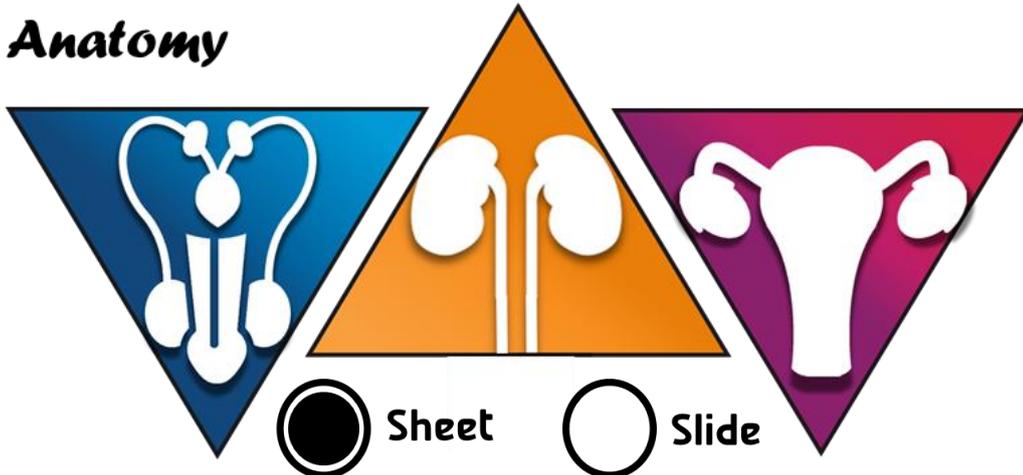




Urogenital system

Anatomy



Number:

- 2

Done by:

- Dana Alrafaiah

Corrected by:

- Amani Nofal

Doctor:

- Ahmad Alsalman

This lecture will discuss five topics as follows:

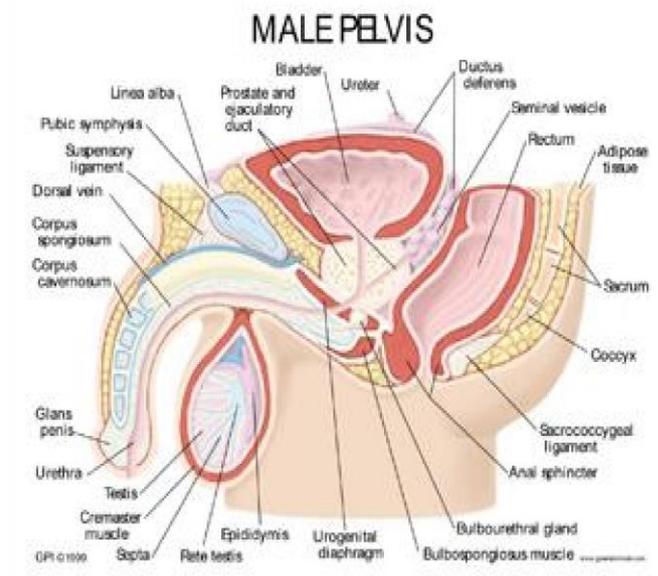
- 1- Arrangement of pelvic viscera.
- 2- Muscles of Pelvis.
- 3- Blood Supply of pelvis.
- 4- Nerve Supply of the Pelvis.
- 5- Lymph Drainage of the Pelvis.

Arrangement of pelvic viscera

In males:

Anteriorly we find the symphysis pubis, and most posteriorly are the sacrum and the coccyx. The viscera of the pelvis will be found between them.

Immediately Behind the symphysis pubis are the urinary bladder and the urethra. Around the urethra we find a gland called the **prostate gland**. Following the urinary bladder, we find the rectum and the anal canal.

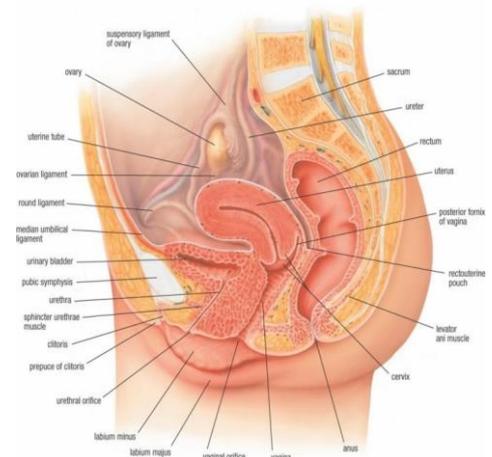


The peritoneum (serous membrane which lines the abdominal cavity) descends and covers the front and sides of upper third of the rectum, then reflects over to cover the superior surface of the urinary bladder. This reflection forms a pouch called **rectovesical pouch**. After that, the peritoneum ascends to cover the anterior abdominal wall.

