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A. ORGANISATIONAL COMPONENT

1. Introduction

Welcome to the clinical anatomy component of block 11 (BOK 480). You are now regarded as an adult learner and thus it is expected of you to integrate knowledge from the previous blocks and to apply such knowledge, anatomically, to the clinical simulations.

2. Lecturers

Mrs. N Briers: R4-13, BMS building, Tel. 319-2631

E-mail: nbriers@up.ac.za

Consultation hours: Wednesdays 8h00 – 9h00 or per appointment

3. Timetable

Consult your block book, section 3 for dates and times.

4. Assessment

The following are examinable components:

- All theory
- Practical content

5. Study material

See study component for specific references.

6. General information

Section B of the practical guide is divided into two practical components. For each component you will find the following in the guide:

- A capability statement;
- References to embedded knowledge which you should have acquired from previous blocks;
- A set of critical outcomes for each component, which are organized into themes;

- A set of specific outcomes in the format required by the **South African Qualifications Authority (SAQA)** (Specific outcomes will be achieved by means of the contact sessions and assignments.);
- Each session is divided into a number of stations, which serve as the assessment criteria.

B. STUDY COMPONENT

SESSION I: Clinical Anatomy of the Reproductive System

UNIT THEME 1: THE FEMALE REPRODUCTIVE SYSTEM

SUB-SPECIFIC OUTCOMES:

This component of block XI is designed to enhance the development of multi-disciplinary knowledge and problem-orientated learning abilities in order to integrate anatomical concepts applicable to the reproductive system.

SUB-UNITS:

1. Support structures
 - a. Endopelvic fascia
 - b. Perineal fascia
 - c. Urogenital diaphragm
 - d. Pelvic diaphragm
 - e. Support of specific structures
2. Blood supply
 - a. Arterial supply and anastomoses
 - b. Venous drainage
3. Innervation
 - a. Pelvic nerves
 - b. Innervation of specific structures
4. Lymphatic drainage
5. Relations

EMBEDDED KNOWLEDGE:

The student must know and understand the following:

The basic anatomy of the urinary and genital systems covered in Syllabus theme three of GNK 288 (SA4) (Dissection Block).

All anatomical concepts covered in BOK 382 (Block 9) (Pregnancy and neonatology).

ASSESSMENT CRITERIA:

Self assessment

1. Make a thorough study of the parts of the female reproductive system.
2. Label diagrammatic sketches, radiological images and wet specimens illustrating any of the above-mentioned aspects or structures.

Peer assessment

You must be able to discuss the subunits with your fellow students.

Formative and summative evaluation

1. One test on this unit theme is written during the block.

ASSESSMENT PORTFOLIO:

Identification of the female genital system and solving clinico-anatomical problems related to these systems.

CRITICAL SKILLS:

The student must be able to:

1. Identify and name the parts of the genital system, and describe its macroscopic appearance and most important relationships.
2. Identify and name the external and internal male and female reproductive organs, and describe the structure and most important relationships of the organs.
3. List, identify and briefly explain how the pelvic content is supported.
4. Identify and describe the blood supply and innervation of the parts of the female genital system.
5. Label a diagrammatic sketch, radiology image and wet specimen of any part of the female genital system.
6. Explain the relationship between the surface anatomy of the female genital and the radiographic procedures used to demonstrate the system.
7. Identify the bony landmarks of the perineum relevant to clinical examination.
8. Explain the anatomy that underlies ectopic pregnancies.
9. Explain the clinical importance and organization of the blood supply, innervation and lymph drainage of the female genital system.
10. Explain the anatomically related complications and pain that may occur during the parturition process.
11. Identify levator ani and describe it regarding origin, insertion, action and innervation.
12. Describe the perineum with special reference to the content of the anal and urogenital triangles.
13. Explain the anatomy related to the treatment of an ischioanal abscess.
14. Describe the uterus and adnexa regarding the following:
 - Position
 - Macroscopic structure
 - Blood supply
 - Venous drainage
 - Innervation

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TERMINOLOGY:

cardinal ligament

HSG

proper ligament of the ovary

pudendal canal

ectopic pregnancy

normal variant

suspensory ligament of the ovary

surface anatomy

episiotomy

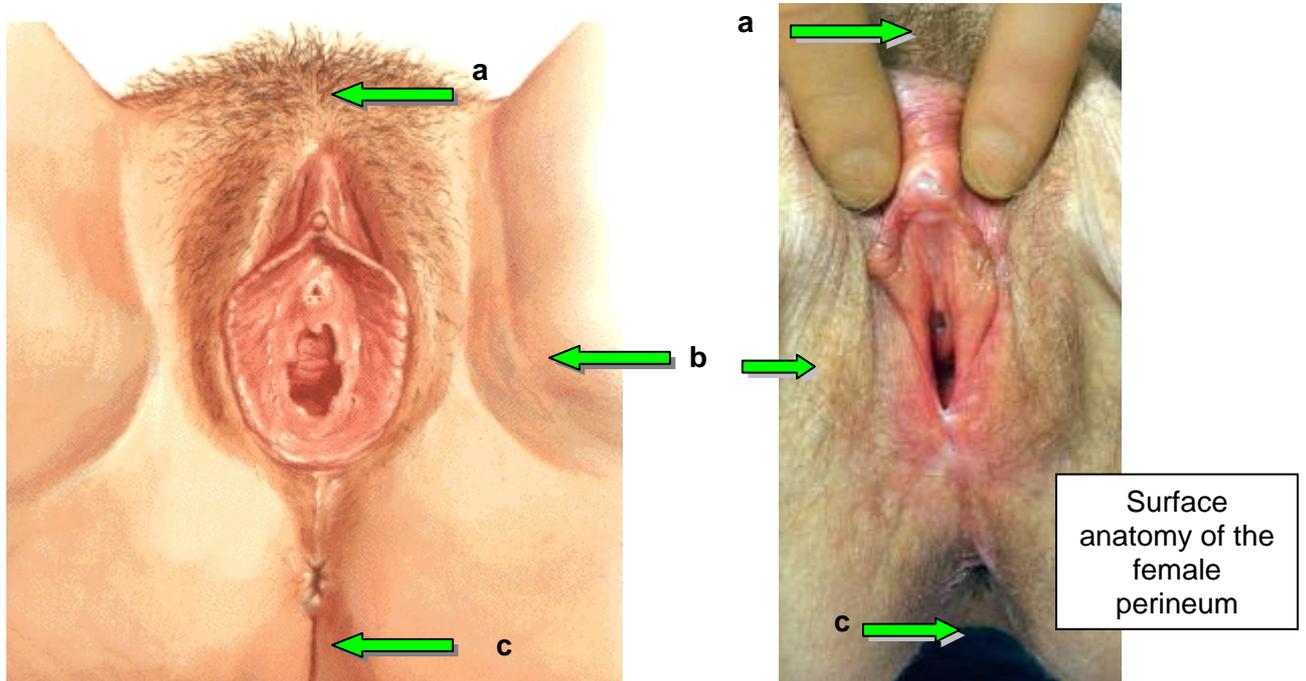
perineum

sonodense

Block XI: Session 1

Station 1: Surface anatomy

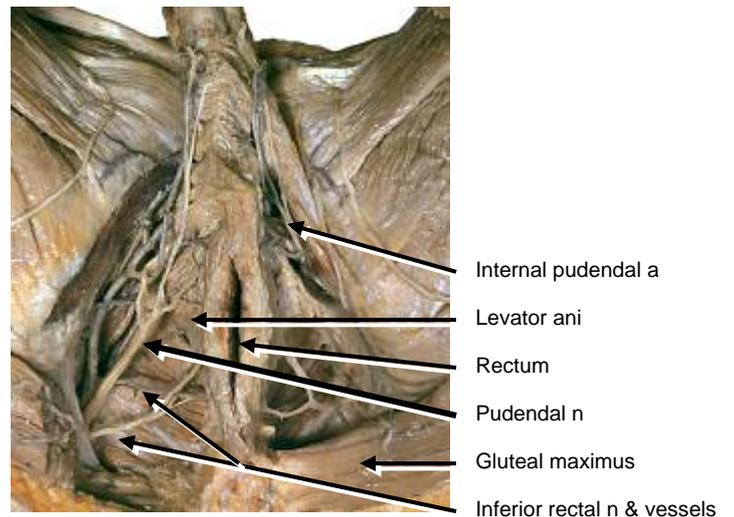
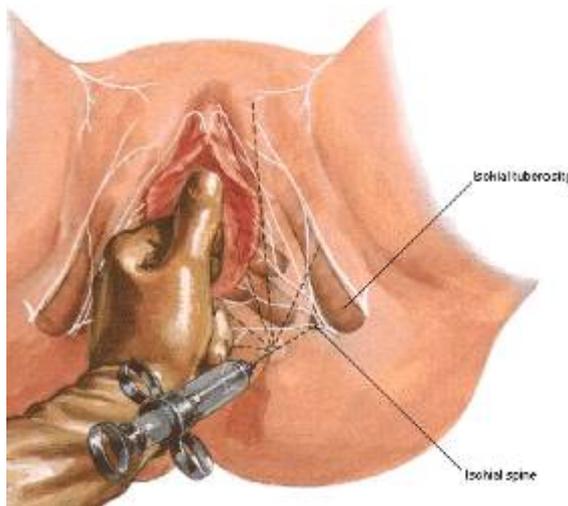
1. Identify the bony landmarks that underlie the marked areas on the diagrams below.



Surface anatomy of the female perineum

a – pubic symphysis; b – ischial tuberosity; c – coccyx

1. In anticipation of an episiotomy, you perform a pudendal nerve block in on a patient in the second stage of labour.

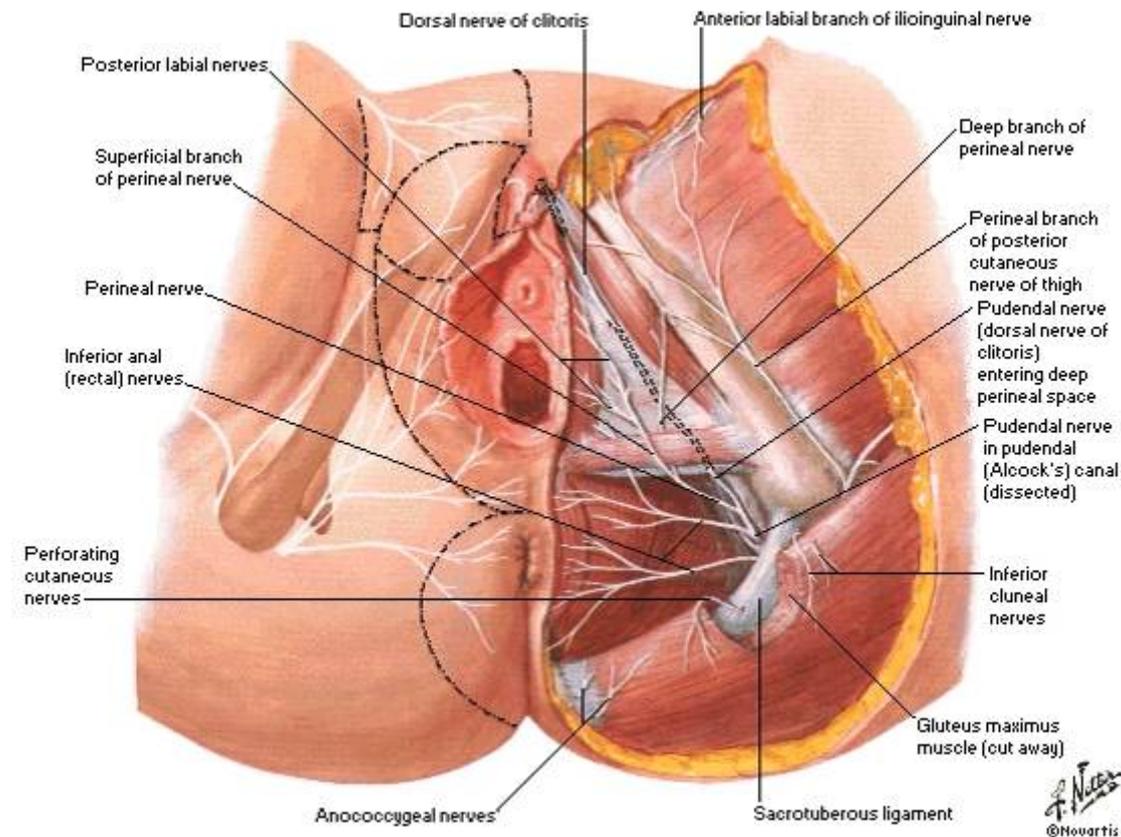


Deep dissection of the perineum

a) What are the root values of this nerve?

