Obstetrics & Gynecology
TEAM

Anatomy + Placenta +Fetal circulation

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◆very important ◆mentioned by doctor ◆team notes ◆not important

Anatomy of the Female Pelvic Organs

Aims

- **To fully understand the anatomy of the female pelvis in terms of bones and tissues, and fetal skull, this would help in explaining the mechanism of Labor**
- **To predict and thus prevent postpartum hemorrhage related to the placenta**
- **To understand the major events in fetal circulation; during pregnancy and after birth**

Objectives

- **Student at the end of session should be able to:**
- **Explain the relationship between pelvic organs**
- **Comprehend the normal organs**
- **Understand the relationship between the female pelvis (Bones& Soft Tissue) and fetal skull, in order to understand the mechanism of labor**
- **Understand the major variant in the fetal circulation than that of the adult**
- **Know the significance of ductus venousus, ductus anteriousus and the first breath.**
- **Explain the changes that occur after birth.**
- **Familiarize yourself with the placental structure.**
- **Know the significance of placental and umbilical cord inspection after birth**
- **Differentiate between the different types of placental abnormalities and their significance**

The Vulva

External organs of the female include:

- Mons veneris
- Labia majora
- Labia minora
- The clitoris
- The vestibule

Vaginal duct is very important b/c when the duct becomes obstructed, the gland will become large and the woman will present with discomfort, but later on, the large gland will become inflamed then the woman will come to you with pain!

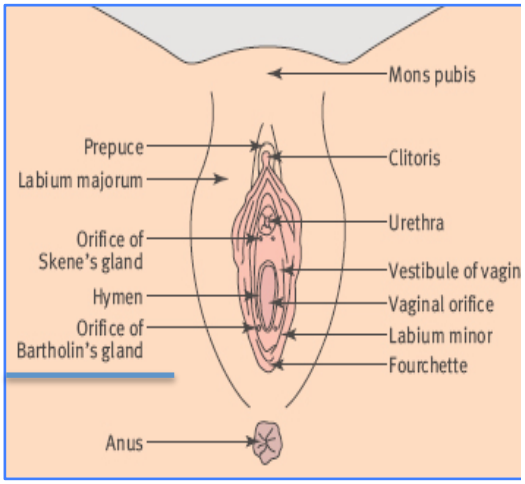
The vestibule has six openings:

- Urethral meatus
- Two skene's ducts
- Vaginal orifice
- Tw Bartholin ducts.

You must know the anatomy of the glands to differentiate them form any abnormal swellings.
And in case of (episiotomy= a man made cut) you must know the anatomy of the vulva to know where to cut.

Bartholin glands: lies on each side of the vagina, in the posterior lower third 1/3 of the interiotus.
Secrete mucus – alkaline

- **Blood supply:**
  Pudendal artery from the femoral **aa**
  Venous drainage in the corresponding vein.
- **Lymphatic:**
  inguinal gland
  External iliac glands
- **Nerves:**
  Branches of the pudendal nerve, perineal nerve (T12 L1-2, S2-4)
- **In labour:**
  Catheterization, Episiotomy, Anesthetic infiltration



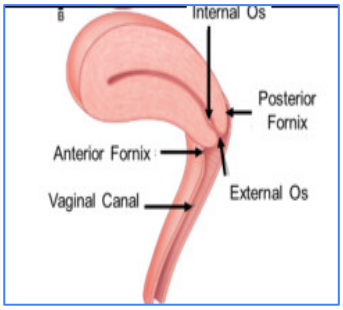
If a woman comes to you in gyn/obstetric, you may end up with doing urethral catheterization to empty the bladder, so in labor, you have to know where is the urethral meatus to insert the cath. but not every woman in labor will end up with catheterization, but in gynecology, you must empty the bladder before starting any procedure.

The vagina

The vagina is closed, so you cannot inspect the vagina except by using an instrument, which is called (speculum). But you have to be careful when you insert the speculum and do not hurt the woman b/c if you hurt the woman, she will hate you and never come back to you!

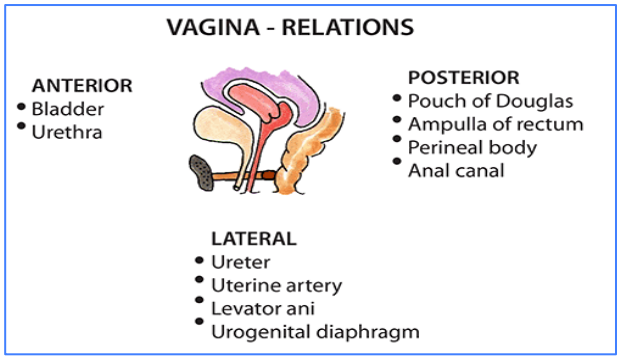
- A Canal/tube extend from the vulva to the uterus
- Runs upwards and backwards
- Walls lie in close contact, easily separated.