FEMALE UROGENITAL SYSTEM (MIDSAGITTAL VIEW)

In females:

As in males, we have the symphysis pubis anteriorly and the sacrum and coccyx posteriorly. The urinary bladder and the urethra also lie behind the symphysis pubis, however, there are no prostate glands in females.



In females, the uterus and the vagina (which is located below it) are behind the urinary bladder. Then we find the rectum and anal canal.

The peritoneum descends to cover the front and sides of upper third of the rectum. However, this time it reflects and covers the uterus forming a pouch called **rectovaginal pouch** or **Douglas pouch**. Then it reflects again from the uterus to the urinary bladder forming another pouch called **uterovesical pouch**.

So, in females we have two pouches: rectovaginal and uterovesical pouches. While in males we only have one: rectovesical pouch.

Piriformis fascia: is a part of parietal pelvic fascia

Anteriorly related to it internal iliac vessels

Posteriorly related to it sacral nerves

Muscles of the pelvis

We have two types of muscles in the pelvis: muscles of the wall and muscles of the floor.

The muscles of the wall are two: **obturator internus muscle**, which covers the obturator foramen, and **piriformis muscle**, which emerges from the sacrum and leaves through the sciatic foramen to enter the lower limb. (Those muscles are not of our concern in this course).

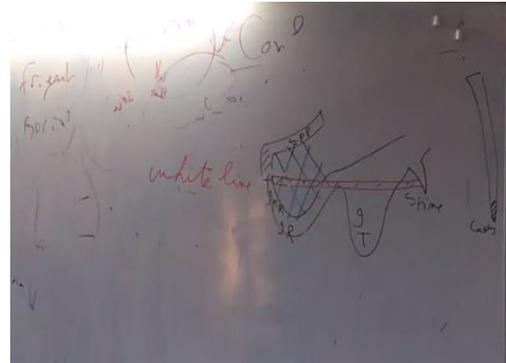
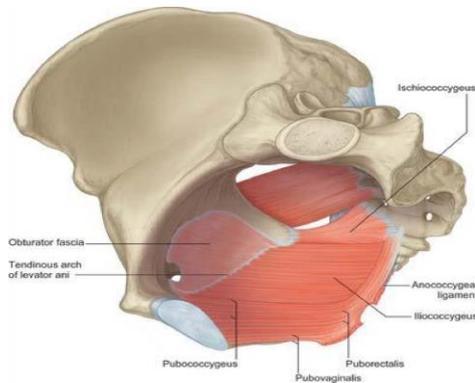
The muscles of the floor are also two: the main large muscle **Levator ani**, and the small muscle **Coccygeus**.

Follow this diagram; note the superior pubic ramus, below it the body of the pubis and inferiorly we find the ischial ramus. Extending behind the ischial ramus is the ischial tuberosity and after it we have the ischial spine. Finally, note the sacrum and coccyx most posteriorly.

Notice also the obturator foramen. As mentioned previously, it is covered by obturator internus muscle, this muscle will be covered by a fascia called **obturator fascia**. This fascia



thickens extending from the pubic bone to the ischial spine. This thickening is called **the white line**. The white line will give origin to Levator ani muscle (will take origin from the pubic bone, the white line and ischial spine). It will also separate the pelvis from the perineum; above the line is the pelvis and below it is the perineum.



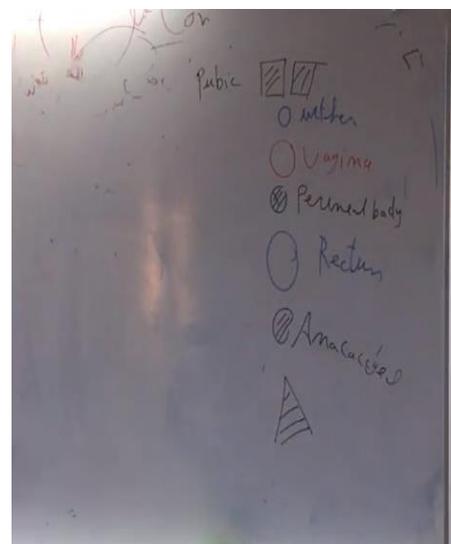
Levator ani muscle is further divided into two parts: **Pubococcygeus** and **Iliococcygeus**.