S2,3,4

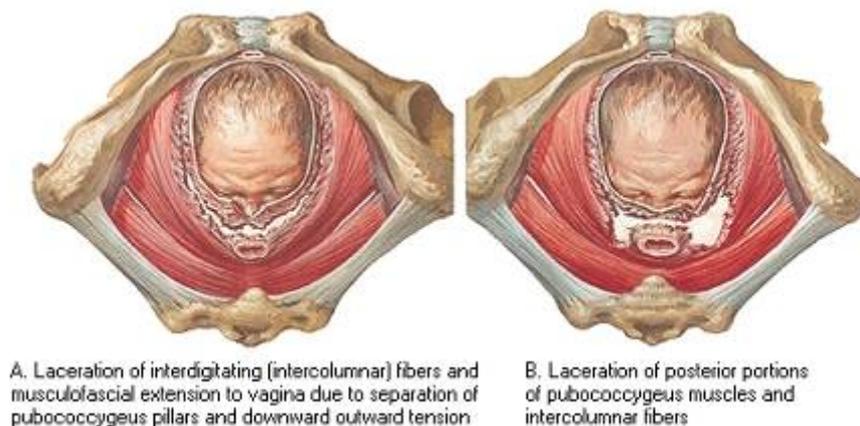
- b) Study the surface anatomy of this nerve as well as its supply areas in the female.



- c) Briefly explain the anatomical basis of vaginal injuries during childbirth.

The most common cause of direct injury to the vagina and its supporting musculature is childbirth. Obstetric lacerations may be consequential to a number of variables during delivery, including precipitous labor with sudden expulsion of the head, abnormal presentation necessitating difficult forceps extraction, large size of the baby, unusually friable (delicate, easily destroyed) maternal tissues, exaggerated lithotomy position, or medical mismanagement. Lacerations are more common and more extensive in nulliparous women, in whom the musculature of the birth canal and perineum has not been stretched. Proponents of childbirth techniques such as the Lamaze method claim that trained relaxation of perineal muscles results in fewer lacerations.

- d) Briefly explain, in anatomical terms, the possible complication(s) that can occur after tearing of the vaginal opening during labour.



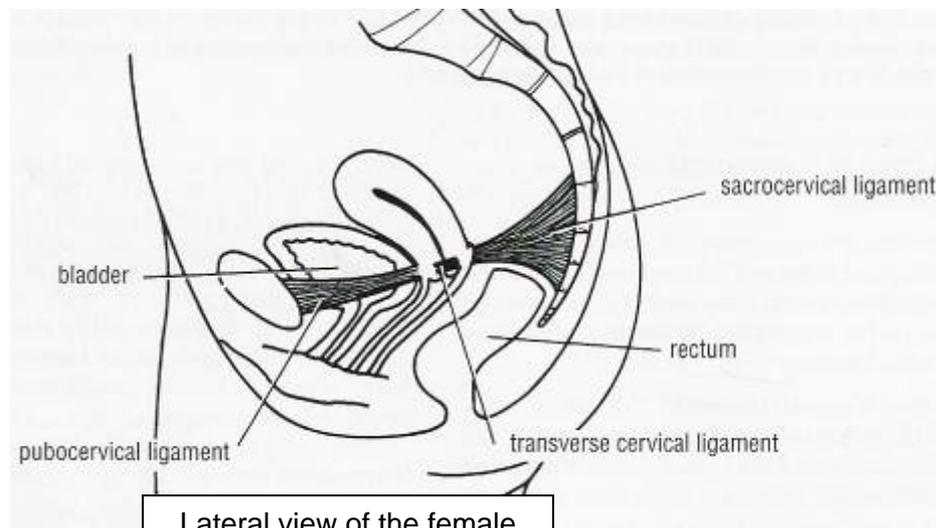
In the cases illustrated here, the infant's head has extended too soon, resulting in a near-brow presentation. This increases the presenting diameter that must pass between the crura (pillars) of the puborectalis part of the levator ani muscle (pelvic sling) at this level. Since the vagina passes inferiorly and anteriorly in the interlevator cleft (urogenital hiatus) connected by musculofascial extensions to the pubococcygeus muscles on either side, downward traction on an infant's head impeded in midvagina may easily tear these connections as well as the interdigitating intercolumnar muscle fibers between the vagina and rectum. The vagina may then become completely separated from the rectum above the level of the external anal sphincter; the separation may continue laterally without damaging the major subdivisions of the pubococcygeus muscles (Figure A). This injury occurs at or near the level of the ischial spines and may be caused by an attempted midforceps extraction.

A more severe laceration at approximately the same level, in addition to separating the crura of the pubococcygeus muscles by rupturing their attachments to the lateral and posterior vagina, may tear the puborectalis component (Figure B), which constitutes one of the most important factor in fecal continence as well as in dynamic support of the pelvic viscera in general and the rectum in particular. The postpartum clinical effect may be incontinence, rectocele, or both.

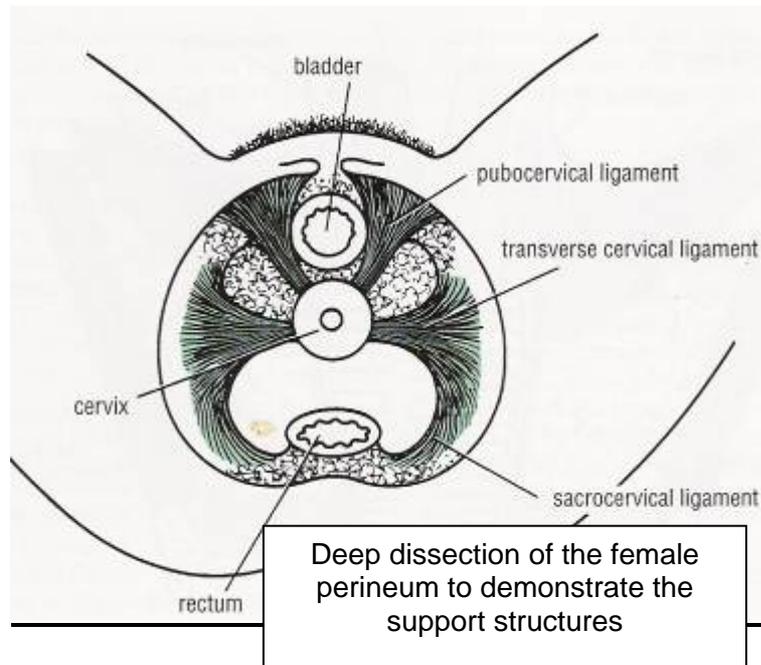
e) Briefly explain the structures that support the pelvic contents.

Endopelvic fascia

Visceral and parietal layers. Parietal fascia is membranous that varies in thickness. Lines the pelvic diaphragm superiorly and inferiorly, and inner surfaces of the obturator internus and piriformis. Females: Attaches to pubis, bladder, cervix, vagina and rectum to form the following ligaments: Pubovesical ligament, Cardinal / transverse cervical ligament, Uterosacral ligament, Males: Attaches to pubis, bladder, prostate and rectum forming the medial and lateral pubovesical / puboprostatic ligaments



Lateral view of the female pelvis demonstrating the supporting ligaments

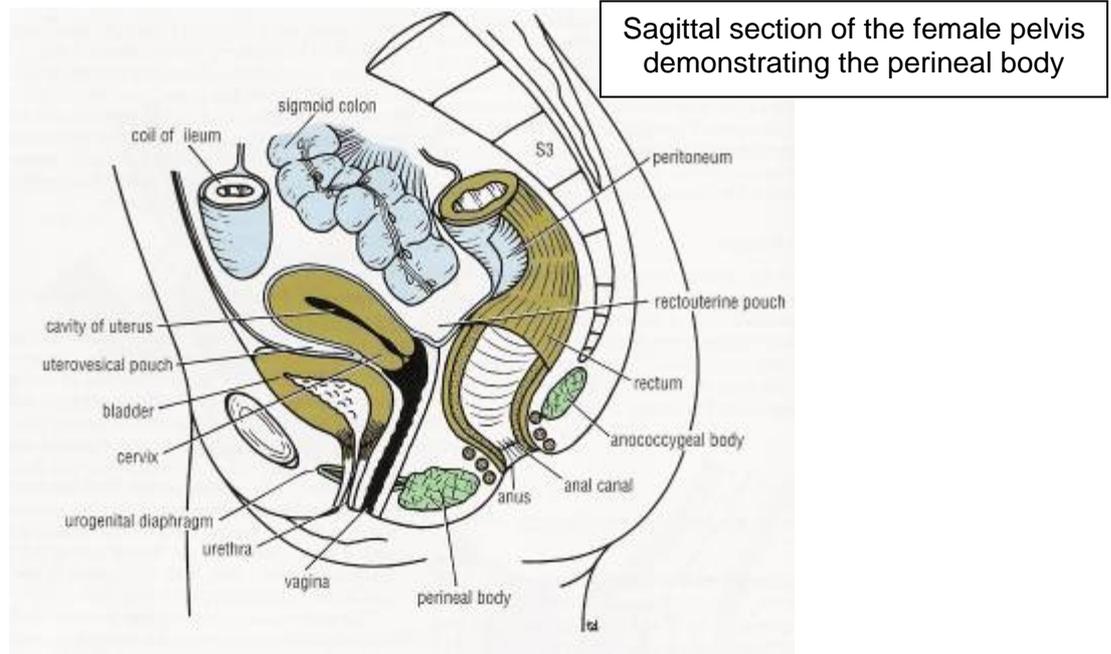


Perineal fascia

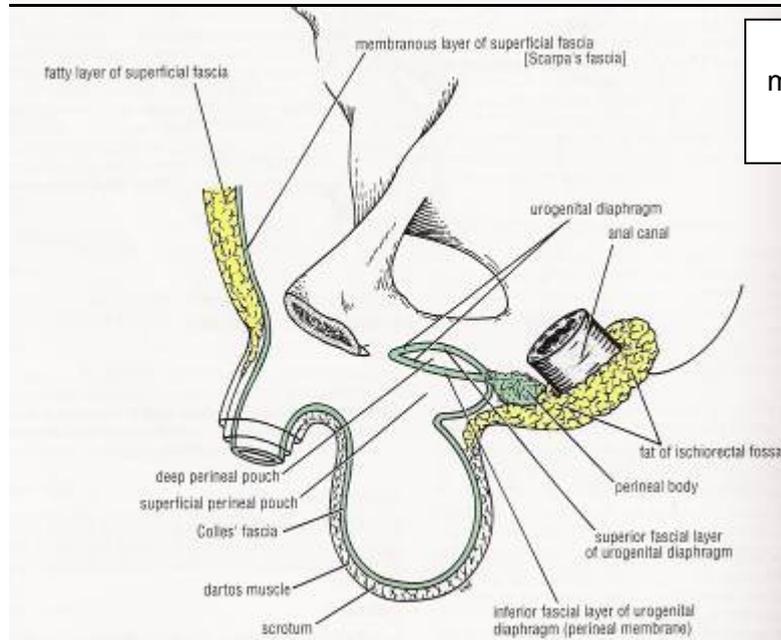
Contributes to the formation of the superficial and deep perineal spaces. Superficial and deep layers. Superficial layer: Superficial fatty and deep membranous (Colles' fascia) layers. Females: Superficial fatty layer continuous with labia majora and unites with superficial fatty layer of the abdomen (Camper's fascia) at the mons pubis. Membranous layer of the abdomen (Scarpa's fascia) passes deep to the fatty layer and also forms part of the labia majora. Fused anteriorly with the clitoris. Deep layer: Attached posteriorly to the perineal membrane and perineal body, and laterally to fascia lata of the thigh and ischiopubic ramus. Males: Superficial fatty layer in the urogenital triangle is replaced by dartos muscle. Membranous layer is continuous with the dartos muscle in the scrotum, but lateral and anterior to the scrotum, it becomes continuous with the membranous layer of the abdomen. Fused anteriorly with the suspensory ligament of the penis. The deep perineal fascia also invests the following muscles: ischiocavernosus, bulbospongiosus, superficial transverse perineal muscles.