Speculum examination



- The posterior vaginal wall is longer than the anterior 11.5 cm (4.5 in) vs 7.5 cm
- Cervix enters the vagina at a right angle.
- **Fornices** = four
  Anterior, posterior, lateral
- **Blood supply:**
- Vaginal aa, uterine aa, middle haemorridal, inferior vesical, pudendal branch of the internal iliac aa.
- **Venous** drainage to corresponding veins.
- **Lymph:** inguinal, internal iliac, sacral glands
- **Nerves**: symphatetic and parasymphatetic
- **Relations:**

Anterior: base of the bladder on upper ½ of vagina.
Posterior: Pouch of Douglas in the lower ½
Rectum centrally
Perineal body inferiorly
Laterally: ??

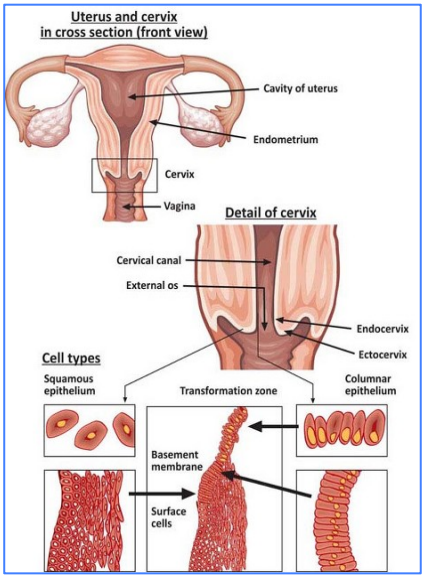


The Cervix

You can also inspect the cervix by using the speculum.
and at the end of your Ex, you have to write (the vulva in normal, the vagina is normal, and the cervix is normal).

Forms the lower 1/3 of the uterus

- Enter the vagina at a right angle
- Barrel shape
- 2.5 cm (1 in) long
- **Two parts:**
  - Supra-vaginal
  - Intra vaginal
- **Cervical os (2 openings)**
  - **Internal os** (You cannot visualize it and you cannot enter your finger in it unless the woman is in labor or in a process of miscarriage/abortion) The internal opening is just like a tip of your pin in case of Nulliparous woman (woman who've **never** given birth), but in case of woman who had babies previously, it is like a slit. **It helps in medico-legal cases, for example, when a woman had a baby and she denies it, you can tell!**
  - **External os (**You can visualize it)
- Cervical canal between the internal os and the external os
- Transformation zone; squamous-columnar junction.



You can protect the women form having cervical cancer by doing a screening test "**Pap smear",** cells form the squamous-columnar junction (squamous cells from the vaginal side of the cervix and columnar calls form the canal of the cervix) are gently scraped from the cervix area. Then the sample of cells is sent to a lab for examination.

Blood supply:

Uterine aa

Lymphatic drainage

Internal iliac, sacral glands

Supports:

- Cardinal ligaments
- Pubocervical ligaments
- Uterosacral ligaments

In early pregnancy and in non-pregnant state, the cervix is very hard and it's just like a carrot, but in late pregnancy, it will become softer.

In pregnancy:

- Rich blood supply – bluish coloration

(The bluish color of the cervix helps in medico-legal cases when you want to know if the woman is pregnant but you're not having facilities to help you!)

- Soft
- Cervical glands – mucus plug "operculum" **This tells you that the cervix will dilate and it's very protective b/c it prevents infection**

Late in pregnancy

- Softer and starts to dilate.

In labor:

- The longitudinal fibers of the uterus contract and retract pulling upward thus reducing the length of the cervix.
- The cervix is made up of fibrous and elastic tissue
- *Full dilatation marks the end of the first stage of labor.*

The Uterus

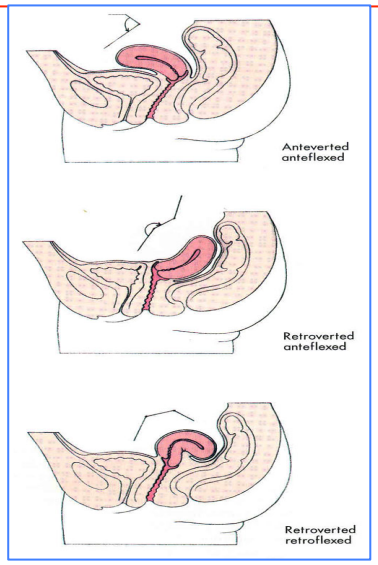
It is a mobile structure, if it is fixed, this is considered "pathology", Q- what can make it fixed?
-Adhesions form a pelvic surgery, pelvis inflammatory disease(PID) or cancers
Most of the female population are having Anteverted uterus, but 20% are having retroverted
you have to say five things when you examine the uterus:
1- position? 2- mobile (normal) or fixed? 3- tender or no tenderness (normal) ?
4- size, Is it normal or not? 5- consistency, Is it firm or soft?

