscular groove called **Hilton's white line** (CH 215; NE 365 calls this the "anocutaneous line").

The anorectal flexure is maintained by the puborectalis m. (part of the levator ani m.).

The **pectinate line** marks an important division in the rectum (SH 189; SA 268-9):

Characteristic	Proximal to pectinate line	Distal to pectinate line
Embryological derivative	Endoderm	Ectoderm
Blood supply	Inferior mesenteric a.	Internal iliac a.
Venous drainage	Portal v.	Inferior vena cava
Nerve supply	Autonomic	Somatic
Lymphatic drainage	Internal iliac	Inguinal

The rectum is "S"-shaped and has three sharp flexures as it follows the sacrococcygeal curve. At each of the three concavities formed by the flexures there are infoldings (**transverse rectal folds**) of the mucous and submucous coats and most of the circular muscle layer of the rectal wall (MA 173).

Clinical correlations

In the male, a **digital rectal examination** can palpate (see Dr. Ashiru's handout and CH 221):

Directly anterior to the rectum:

- Bulb of penis
- Membranous urethra

Anterior to the rectum, 4cm above the anus:

- Prostate
- Seminal vesicles
- Base of bladder

Posterior to the rectum:

- Lower sacrum and coccyx

Lateral to the rectum:

- Ischial spine
- Ischial tuberosity
- Enlarged lymph nodes

In the female, a digital rectal examination can palpate:

- Uterine cervix
- Ovaries, uterine tubes, broad ligament of the uterus
- Recto-uterine pouch (of Douglas)

Nerves (MA 175-6)

Sympathetic supply from the lumbar part of the sympathetic trunk and the superior hypogastric plexus.

Parasympathetic supply from the pelvic splanchnic nn. (S2-S4).

Arteries (MA 173-4 and Dr. Ashiru's handout)

For an illustration of the arterial supply to the rectum see CL 294.

Two unpaired arteries:

- The **middle sacral a.** (from the abdominal aorta)
- The **superior rectal a.** (from inferior mesenteric a.) supplies the proximal part of the rectum.

Two paired arteries:

- The **middle rectal aa.** (anterior division of the internal iliac a.) supply the middle and inferior parts of the rectum.
- The **inferior rectal aa.** (from the internal pudendal a. ← anterior division of internal iliac a.) supply the distal part of the rectum.

Veins

Blood drains into the **superior, middle and inferior rectal vv.**

The superior rectal v. constitutes an element of the portocaval anastomotic system (MA 174).

See CL 295 for venous drainage of rectum.

Landmarks

The level of Sv3 marks the transition between the sigmoid colon and the rectum.