Perineal body:

A fibromuscular structure. F: Supports the posterior wall of the vagina, also forms the dynamic support of other pelvic viscera. Is found between the inferior part of the vagina and anal canal. It is held in position by the attachment of the perineal and levator ani muscles.



Sagittal section of the female pelvis demonstrating the perineal body



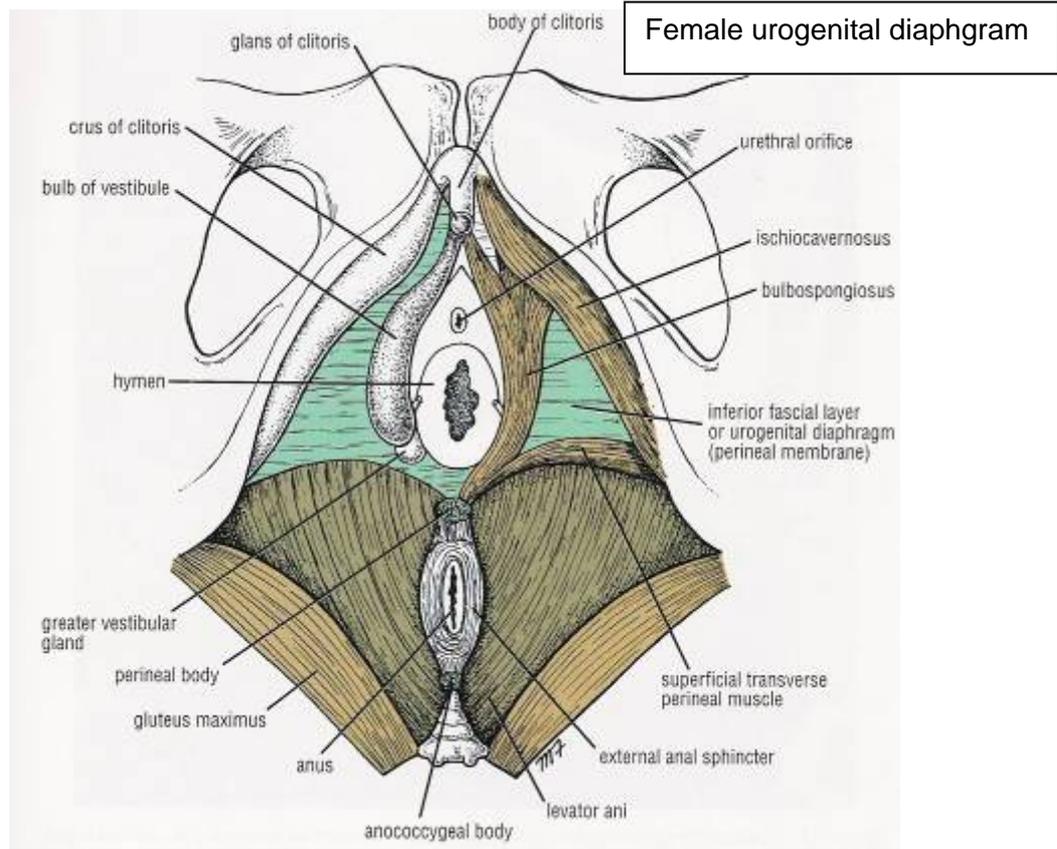
Sagittal section of the male pelvis demonstrating the perineal body

Urogenital diaphragm

Found in the deep perineal space. Consists of a deep transverse perineal muscle. F: Offers dynamic support for pelvis viscera

Pelvic diaphragm

Forms the funnel-shaped floor of the pelvic cavity. Components: coccygeus and levator ani (pubococcygeus, puborectalis, iliococcygeus). F: Forms the muscular sling that supports the abdominal and pelvic viscera, resists increases in abdominal pressure, holds pelvic viscera in position, assists in defecation and urination, and supports the uterus.



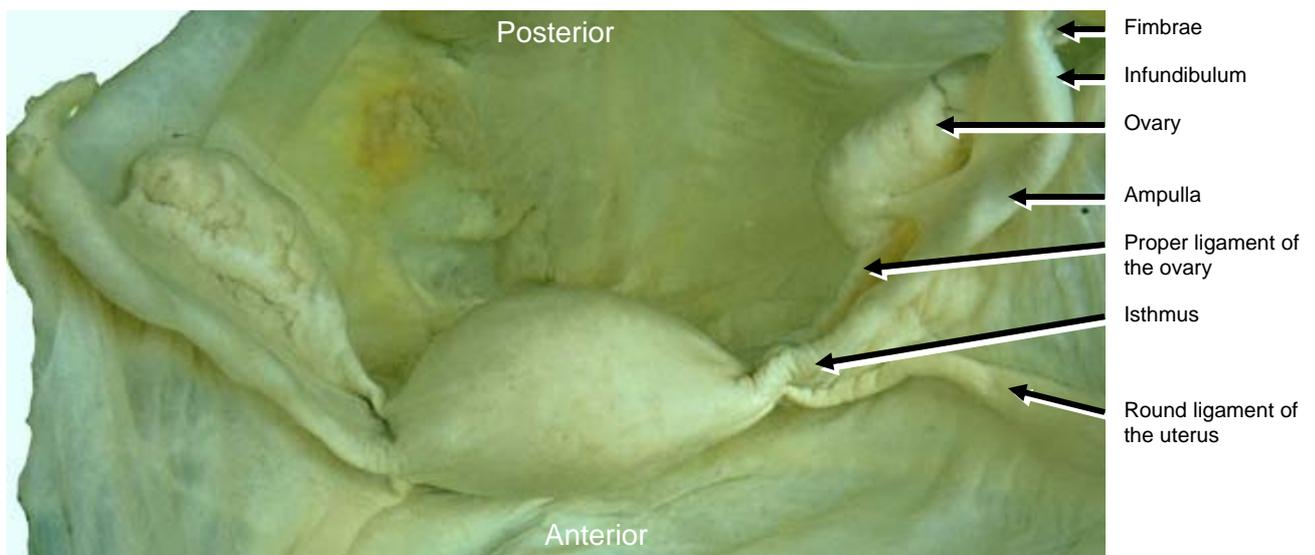
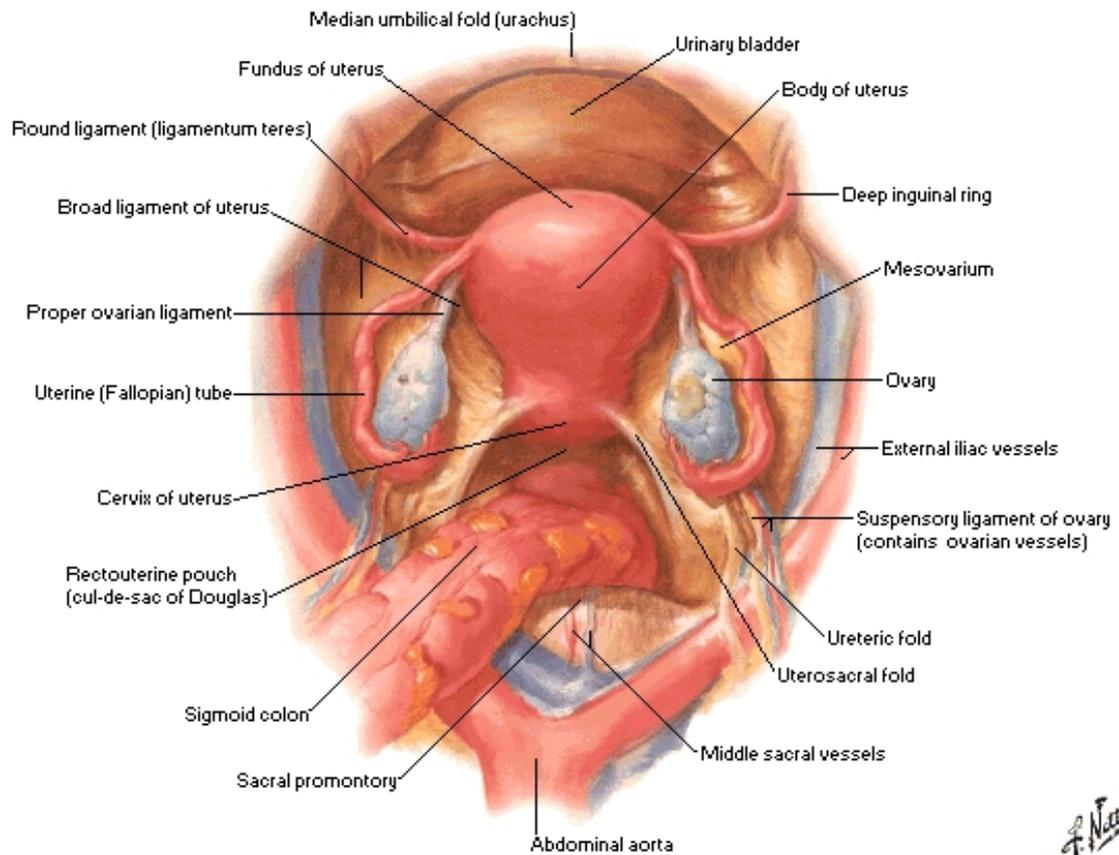
Support of specific structures

Principle supporting structures of the uterus are the pelvic fascia and bladder. The cervix, in part, is kept in position by the following ligaments derived from the endopelvic fascia: Cardinal / transverse cervical ligament, which extend from the cervix and lateral fornices to the lateral pelvic walls, Uterosacral ligament, which passes superior and posterior from the cervix to the middle of the sacrum. The uterosacral ligament can be palpated through the rectum. Other supporting structures are the: Broad ligament, round ligament of the uterus, suspensory ligament of the ovary, mesovarium, mesometrium, mesosalpinx. Broad ligament: A double layer of peritoneum that covers the uterus and extends to the lateral pelvic walls and pelvic floor. Contents of the broad ligament: Revise from Meiring et al. The lateral parts of the broad ligament, covers the ovarian blood vessels as the suspensory ligament of the ovary. The round ligament of the uterus lies within the layers of the broad ligament of the uterus. The part of the broad ligament that suspends the ovary is called the mesovarium. The ovary is also attached to the uterus by means of the proper ligament of the ovary, which can be found in the mesovarium. The part of the broad ligament that forms the mesentery of the uterine tube is known as the mesosalpinx. The mesometrium is the main part of the broad ligament and is found inferior to the mesosalpinx and mesovarium.