The uterus lies in the true pelvis.
Anteverted (A/V)and anteflexed (A/F)in position.
The body of the uterus lies above the bladder.

- **Size:** 7.5 cm length
- 5 cm wide
- 2.5 cm thick
- 50 -75 gm weight

Gross structure:

- The cervix lower 1/3
- The isthmus
- The cavity
- The corpus
- The cornua ***(at the level of fallopian tube).***
- The fundus



In late pregnancy, the uterus is divided into 2 parts the upper and lower segments and you need to know them when yo deliver the baby by abdominal rote.

Layers:
Endometrium*(is the one that changes in menstrual cycle and sheds during menstruation)*
Myometrium *(3 layers)*
Perimetrium - peritoneum
Adherent, where??? *at the posterior part of the uterus.*
Loose,??? *at the anterior part of the uterus, this lets the bladder to extend and expand. And the loose part helps us a the time of delivery by abdominal rote (C-section), so you can open the loose peritoneum and push the bladder and not let the bladder to be injured then open the uterus at the lower segment.*

Blood supply:
Arteries: fundus – ovarian artery (aa)
Body - uterine aa , directlty from internal iliac aa

The relationship between the ureter and uterine aa

- Uterine aa runs behind the peritonieum, cross transeverse cervical ligament (Cardinal ligament) ther the aa pass anterior to and above the uerter 1.5cm from lateral vaginal wall fornix

Venous: Right ovarian vein - inferior vena cava
Left ovarian vein – renal vein
Lymph: Internal and external iliac gland
Inguinal /Sacral gland

THE FALLOPIAN TUBEs

It's important b/c of Ectopic pregnancy and PID (pelvic inflammatory diseases)

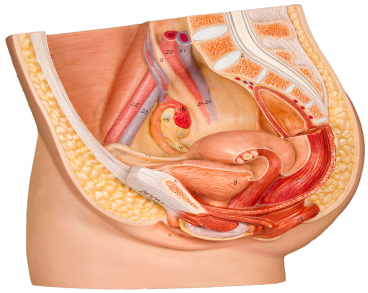
- Extend from the cornua of the uterus, travels towards the sidewalls of the pelvis. Then turns downwards and backwards.
- The tube lies in the upper margin of the broad ligaments
- **Communicate**; superiorly with the uterine cavity, Inferiorly with the perineal cavity
- Length 10 cm (4cm) : 3 mm thick

- **4 PARTS:** **(the parts are imp b/c the presentations are different in case of ectopic pregnancies)**
  - ✓ Interstitial
  - ✓ Ampula *(is the widest part, the ectopic pregnancy in this part will take up to 8 weeks!)*
  - ✓ Infundebulum
  - ✓ Fimbrial
- **BLOOD SUPPLY:** - ovarian aa
  -Uterine aa
  -Venous drainage by corresponding veins

THE OVARIES **(normally they are not palpable)**

- Lie in the posterior wall of the broad ligament at the fiberal end of the fallopian tubes at the level of the pelvic brim.
- Size: almond like = 3 x 2 x 1 cm
  Dull white colour, Corrugated surface *(b/c of ovulation)*
- Structure varies with woman's age.
- **Blood supply** – ovarian aa
- Ovarian vein
- **Lymphatic** lumbar glands
- **Nerves** ovarian plexus
- **SUPPORTS**: They lie in a fossa
  Attached to broad ligament – meso ovarian
  The meso salpinx is the broad ligament that extend between the fallopian tube and the ovary.

❑ ***The Fallopion tubes, ovaries and broad ligments are called Adenxa***



Ligaments:

- **Round ligaments**
  Maintains uterus in A/V + A/F
  From the cornua of the uterus – pass downwards and insert in the tissue of the labia majora.
- **Broad ligaments**
  Not true ligament
  Folds of peritoneum extend laterally from the uterus to the pelvic side walls.
- **Cardinal ligaments**

– Pubocervical
– Uterosacral

THE NORMAL FEMALE PELVIS

The pelvis articulate with the fifth lumbar vertebra above and with the head of each femur in the right and left acetabulum.

The most common female pelvic shapes is gynecoid

- The weight of the trunk is transmitted through the pelvis into the legs.
- Gives protection to the pelvic organs
- The pelvis is the largest bone in the body.