Pubococcygeus is located anteriorly and takes origin from the body of the pubis and first half of the white line, it is also further divided into three parts. While iliococcygeus is located posteriorly and takes origin from the other half of the white line and the ischial spine.

Let's take a superior view of pubococcygeus in a female:

First, we will arrange the structures once again: most anteriorly we find the pubic bone, followed by the urethra, vagina, rectum and anal canal and most posteriorly we find the coccyx.

We will also add two structures: the **perineal body** between the vagina and the rectum, and the **anococcygeal body** (raphe) between the rectum and the coccyx. Both of these bodies are fibrous masses. The perineal body has the muscle of the perineum attached to it, and in males it locates between the rectum and

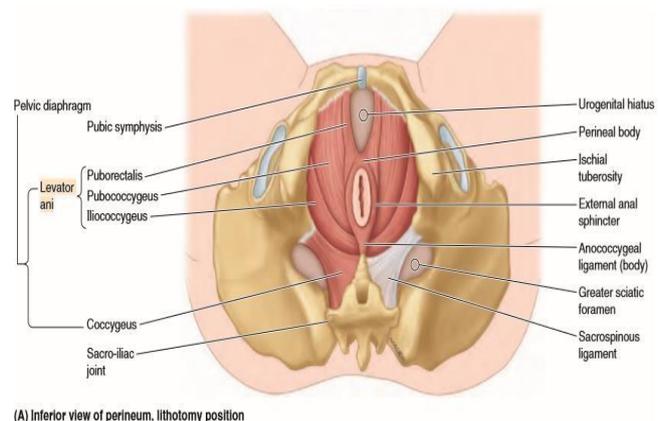
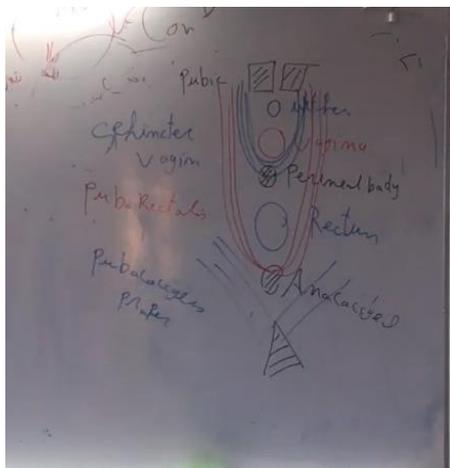


the bulb of the penis instead of the vagina. The anococcygeal body is a fibrous band located where noted.

We said that pubococcygeus is divided into three parts that extend from the pubic bone, the first part attaches to the perineal body and goes around the vagina forming **Sphincter vaginae**. In males it goes around the prostate and is called **Levator prostate**. Both inserted into **perineal body**

The second part goes around the rectum and attaches to the anococcygeal body to form **puborectalis** (between pubic bone and rectum).

The third part inserts on the anococcygeal body and is called **pubococcygeus proper**.



The second part of the Levator ani muscle is the iliococcygeus, which is like a layer below the pubococcygeus proper; it is in the same place and has the same insertion: the anococcygeal body and coccyx. They differ only in the origin, as iliococcygeus originates from the last half of the white line and the ischial spine.

The other muscle of the pelvic floor (or pelvic diaphragm) is the coccygeus, which originates from the ischial spine and inserts on the coccyx.

Functions of the pelvic floor/ diaphragm:

- Support of pelvic viscera (keeps it in place).
- Formation of sphincters like sphincter vaginae.

- Sphincter like function, as what the puborectalis does; it pulls the area between the rectum and anal canal acting like a sphincter canal.
- Resistance of increase in intrapelvic pressure.

Injury to pelvic floor/ diaphragm:

pelvic viscera will move out of its place leading to **prolapse**: a condition where organs fall or slip out of place and appear externally, for example: the uterus could emerge through the vagina, the rectum through the anal canal and in severe cases the urinary bladder can also slip out of place.

Prolapse can occur during labour. It can also result in **stress incontinence**; which is a condition where an injury to Levator ani muscle causes the neck of the bladder to move out of place. In this case, any increase in intrabdominal pressure, like sneezing, coughing and laughing, will lead to dripping of urine.