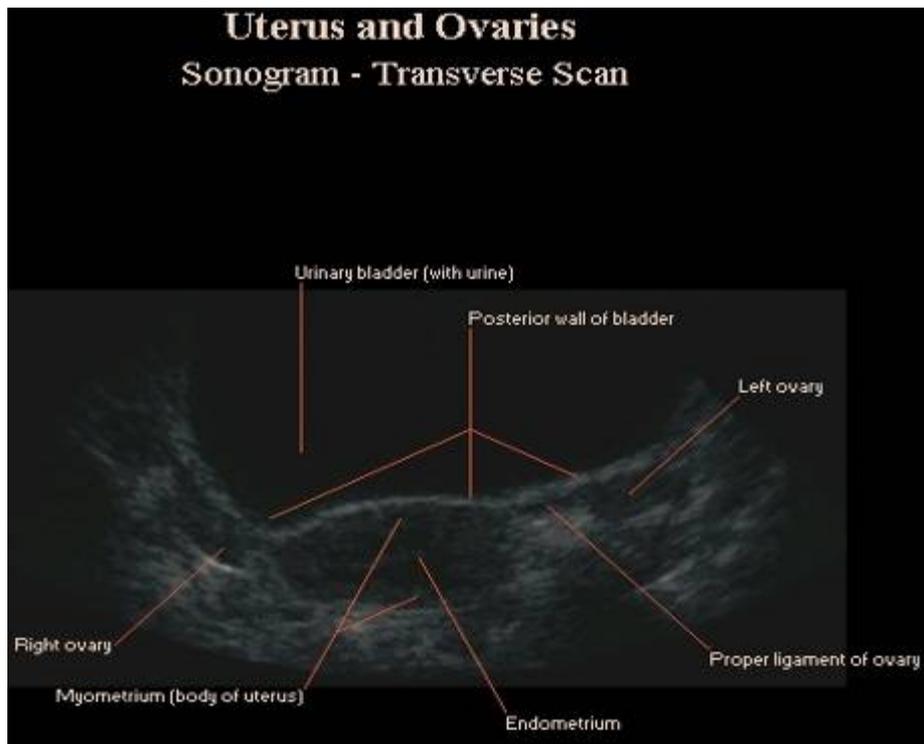
Station 2: Radiology

1. Compare the labelled diagram and sonogram (in transverse plane) below. Briefly explain how the view of the sonogram was obtained. Add a note on the structures visible on the sonogram.

Superior View - Peritoneum Intact



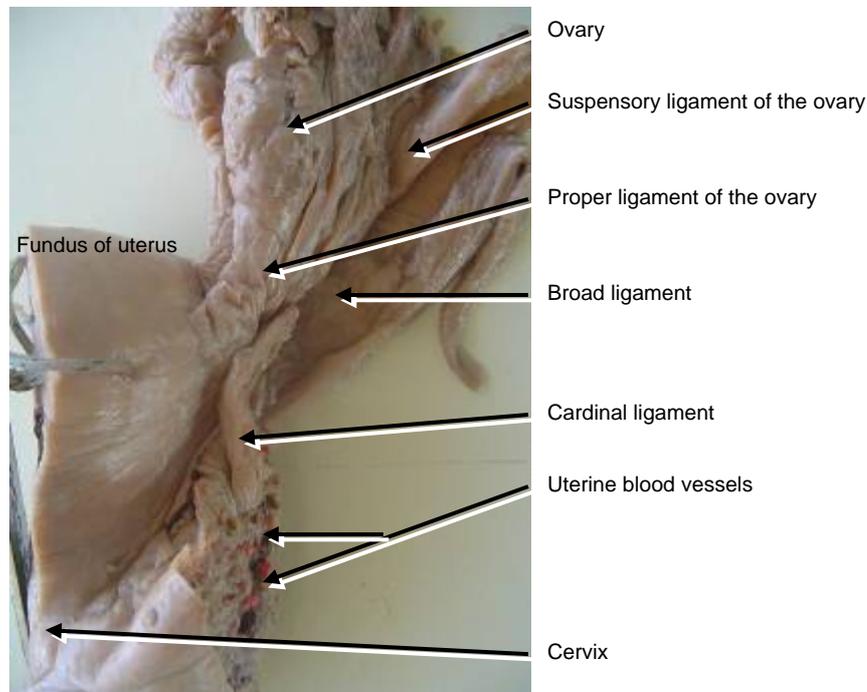
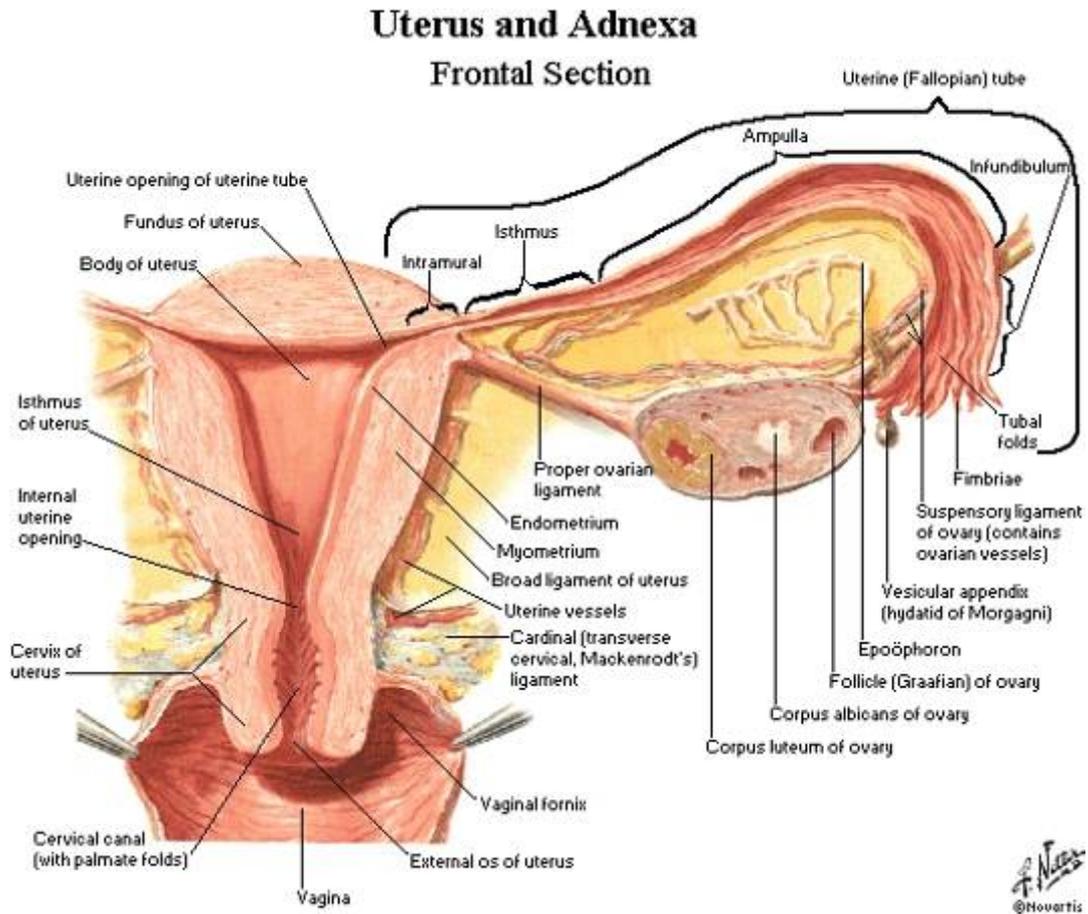
Superior view of the uterus *in situ*



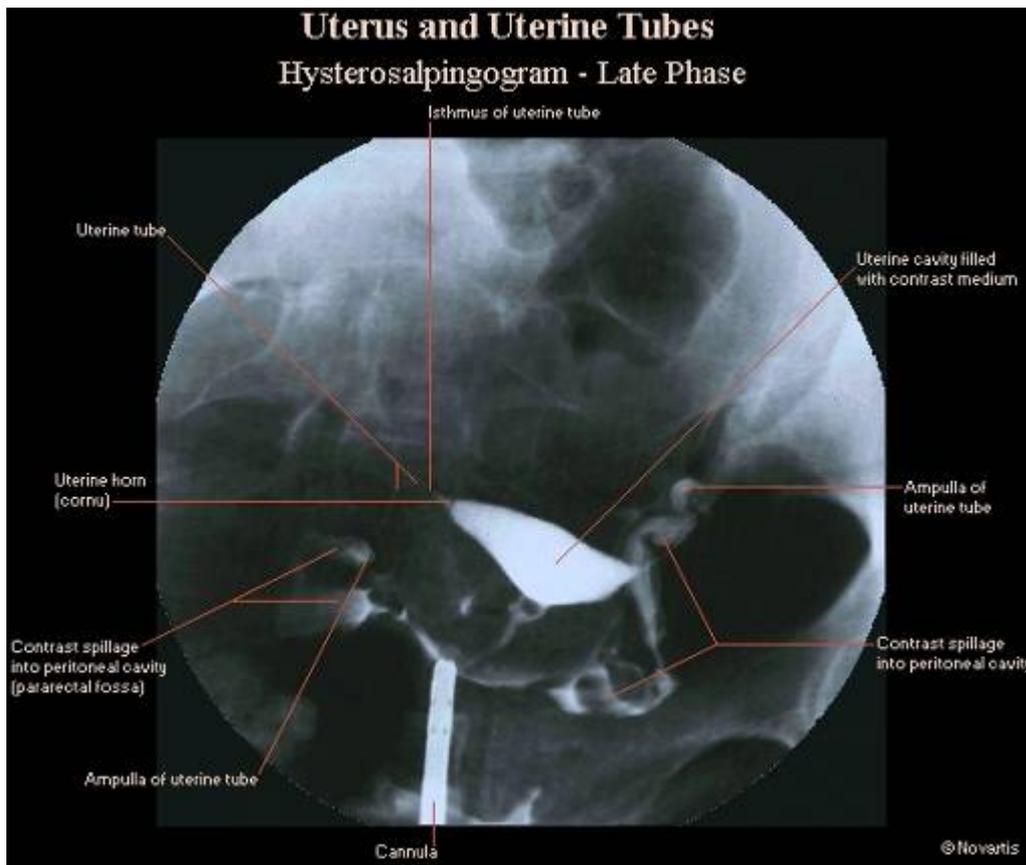
To obtain this view, the transducer is placed in the midline of the lower abdomen, just above the pubic symphysis, with the scanning sector aligned transversely. The maximally filled urinary bladder has produced a temporary retroversion of the uterus, tipping it up and backwards so that the transverse section through the body also intersects the uterus in the axial section (compared with the longitudinal section that would result if the bladder were empty and the uterus had resumed its normal, anteverted, anteflexed position). Thus, the body of the uterus is seen as a mostly round density in the center, directly posterior to the bladder. In this patient, the ovaries are very symmetrically placed (commonly not the case), lying to each side of the uterus. Within the sonodense uterus, the endometrium can be distinguished from the myometrium.