Gross structure: Consists of:

- 5 fused sacral vertebrae and coccyx
- Left & right innominate bones
- 4 pairs of holes (nerves, blood vessels/lymph)
- 4 pairs of holes (nerves, blood vessels/lymph)

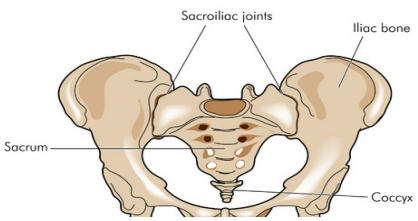
The Sacrum

Based on the shape of the sacrum, you can assess (if the woman can deliver vaginally or not). If a pregnant woman comes to me to assess her pelvis before labor, I would like to know form her sacrum if this woman can deliver vaginally or not, but this is only assessment!!! b/c you can't say 100% this woman cannot deliver vaginally. The best trial for this woman is that she should go into normal delivery (this is the real test) you should give her a chance!

- A triangular shape;
  The hollow of the sacrum – smooth and concave
  The alae of the sacrum - give the appearance of wings
- **The sacral promontory**
  is the center point of the upper border of the first sacral vertebrae.
- The sacral canal opens at the level of 5th sacral vertebra, a passage for spinal cord.
- At the level of the 2nd and 3rd sacral vertebrae, the nerves spread out to form the **cauda equina**.
- **Anesthesia in labor**

THE COCCYX

- 4 Fusesd coccygeal vertebrae
- Triangular shape
- Articulate with the sacrum
- Muscles are attached to its tip.



Right &Left In-nominate Bones

- **Each made of 3 separate parts meet in the acetabulum.**
- **Ilium** upper part is iliac crest (anterior and posterior, superior iliac crest
- **Ischium** ischial tuberosity , 2 cm above is the ischial spines.
- **Pubis** both meet the pubic body fused by cartilage "symphysis pubis"

- **PELVIC JOINTS**
- The two sacroiliac joints
- The symphysis pubis
- The sacrococcygeal joints

- **THE PELVIC LIGAMENTS**
- Sacroiliac ligament = strongest in the body
- Sacro tuberous
- Sacro spinous
- Inguinal ligament

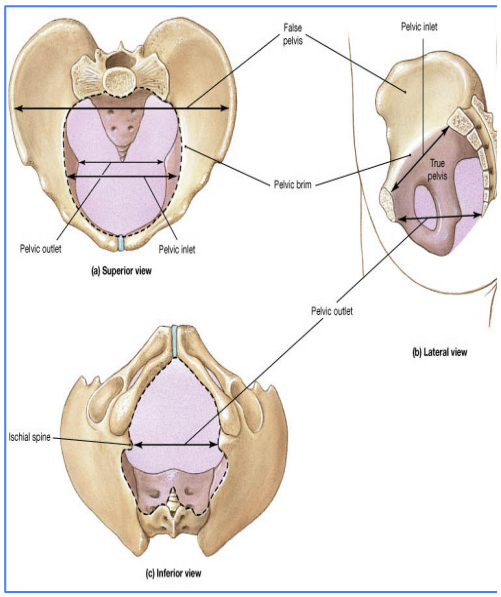
DIVISIONS OF THE PELVIS

The brim divides the pelvis into the parts:

- **The false**: lies above the pelvic brim not important in obstetrics
- **The true**: what lies below the pelvic brim.

It has a : cavity, outlet and a brim

- Forms the curved canal through which the fetus pass during labor.



- **The brim or inlet:**
  - Round in shape
  - Has eight points as demonstrated
  - Bounded anteriorly by the pubis
  - Laterally by illiopectineal lines
  - Posteriorly by ale and sacral promentary
  - Widest diameter is, Transverse
  - True Conjugate (Antero-posterior diameter) from sacral promentary to upper inner border of Symphysis pubis
  - Diagonal Conjugate

- **The Pelvic cavity:**
  - **Extend from the brim above to the pelvic outlet below**
  - **The posterior wall 11 cm formed by hollow of the sacrum**
  - **The anterior wall is formed by the symphysis pubis and obturator foramen 3.8 cm**
  - **The lateral walls sacrosciatic ligamnet and ischial spines**
  - **Interspines Diameter**

❖ **The pelvic outlet**

- ***Anatomical outlet***
- ***Obstetrical outlet***

➢ **The anatomical outlet is formed by fixed pointes useful landmarks for taking pelvic measurement.**