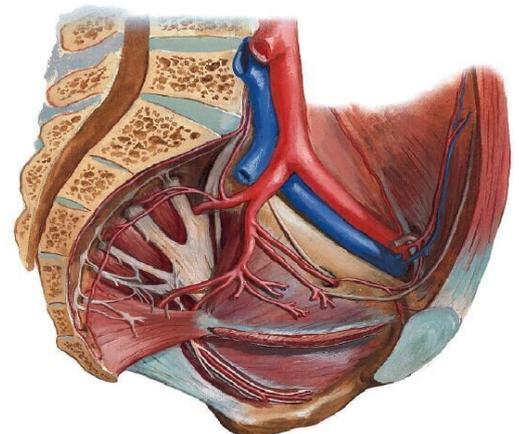
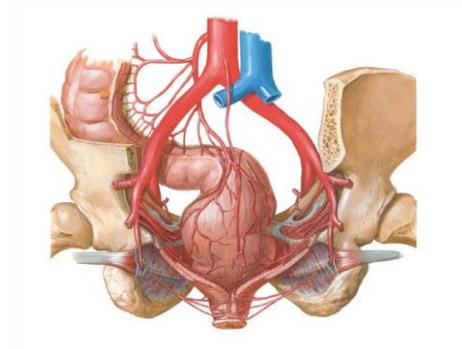
Note: stress incontinence has many other causes in addition to injury to Levator ani muscle.

Blood supply of the pelvis

The main artery of the pelvis is **internal iliac artery**, other smaller branches include ovarian artery, middle sacral artery and superior rectal artery.

The abdominal aorta gives common iliac artery, which has two branches: external iliac artery and internal iliac artery.

The internal iliac artery starts at the lumbosacral disc between “last lumbar vertebra (L5) and sacrum” and ends at a large notch called greater sciatic notch/foramen. The internal iliac artery will give two branches: anterior and posterior. These branches will give visceral branches to supply pelvic viscera, and parietal branches to supply pelvic wall. The anterior branch will give both visceral and



parietal arteries, while the posterior branch will only give parietal arteries.

Visceral Female blood supply:

- First branch is to urinary blood, called **superior vesicle artery**.
- Second and third branches are to supply the genital system of the female: **uterine branch** to the uterus and **vaginal branch** to the vagina.
- The middle part of the rectum receives the fourth branch, which is called **middle rectal artery**.

Note: remember the first part of the rectum received its blood supply from the superior rectal artery.

Visceral Male blood supply:

- As in females, first branch is **superior vesical** to urinary bladder.
- Instead of uterine and vaginal branches, in males we have an additional artery to the urinary bladder called the **inferior vesical artery**.
- The middle part of the rectum also receives **middle rectal artery**.

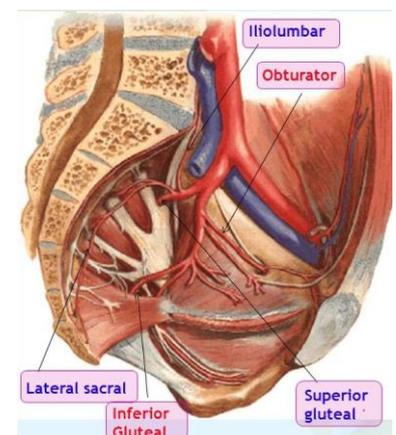
So, the urinary system in females receives only *one* branch (superior vesicle), while in males it receives *two* (superior and inferior vesicle), and the genital system in females receives *two* branches (uterine and vaginal), and *no* branches from the internal iliac reach the genital system in male. In conclusion, females have four branches of visceral blood supply, while males have three.

Remember: all visceral branches are from the anterior branch of internal iliac artery.

Parietal blood supply:

There are six parietal branches of the internal iliac artery, and they are the same in males and females.

- Obturator artery: anterior branch.
- Lateral sacral, which enters through sacral foramina to supply the sacral canal and emerge from dorsal sacral foramina: posterior branch.



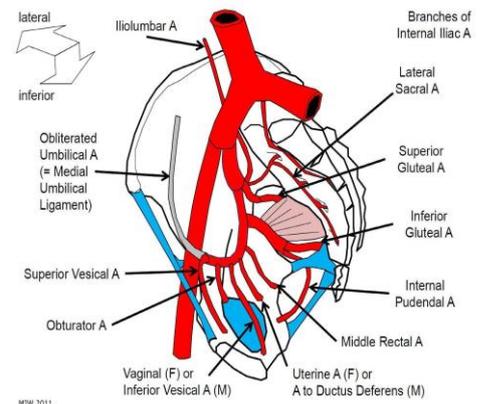
- Internal pudendal, to genitalia: anterior branch.
- Iliolumbar, to muscles of posterior abdominal wall; psoas major, iliacus and quadratus lumborum: posterior branch.
- Superior gluteal: posterior branch.
- Inferior gluteal: anterior branch.