Station 3: Special radiology

1. Compare the labelled diagram and hysterosalpingogram (HSG).



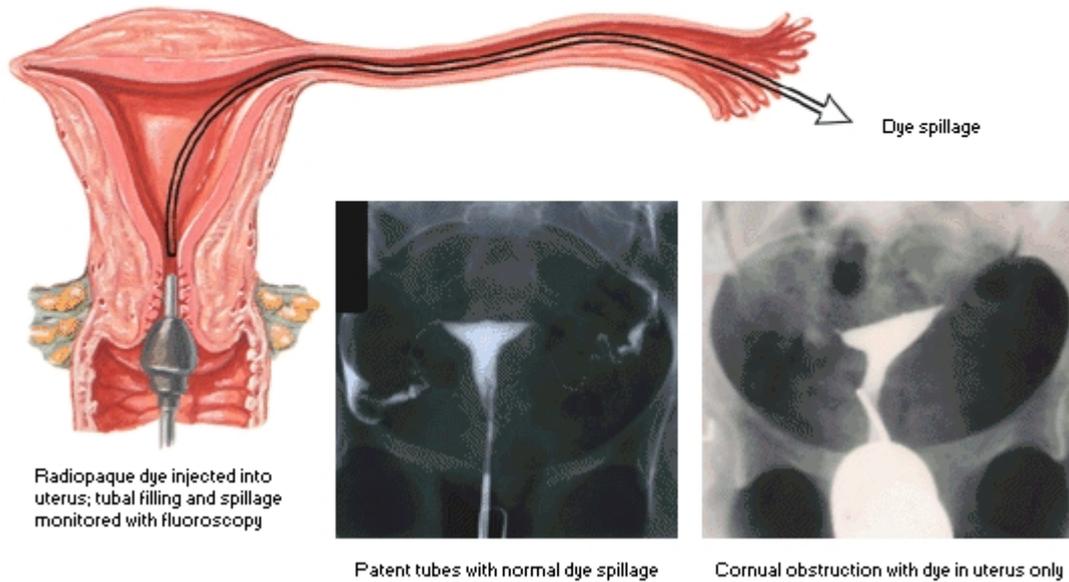
Anterior view uterus and adnexa



2. What is a HSG and what is the clinical relevance of this procedure?

A radiopaque contrast agent has been injected via the external uterine (cervical) os into the body of the uterus, filling the uterine cavity (endometrial canal). If the uterine tubes are patent, continued injection will cause the contrast agent to enter and traverse the uterine tubes and spill into the peritoneal cavity around the ovaries (in the pararectal fossae). If the tube or tubes are obstructed, the dye will remain confined to the uterine cavity, as shown in this view, at least on the side of the obstruction.

Tests for Tubal Patency Hysterosalpingography



3. The following article was published in “Beeld” during 1999.

Woman pregnant after hysterectomy; SA medics astounded by rare case

Mrs Elizna Lachenicht (35) from Worcester became pregnant after having had a hysterectomy. This mother of three, who works as a secretary for a firm of architects, is the first such case in South Africa and one of only twenty world wide to have become pregnant following removal of the uterus. Lachenicht underwent the hysterectomy three years ago. “ The thought that I might be pregnant never occurred to me. I thought that I was suffering from bladder problems and as a result of my strict diet that I was experiencing stomach pain”. She was treated for bladder problems but was in constant pain. Although she had symptoms related to pregnancy, she was not tested for a pregnancy. A surgeon finally operated to establish the problem. The surgeon was expecting to find bleeding within the abdomen but not a fetus. He was astounded to find a perfect 16-week fetus in her abdominal cavity. “ It was very strange to see the fetus there. The fetus had, in its amniotic sac burrowed through the uterine tube and caused severe bleeding. This is what resulted in the pain. We immediately removed the fetus, which was still alive, as it was a life threatening condition to the mother.”

- a) How would this case of abdominal ectopic pregnancy differ from a tubal pregnancy? Also mention factors that may lead to tubal pregnancy.

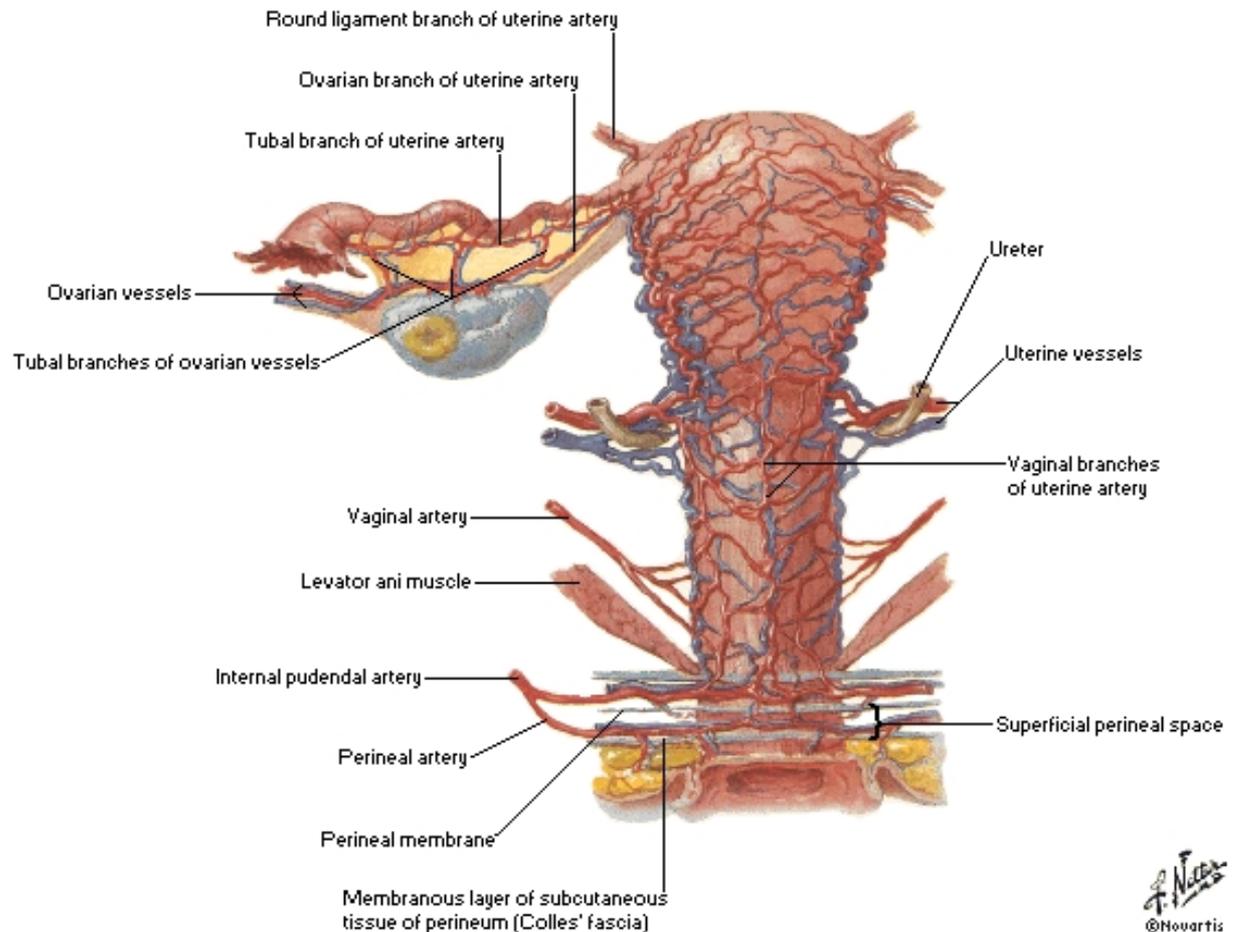
Ectopic pregnancy refers to the implantation of the zygote (fertilized egg, conceptus) in any place other than the lining of the uterine cavity (the endometrium or decidua). According to the site of implantation, four kinds of ectopic pregnancy are distinguished: (1) tubal, (2) abdominal or peritoneal, (3) ovarian, and (4) cervical. Tubal pregnancy is by far the most common of all ectopic pregnancies, occurring about once in every 250 pregnancies in North America. Here again, four types are recognized, depending on the portion of the tube in which the implantation takes place: infundibular, ampullar, isthmic, and interstitial (intramural). Although ampullar implantation is associated with the highest incidence of tubal pregnancy, it is the interstitial form which represents the most serious type from the clinical view.

Causative factors may be organic or functional in nature, or both. Organic factors include those that mechanically distort the tube and impede normal migration of the zygote, either by processes inside the lumen or by elements working outside, such as adhesions, tumors, malposition of the uterus, and so forth. The incidence of tubal pregnancy has increased in recent years due to an increase in sexually transmitted infections. Functional causative factors are more obscure, and include alterations in the properties of the zygote, leading to premature implantation, or in the properties of the tubal walls, such as altered contractility or endometrial transformation of the endosalpinx (tubal lining).

- b) Discuss the development of a tubal pregnancy.

Implantation events and early development of an ectopic pregnancy are the same as those of a regular (topic) pregnancy. If not diagnosed early or if an early spontaneous abortion does not occur, ectopic tubal pregnancies result in rupture of the uterine tube during the first 8 weeks of gestation, causing fetal death and hemorrhage into the abdominopelvic cavity. Prompt surgical intervention is required. In the relatively uncommon interstitial tubal pregnancy, in which implantation has occurred in the farthest uterine end of the tube, fetal growth may continue longer than in the other types of tubal pregnancy, because of the greater muscular mass and vascularity. The danger resulting from rupture is also greater, however, because the hemorrhage may be so profuse that it is fatal within a very short time. Increased medical surveillance early in pregnancy and more accurate pregnancy tests have allowed tubal pregnancies to be diagnosed and surgically treated before rupture has a chance to occur. This type of surgery is more conservative, permitting tubal preservation and reconstruction.

- c) Demonstrate, by means of a labelled diagram, the cause of the profuse haemorrhage after rupture of the tube.



- d) Briefly explain the normal blood supply (arterial supply and venous drainage) and anastomosis of the female genitalia.

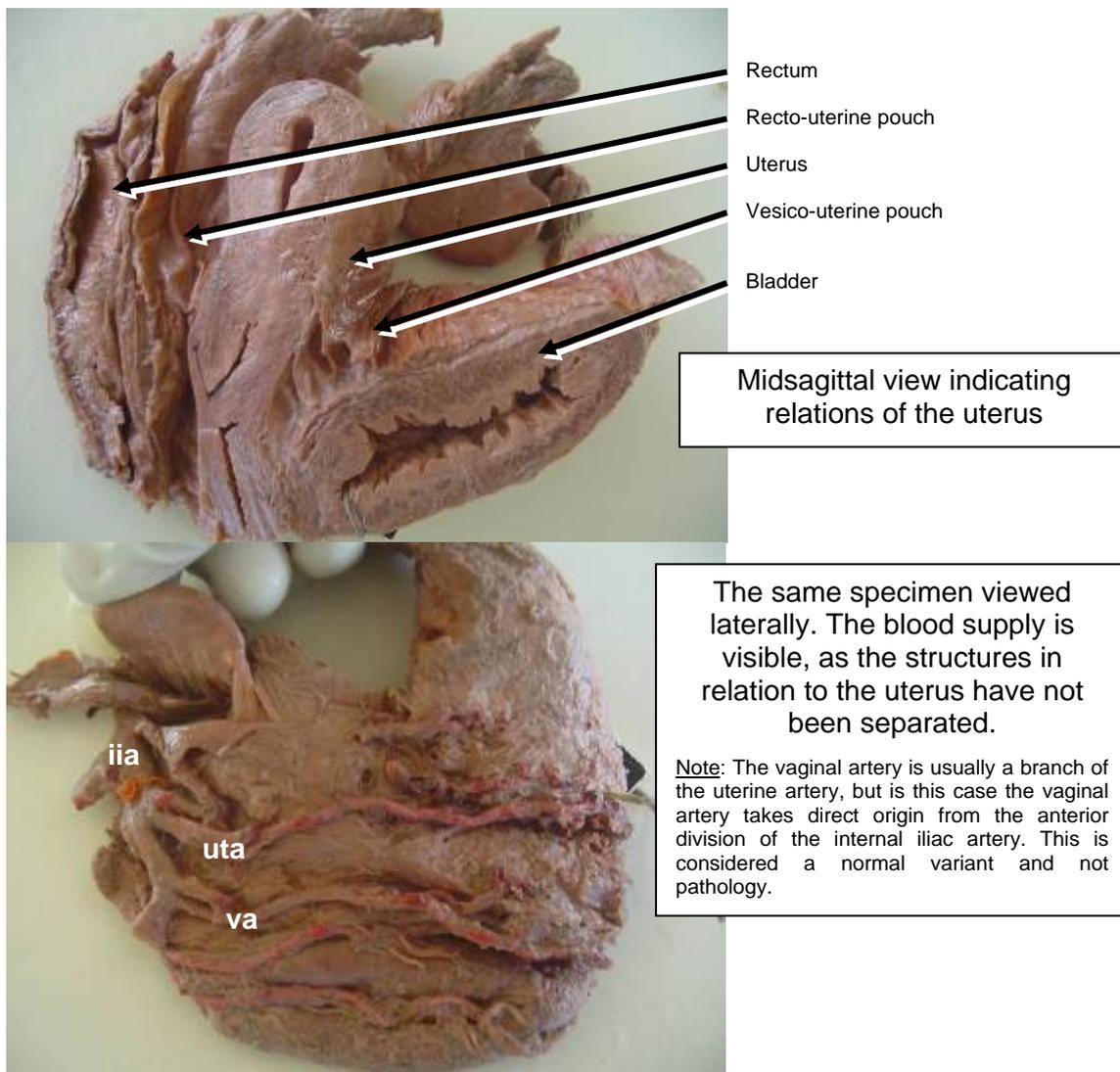
Arterial supply and anastomoses:

- External genitalia (female): External pudendal artery, internal pudendal artery (labial, clitoris branches).
- Vagina: Superior part: uterine artery; Middle and inferior parts: Vaginal artery derived from the middle rectal and internal pudendal arteries
- Uterus: The uterine artery from the internal iliac artery mainly supplies the uterus. The ovarian artery, from the abdominal aorta, forms an anastomosis with the uterine artery inferior to the uterine tube.
- Uterine tubes: Arterial supply of the uterine tubes arises from the anastomosis between the ovarian and uterine arteries.
- Ovaries: Ovarian arteries directly from the abdominal aorta. The ovarian arteries run over the internal iliac arteries to enter the suspensory ligament of the ovary. Branches of the ovarian arteries then pierce the mesovarium and mesosalpinx to also supply the uterine tube.

Venous drainage

- External genitalia (female): Labial vein are a tributary of the internal pudendal vein and vv. communicantes.

- Vagina: Vaginal veins form the vaginal venous plexus which in turn drain to the following: Internal iliac vein, vesical venous plexus, uterine venous plexus, rectal venous plexus.
- Uterus: The uterine venous plexus drain to the internal iliac vein, via the uterine vein, which pass through the broad ligament.
- Uterine tubes: Tubal veins drain to the uterine and ovarian venous plexii.
- Ovaries: Veins from the ovaries form the pampiniform venous plexus close to the ovary and the uterine tube. Veins from this plexus then form a single ovarian on each side and leave the pelvis as a companion of the incoming ovarian artery. The right ovarian vein drains directly into the inferior vena cava, while the left ovarian veins drains into the left renal vein.

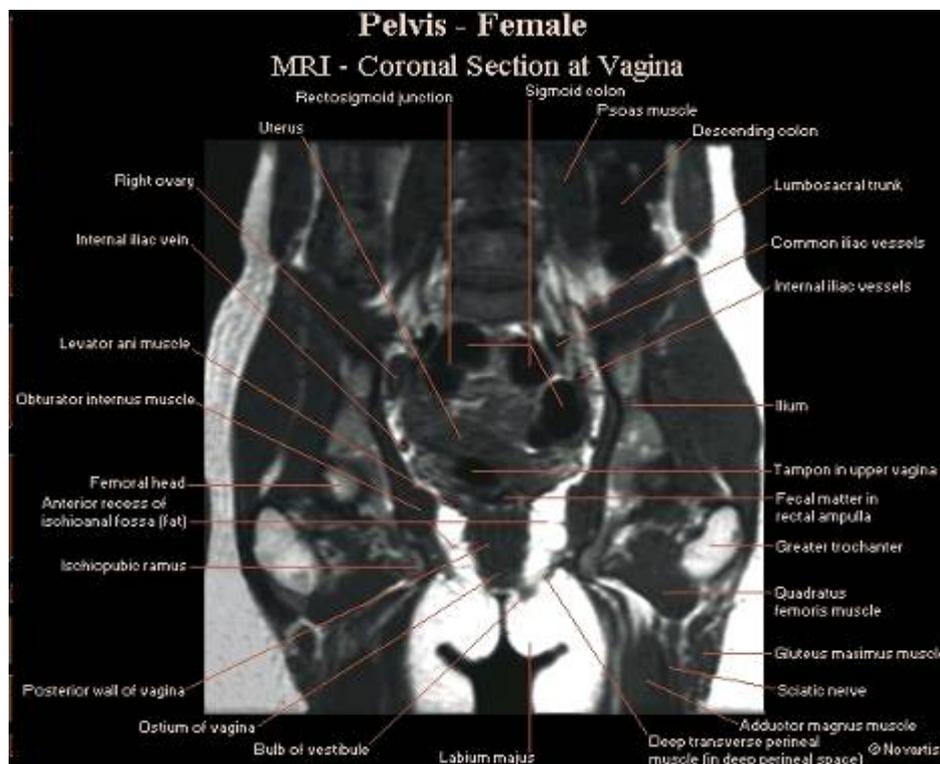
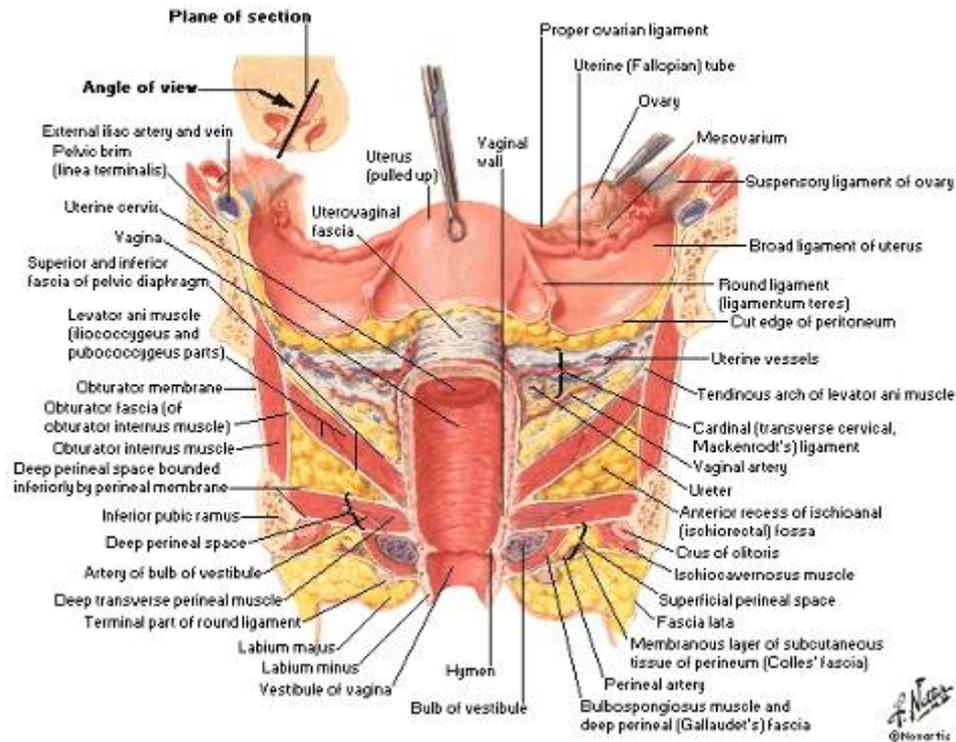


iia – internal iliac artery; uta – uterine artery; va – vaginal artery

Station 4: Relations I

1. Compare coronal sections through the urogenital triangle on the labelled diagram and MRI.

Uterus, Vagina and Supporting Structures

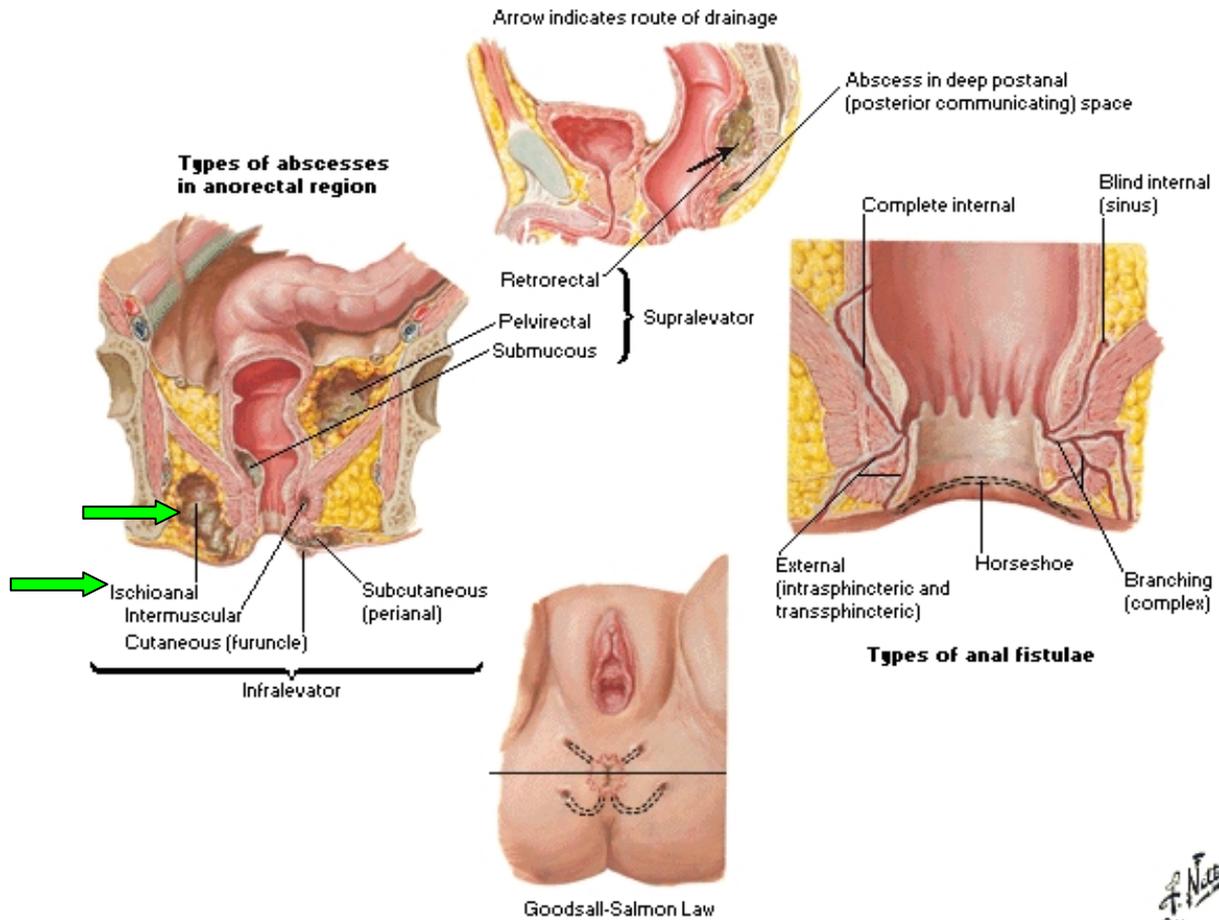


The vagina of the patient studied here is disposed vertically in contrast to the more common position passing posteriorly and superiorly (see Plate 346A). In determining where this coronal plane intersects a midsagittal section of the female pelvis (such as that in Plates 346A or 367B), note that this MRI passes immediately anterior to the perineal body (through the posterior portion of the vaginal ostium) and continues superiorly along the long axis of the vagina, adjacent to or through the vaginal lumen. Just below the level of the vaginal fornix, the posterior wall of the vagina is indented by the anterior wall of the rectal ampulla (the perineal flexure of the rectum), which contains a small amount of fecal matter. A tampon resides within the vagina at the level of the fornices, above which the lower uterine body is sectioned. In the region of the vagina, this section is comparable to Plate 349. Note the rugose, or corrugated, pattern of the vaginal wall. Fibers of the deep transverse perineal muscle (traditionally, considered to be forming the urogenital diaphragm) extend medially to the perineal body (below the section of the vagina) from the ischiopubic ramus on each side. Above this musculature, the anterior recess of the ischioanal fossa, filled with bright (signal-intense) fatty tissue, is roofed by the levator ani muscle (pelvic diaphragm). Below the musculature, on the left side, the bulb of the vestibule lies adjacent to the inferior end of the vagina and above the labium majus.