➢ **Bounded anteriorly by pubic Arch**

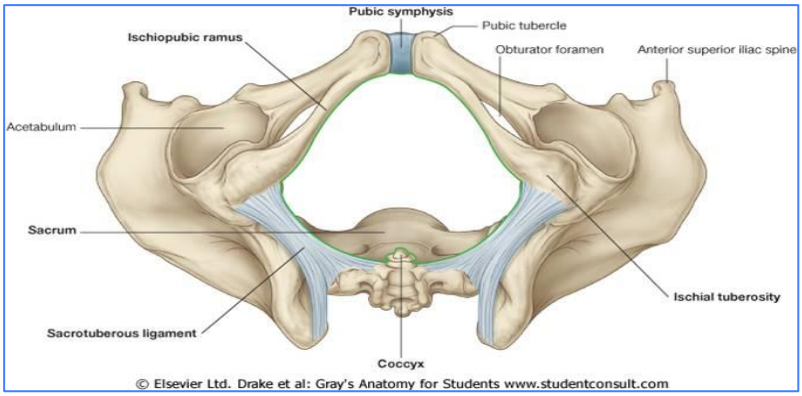
➢ **Laterally by sacro-sciatic lig&Ischail Tuberosity**

➢ **Posteriorly by tip of Coccyx**

➢ **The obstetrical outlet**

<u>The landmarks are:</u>

- **The lower border of the symphysis pubis**
- **The ischial spines**
- **The sacro-spinous ligament**
- **The lower border of the sacrum.**



Average measurements of pelvis

- ***Brim***

Antero-posterior = 11.5 cm
Transverse = 13.0 cm

- ***Cavity***

Antero-posterior = 12.0 cm
Transverse (I/S) = 10.5 cm

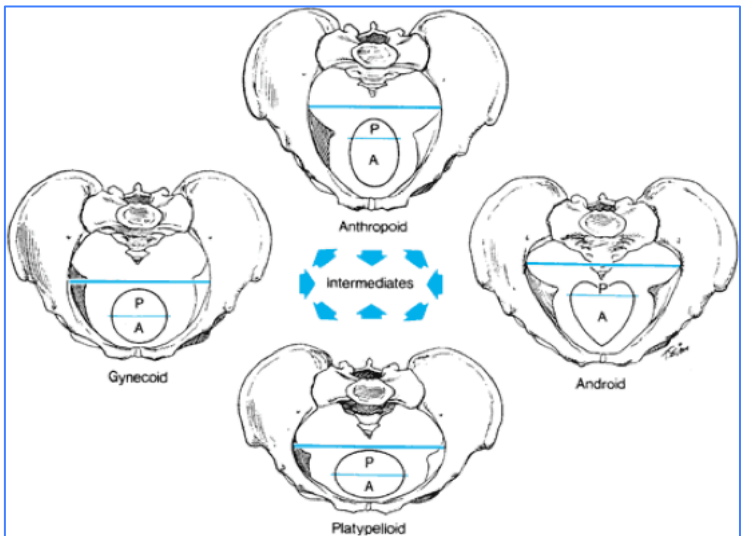
- ***Outlet***

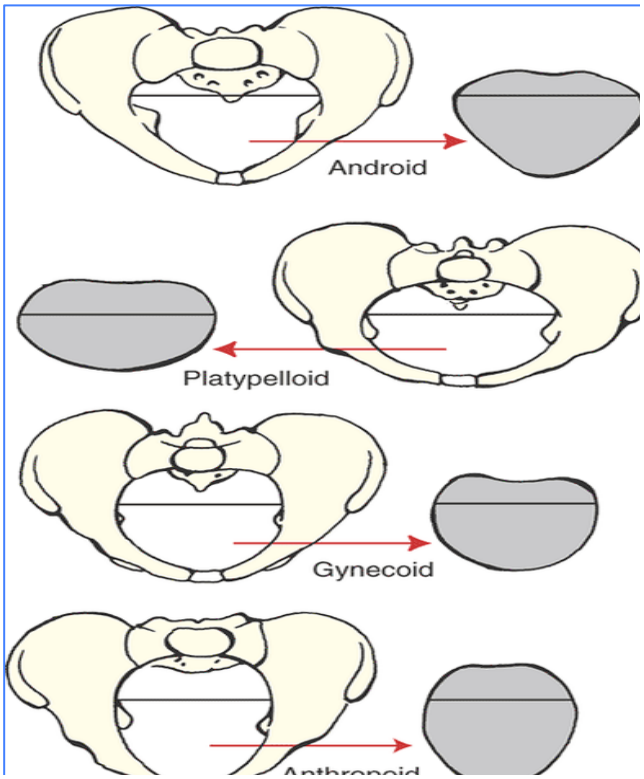
Antero-posterior = 12.5 cm
Transverse = 11.0 cm