Note: most of these branches will be discussed in more details in the genital part of the course.

So, anterior branches in MALES are: superior and inferior vesical, middle rectal, obturator, internal pudendal and inferior gluteal

Anterior branches in FEMALES: superior vesicle, uterine, vaginal, middle rectal, obturator, internal pudendal and inferior gluteal.

Remember: anterior branch gives both visceral and parietal, while posterior branch only gives parietal branches.



1) Superior Vesical A. (Obliterated Umbilical A.):

- *It was the umbilical artery in the fetus*
- *Its **proximal part is patent** (= superior vesical A.)*
- *It gives branches to the bladder, ureter and vas deference (In male).*
- *Its **distal part is fibrosed** form medial umbilical ligament which form the medial the medial umbilical fold of peritoneum.*

2) Inferior Vesical A. (Vaginal A. in the female):

- *It supplies base of the urinary bladder, seminal vesicle, prostate and **gives artery of the vas** which runs in the spermatic cord and anastomoses with the testicular artery.*
- ***In female:** The vaginal A. supplies the base of the bladder and gives vaginal branches which anastomose with vaginal branches from uterine A.*

3) Middle Rectal Artery:

- ❖ It supplies the musculosa of rectum, seminal vesicles and prostate in the male and vagina in the female.
- ❖ It anastomoses with other rectal arteries.

Venous drainage of the pelvis

Internal Iliac Vein:

- It begins opposite the upper part of greater sciatic foramen
- It ends at pelvic brim by joining the external iliac vein to form the common iliac vein
- It receives veins similar to the branches of internal iliac artery except the iliolumbar vein which ends in the common iliac vein.

N.B

- The internal iliac veins drain blood from the **pelvic viscera** by means of visceral veins and drain blood from the **internal vertebral venous** plexuses by means of the valveless lateral sacral veins.
- Increase in the pelvic pressure (e.g. coughing & straining) may cause reflux of blood backwards up to the internal vertebral venous plexuses.
- In this way, primary tumors in pelvic viscera give rise to secondaries in the lumbar vertebrae

Nerve supply of the pelvis

The nerve supply of any part of the body is composed of two: somatic supply and autonomic supply, sympathetic and parasympathetic.

Somatic supply:

The somatic nerve supply comes from two plexuses called sacral and coccygeal plexuses.

- Sacral plexus:

Remember: the other plexus present in the same area is the lumbar plexus (T12, L1-L4) which supplies the lower limb. This plexus is not of our concern in this course, however, one relevant information is that L4 with contribution from L5 gives roots that unite to form the lumbosacral trunk. We'll see next how it is relevant.

The sacral plexus is composed of the ventral rami of L4, L5 - the parts that are not involved in the formation of the lumbosacral trunk -, S1-S3 and part of S4.

Note: any plexus in the body is formed from ventral rami.

Somatic supply is for muscles or skin, and the large muscle we want to supply here is the Levator ani muscle along with coccygeus. The plexus also supplies the anal sphincter muscle and perineal skin through its perineal branch. Another one of its branches is the internal pudendal nerve which supplies the genitalia. Finally, the perforating cutaneous nerve supplies the skin of the buttocks.

Note: some branches of the sacral plexus will supply the lower limb.

Note: S2, S3 and S4 will give pelvic splanchnic nerve, which will provide parasympathetic supply to the pelvis. (Further discussed next).

- Coccygeal plexus:

Formed from the rest of S4, S5 and the coccygeal nerve (remember there's only one coccygeal nerve). Gives one nerve: anococcygeal nerve, which supplies the skin between the anus and coccyx.

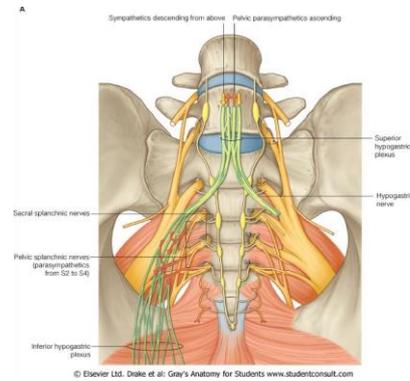
Question: a pregnant woman feels pain when she walks, why?

Compression of any of the nerves of the sacral plexus. (Sciatic, obturator and other branches that pass near the sacral plexus can be compressed too and result in pain).