Superiorly, the right ovary lies just within the pelvic brim, located in a higher position than its contralateral partner (see the Imaging Correlation C328 "Pelvis - Female: MRI - Coronal Section at Neck of Bladder"). Asymmetry of the position of the ovaries and uterine tubes is most common. Just above the pelvic brim and to the left of the protruding lumbar vertebrae, the lumbosacral (nervous) trunk, formed by the merging of the ventral rami of spinal nerves L4 and L5, can be seen embedded in fatty tissue (compare with Plate 250).

Station 5: Relations II

1. You assist with the removal of an ischioanal abscess.



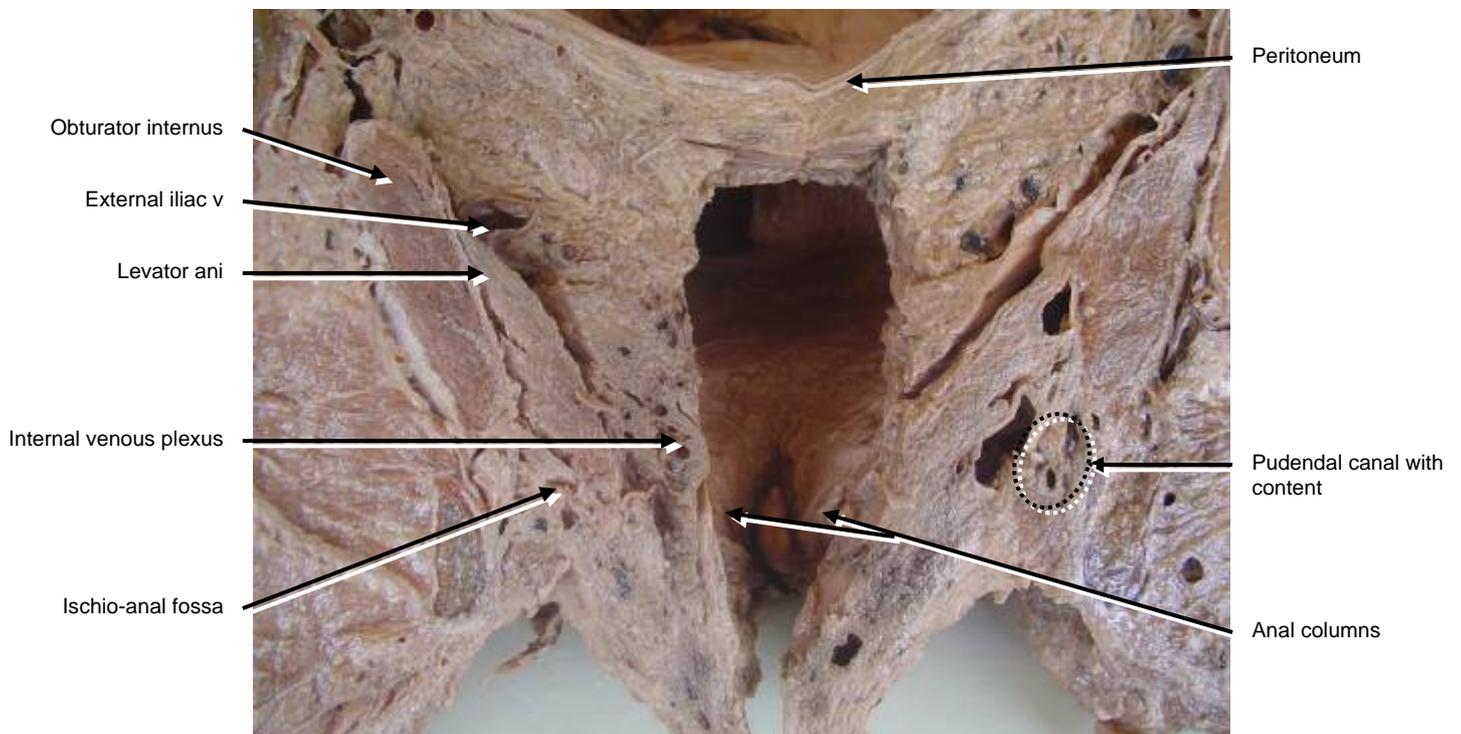
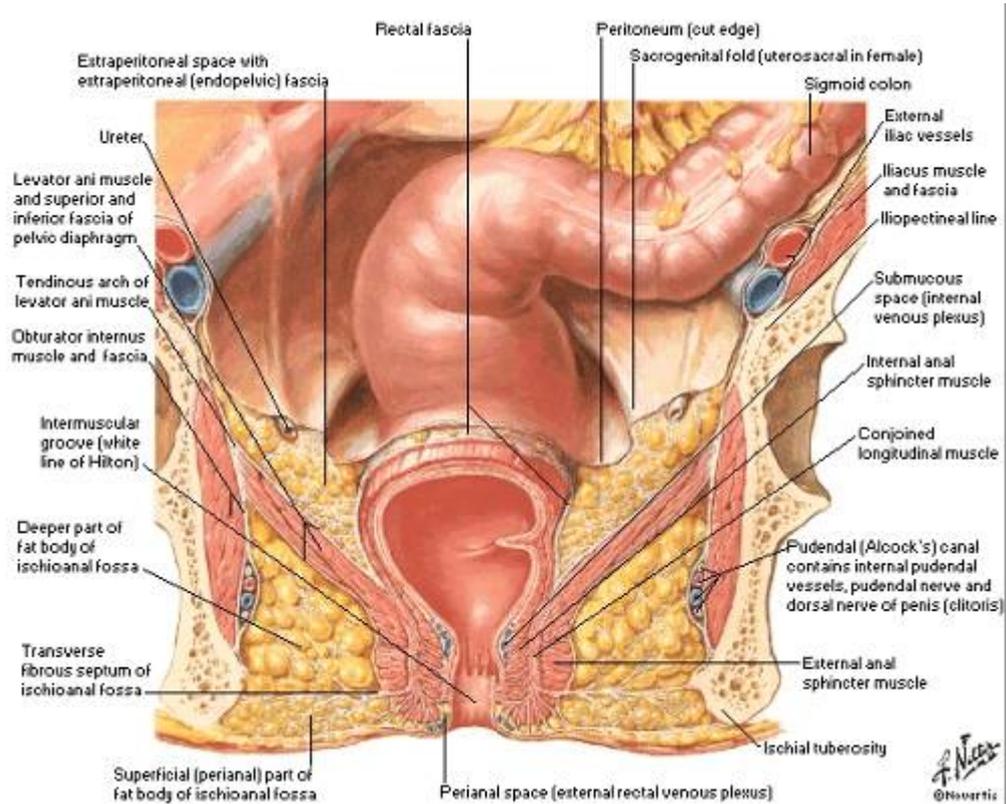
a) What structure superior to this particular type of abscess is in danger?

Levator ani

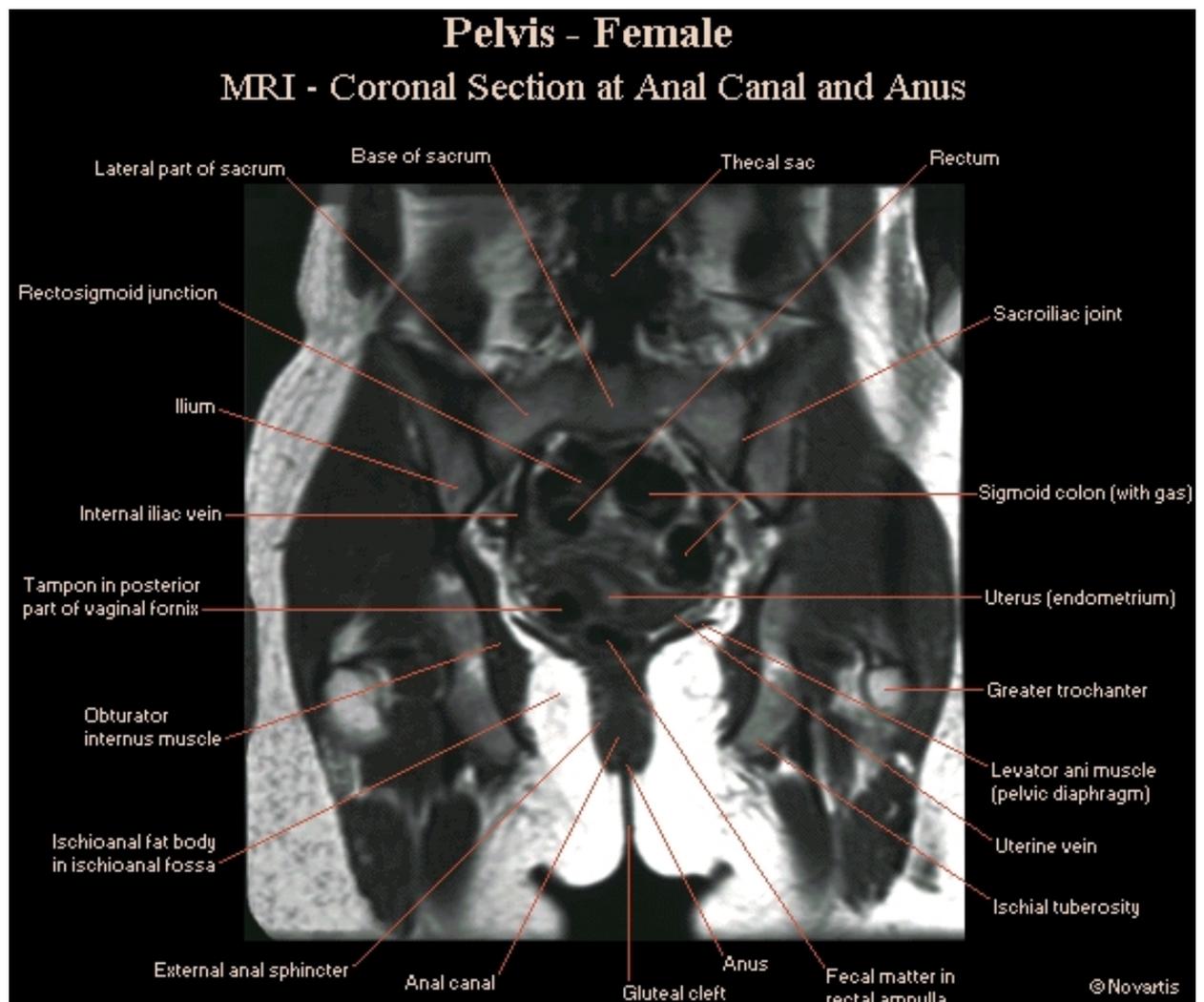
b) Name a complication should this structure(s) be accidentally damaged.

Incontinence regarding defecation

c) Compare coronal sections through the anal triangle on the labelled diagram and MRI.