Abnormal Pelvis

Four Types

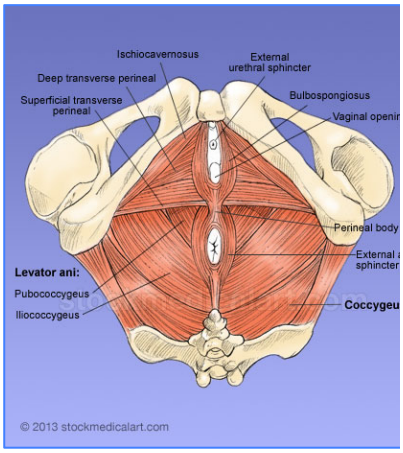
1. Gynecoid Pelvis 50%
2. Anthropoid 25%
3. Android Pelvis 20%
4. Platypelloid (flat)5%





THE PELVIC FLOOR

- The outlet of the pelvis is filled with a soft tissue that supports the pelvic and abdominal organs.
- It forms as a gutler-shaped structure highest anteriorly than posteriorly.
- Three canals with external orifices run through the tissue
  1. The urethra
  2. The vagina
  3. The rectum



- **There are six layers of tissue.**

1. An outer covering of skin
2. Subcutaneous fat
3. Superficial muscles enclosed in fascia
4. Deep muscles enclosed in fascia
5. Pelvic fascia, thickened to form pelvic ligaments
6. Peritoneum

- **Superficial muscles:**

1) Transverse perinei
2) Bulbo-cavernosus
3) Ischio-cavernosus

- **Deep muscles**

Three pairs of muscles all have their insertion around the coccyx
Their anatomical name is levator ani muscles, 5 mm thick

1. Ilio coccygeus
2. ischio coccygeus
3. pubo- coccygeus

PERINEA BODY

- Lies between the <u>vaginal and rectal canals</u>
- Is triangular, the base is the skin and the apex pointing upward each side is 3.8 cm in length
- **Three layers of tissue**
  1. outer covering of skin
  2. superficial pelvic floor
- bubo-cavernous
- transverse perinei
  3. deep pelvic floor muscle.

Episiotomy, types?, indications?*" read about them"*

FETAL SKULL

- Vault – formed from membrane and not cartilage
  There are 5 points – ossification centers
- Calcification begins as early as 5 weeks after conception
- Premature baby is born, intracranial damage!!!!
- Skull is divided into **regions**
  1-The vault (cranium) (it extends from orbital ridges until the nape of the neck) and it consists of the occipital bone, parietal bones, temporal, and frontal bones.

Anencephaly is a neural tube defect characterized by **absence** of the cranial ***vault*** and cerebral hemispheres. And it can be diagnosed by ***ultrasound in week 12***

  2-The face.
  3- The base
- **Bones:** *Bones are separated by? **"Sutures" they are imp in labor b/c they overlap during delivery, but we don't want too much overlapping b/c this is dangerous for the baby.*** At **birth, the cranial bones touch each other, this process known as "*molding*" which is (grade one)**
  And if they overlap and you can separate them, this is (grade two).
  But if they overlap and you cannot separate them, this is (grade three) and it's dangerous, grade 3 is a sign of "cephalopelvic disproportion" the head cannot go through the maternal pelvis, so it can damage the brain! .

1. Two frontal bones
2. Two parental bones
3. One occipital bone

Suture, an area of membrane which has not ossified:

- Lambdoidal suture
- Sagittal suture
- Coronal suture
- Frontal suture

- **Fontanelles very important landmarks**
  Areas where two or more sutures meet.
- **Anterior fontanelle**, diamond in shape where sagittal and frontal sutures meet
- **Posterior fontanelle**, where lambdoidal and sagittal sutures meet.