Autonomic supply:

- Sympathetic supply:

It comes from the **sacral sympathetic plexus**, which has ganglia on either sides of the sacrum and unites at the end of it in front of the coccyx to form **ganglion impar**.



- Parasympathetic supply:

Remember: parasympathetic supply of the body is craniosacral.

As mentioned previously, S2, S3 and S4 give pelvic splanchnic nerve, which provides parasympathetic supply to the pelvis.

- Remember that autonomic supply doesn't reach the organs immediately, rather it relays first in a plexus to synapse. This plexus in the pelvis is called **inferior hypogastric plexus**; its sympathetic roots are from the sacral sympathetic plexus and superior hypogastric plexus

and its parasympathetic roots are through the pelvic splanchnic nerve. Postsynaptic fibres of this plexus will reach the pelvic organs (uterus, vagina, prostate etc) to supply them.

Note: Some branches will leave the plexus to the superior mesenteric plexus to supply the hindgut.

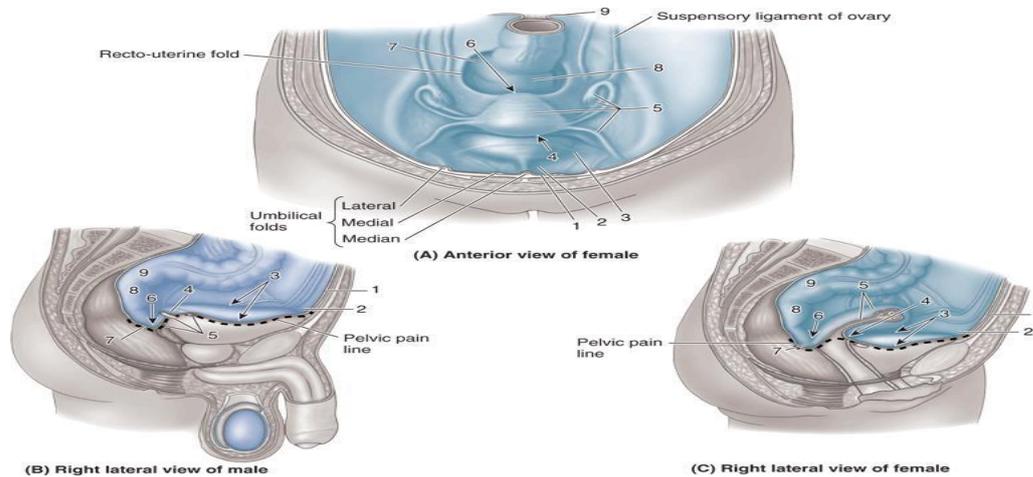
Pelvic pain line

Pain sensation in the pelvis is carried by autonomic fibers not somatic.

The pelvic pain line will separate between what is covered by the peritoneum, which will locate above the line, and what is not covered by the peritoneum, which will locate below it.

Pain in organs above this line (covered by peritoneum) is transmitted through sympathetic fibers, **EXCEPT** for the distal sigmoid colon and rectum while in organs below it (not covered by perineum) through parasympathetic fibers.

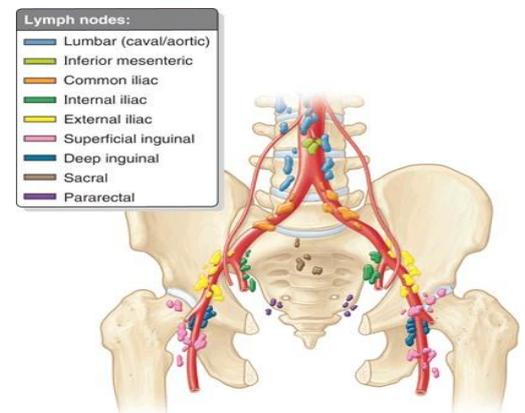
Example: Remember that only the superior part of the bladder was covered by the peritoneum (only upper part is above the pelvic pain line). This means that pain in the upper part is transmitted by sympathetic fibers while pain in the rest of the bladder is transmitted through parasympathetic fibers.



Lymphatic drainage of the pelvis

There are three major lymphatic groups in which the pelvis drains:

- Internal iliac lymph node around the internal iliac vessels.
- External iliac lymph node around the external iliac vessels.
- Sacral lymph node around lateral sacral vessels.



All these lymph nodes will drain into the common iliac lymph node and then into the lateral aortic lymph nodes.

Don't forget to refer to the slides

The End