Coronal section through the anal triangle

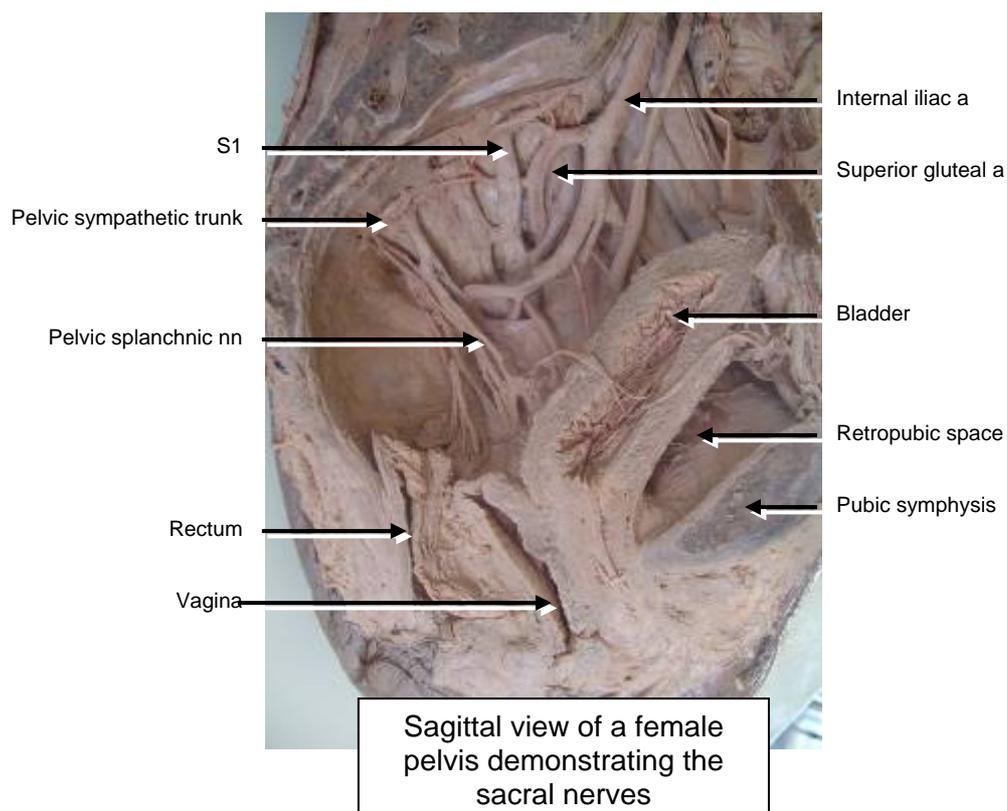
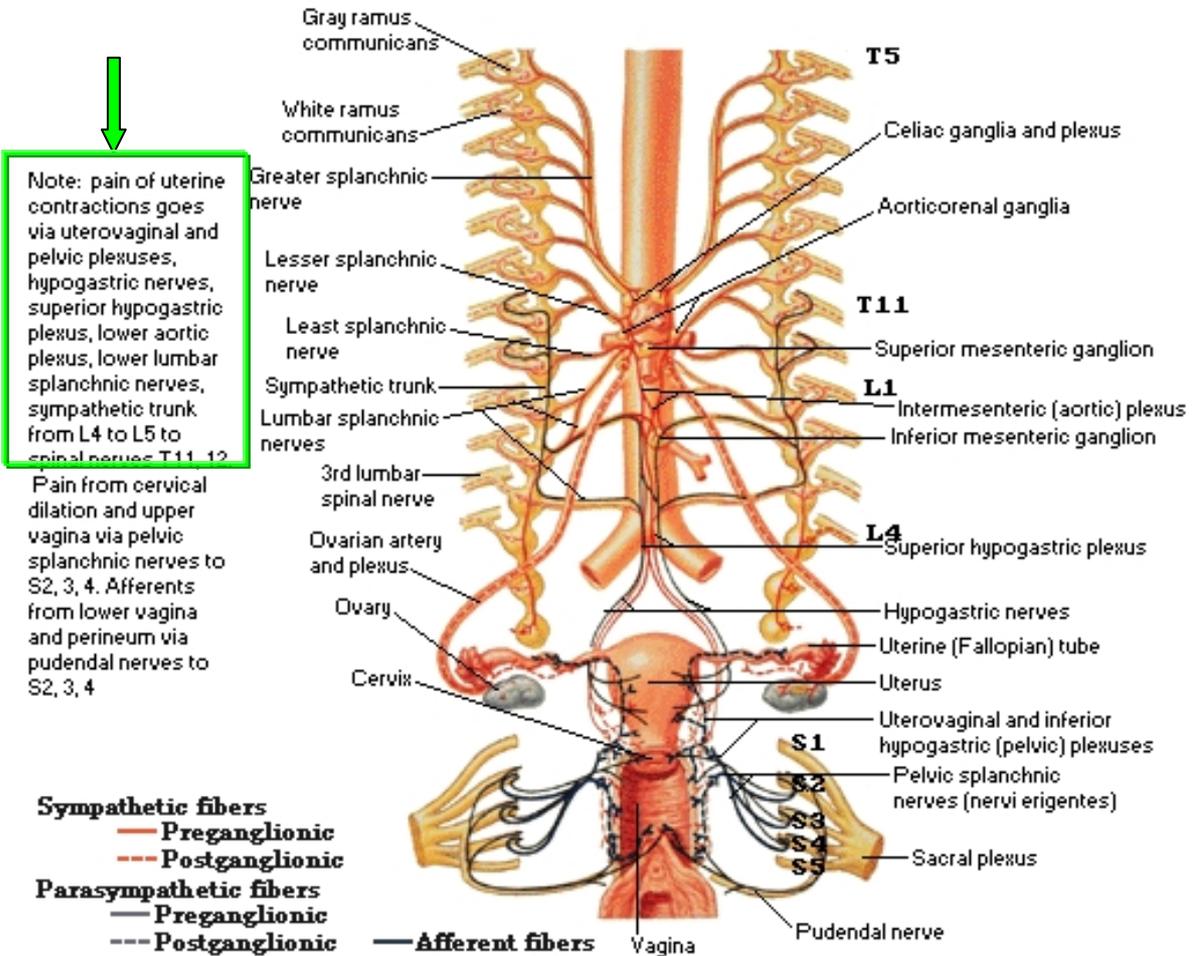


This section passes through the base of the sacrum, the sacroiliac joints, and the ischial tuberosities (compare with the plane of section demonstrated in Plate 368). The empty anal canal is collapsed transversely in life into an anteroposteriorly directed slit. The empty lumen is thus not evident, and most of what is seen as the anal canal separating the two signal-intense ischioanal fossae is formed by the anal sphincters (internal and external). The ischioanal fossae are roofed by the levator ani muscle (pelvic diaphragm), immediately above which the rectal ampulla, or perineal flexure, of the rectum (in this study, containing a small amount of fecal matter) is supported. The body and cervix of the somewhat retrocessed uterus lie within the concavity of the rectum (the cervix does not occur within this section). In this menstruating patient, the portion of the uterine cavity occurring within this section appears to contain some sloughing, relatively signal-intense endometrium that has not yet been absorbed by the tampon resting in the vagina below. The internal iliac vessels appear just inside the pelvic brim laterally.

Station 6: Innervation

1. Briefly discuss the pain felt during uterine contraction in the 1st phase of labour.

**Innervation of Female Reproductive Organs
Schema**



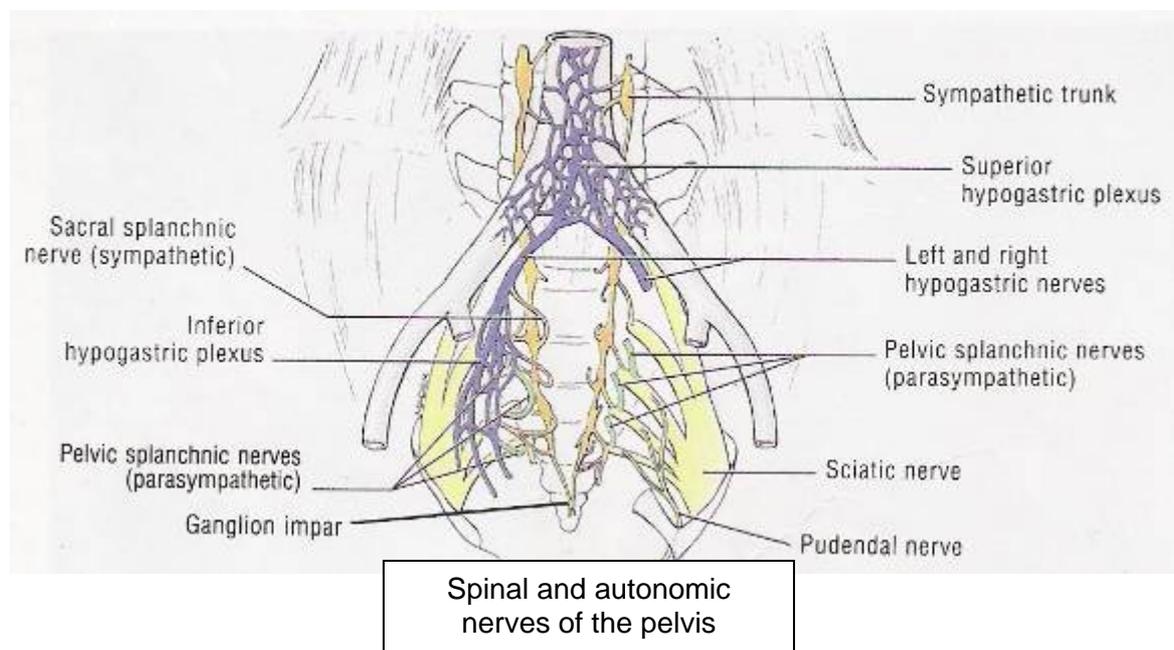
2. Briefly discuss the specific innervation of the female genitalia.

Vagina: Main innervation of the vagina is from the uterovaginal plexus which contains sympathetic and parasympathetic nerve fibres. This plexus is an extension of the inferior hypogastric plexus. Afferent fibres from T10 – T12 ascend through this plexus. Lower part of the vagina: Supplied by the deep perineal branch of the pudendal nerve that contains sympathetic and somatic afferent nerve fibres from S2 – S4. This part of the vagina has no parasympathetic innervation. Only the somatic innervated part is sensitive to touch and temperature.

Uterus: Innervation by the uterovaginal plexus. Sympathetic nerves T10 – T12 pass through the lumbar splanchnic nerves, intermesenteric and inferior hypogastric plexii. Parasympathetic nerves originate from S2 – S4 and pass through the inferior hypogastric and uterovaginal plexii. Visceral afferent fibres, that register pain from the fundus, accompany the sympathetic fibres to the lower thoracic and upper lumbar parts of the spinal cord. Afferent nerve fibres from the cervix and upper vagina accompany the parasympathetic fibres to the spinal ganglia.

Uterine tubes: Nerves from the ovarian and uterine nerve plexii supply the uterine tubes. Afferent fibres pass through the ovarian plexus and lumbar splanchnic nerves to T11 – L1 spinal ganglia.

Ovaries: Nerves to the ovaries accompany the ovarian blood vessels to form an ovarian nerve plexus, which communicates with the uterine nerve plexus. Parasympathetic nerve fibres originate from the pelvic splanchnic nerves. Afferent nerve fibres from the ovary enter the spinal cord through T10 and T11 spinal nerves.



Station 7: Lymph drainage

1. Briefly discuss the lymphatic drainage of the female genitalia.

External genitalia : The vulva contains a rich network of lymphatics that drains to the superficial inguinal lymph nodes

Vagina: Superior part: internal and external iliac lymph nodes; Middle part: internal iliac lymph nodes; Inferior part: sacral, common iliac and superficial inguinal lymph nodes

Uterus: Fundus: Lumbar, external iliac and superficial inguinal lymph nodes; Corpus / body: External iliac lymph nodes; Cervix: Internal iliac and sacral lymph nodes

Uterine tubes: Lumbar lymph nodes

Ovaries: Lumbar lymph nodes