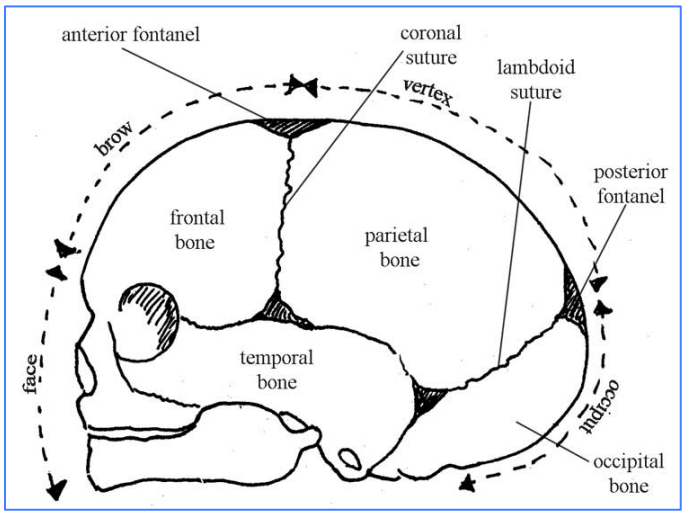
AREAS OF THE SKULL

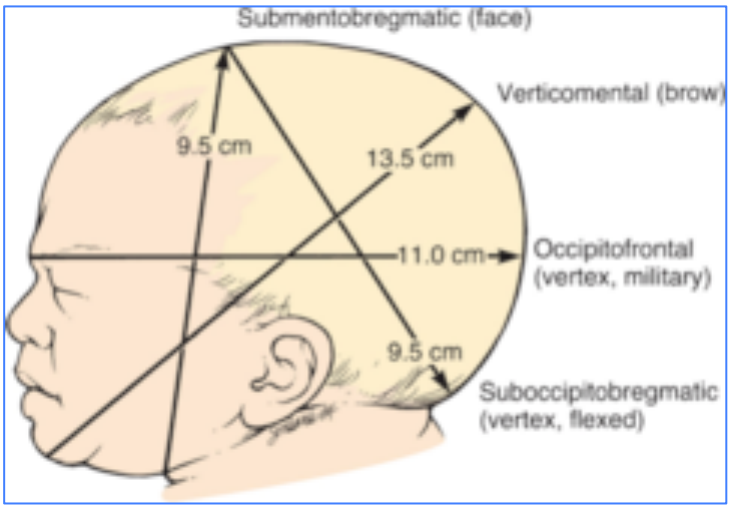
1. Glabella: the bridge of the nose
2. Sinciput : the forehead
3. Bregma: the anterior fontanelle
4. **Vertex**
5. Lambda: the posterior fontenlle
6. Occiput
7. Suboccipital area
8. Mentum: the chin

Malposition
Malpresentation

CIRCUMFERENCES OF THE FETAL SKULL

- The engaging Diameter in a well flexed head:
  suboccipito-bregmatic+ Biparietal
  In Vertex presentation
- The engaging Diameter in a Deflexed head (partly extended)
  OccipitoFrontal+Biparietal
  In Occipito posterior Position





DIAMETERS OF FETAL SKULL

- Bipareital
- Bitemporal
- Suboccipital-bregmatic
- Occipito frontal
- Mentovertical
- Submento-bregmatic

Effect of Labor and delivery

- **Molding** (we've discussed it previously)
- **Caput succedaneum**

When there are good contractions and the baby fails to flex and rotate his/her head and there is increasing in molding, those will increase the caput succedaneum (it's edema 'collection of fluid' in the fetal head b/c there is pressure of the cervix on the fetal head)

- ***Cephalhematoma*** ***(blood between the skull and the periosteum of a newborn baby)*** Effect of ??????
  Cephalhematoma is one of the most common cranial injuries that an infant may suffer especially during a forceps-assisted delivery (instrumental delivery)

The placenta

It's very imp to know the structure of the placenta to prevent postpartum hemorrhage

- ***Structure of the mature placenta***

  Maternal surface lies next to the uterus on inspection, chorionic villi are arranged in lobes/cotyledons – **20 in number** – 200 lobules. ***After the delivery of the placenta you have to inspect it very well and check the 20 cotyledons carefully to prevent any complications from any missed parts inside the uterus b/c she may get infection or 2ry postpartum hemorrhage.***

  - The groove separating the lobes are sulci
  - dark – red color, rough surface

  Fetal surface, faces the baby. Bluish gray color, smooth, shiny surface.

  Umbilical cord inserted in the fetal surface usually in the center

  - Blood vessels seen radiating from the cord
  - The amniotic membranes covers the fetal surface.

❖ ***Structure of the mature placenta***

- Flat, Roughly circular
- 22 cm in Diameter
- 2cm thick in the center
- Weight: 1/6 of the baby's weight

❖ Abnormalities of placental development.

- Placenta succenturiata
- Placenta bipartita
- Placenta circumvallata
- Placenta velamentosa
- Placenta succenturiata/ Placenta velamentosa

and **Vasa previa** ***(it's very dangerous, may cause fetal death!)***

Before labor, when you start artificial rupture of the membrane and you get bleeding, this can be vasa previa or premature separation of placenta)

Umbilical cord

(After the delivery, you have to inspect the umbilical cord and write that it contains 2 arteries and one vein)

❖ At full term: 40-50 cm long
1.5 cm in diameter

- Twisted in appearance
- Two umbilical arteries
- One umbilical vein
- Wharton jelly

❖ Abnormal insertion of the cord

➢ Battledore insertion
➢ Velamentous insertion

Fetal circulation

Very helpful videos

Fetal circulation before birth http://www.youtube.com/watch?v=-IRkisEtzsk

Fetal circulation after birth http://www.youtube.com/watch?v=jFn0dyU5wUw

- How does the fetal circulatory system works?
- Two Major Events?

Cardiovascular system

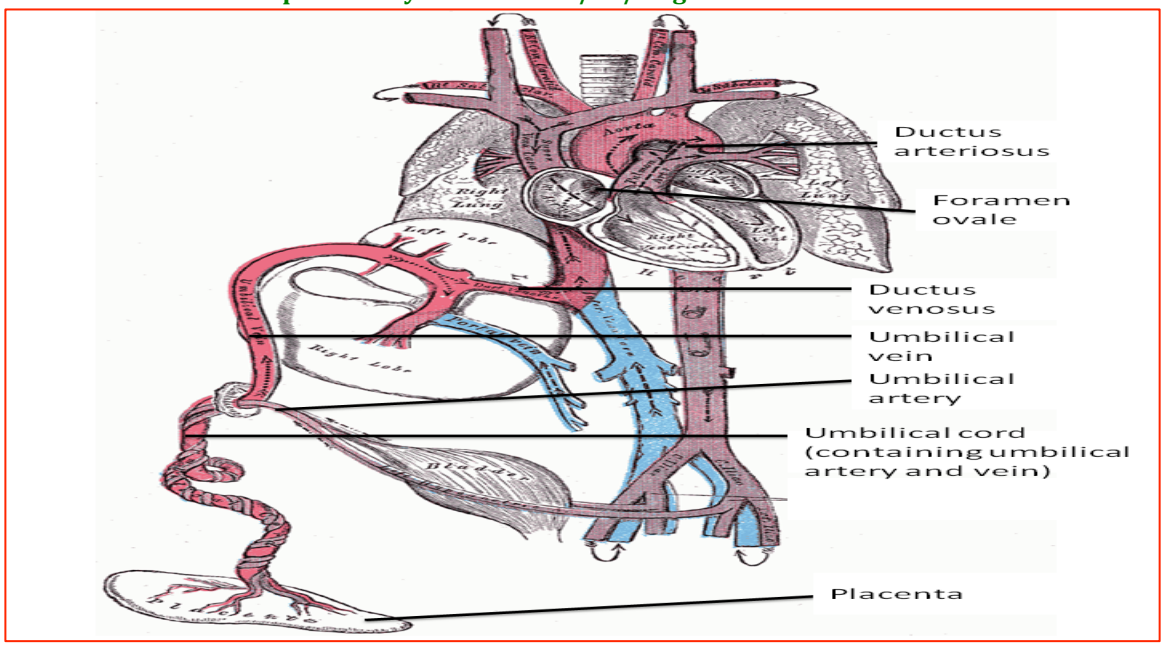
Major variant are explained by:

- ❑ the presence of umbilical-placental circulation ***(during pregnancy(it relies on the mother 'placenta ')***

and

- ❑ absence of significant pulmonary circulation.

The fetus doesn't need pulmonary circulation b/c s/he gets O2 form the mother



- The fetal circulatory system uses three shunts???

- Purpose of these shunts?

The O2 comes from the mother to the fetus through the placenta→ umbilical vein → ductus venosus (in the liver- what makes this duct open? Is the Prostaglandin (PG))→foramen ovale (heart)→ ductus arteriosus →brain!

After delivery of the baby and placenta, you have to clam in both direction NOT CUT → there will be pressure changes in the shunts which will close them.

- The respiratory function of the placenta requires that oxygenated blood be returned via the umbilical vein and into the fetal circulation.
- High venous return from the placenta (oxygenated blood O2 saturation 70-80%) through the umbilical vein.
- This maintains the right-left shunt through the foramen ovale
- Delivers most oxygenated blood to fetal heart and brain (major organs)and upper extremities .

- Placenta -umbilical vein- ductus venosus,
- Most of the blood into the inferior vena cava (IVC), this mixes with returning non oxygenated blood from the lower limbs and kidney, liver. However, only partial mixing of the two streams.
- Most of the oxygenated blood is directed to the crista dividens at the upper end of the inferior vena cava into the right atrium through the foramen ovale
  and thus into the left atrium and hence to the left ventricles and ascending aorta to be directed to the brain, heart and upper extremities.

- The remainder of the blood from the superior vena cava mixes with that of IVC and passes directly to the right ventricle.
- 10% of it goes through the pulmonary artery to the lung.
- Most of this enters the systemic circulation via the ductus arteriosus and into the descending aorta beyond the vessels supplying the head,
- It supplies the viscera and lower limbs
- It then passes into the umbilical arteries (branches of left and right internal iliac arteries)
- High pulomary vascular resistance maintains the right-left shunt through the ductus arteriosus.

At birth:

- **Blood circulation after birth,**
- **The closure of the shunts;**
  - **Ductus arteriosus**
  - **Foramen ovale**
    - **Completes the transition of fetal circulation to newborn circulation.**

❑ **Umbilical vessels contract**

- **Cessation of umbilical blood flow causes a fall in pressure in the right atrium. The foramen ovale is a valvular opening, the valve functioning from the right to left.**
- **The left atrial pressure rises and thus closure of the foramen ovula.**

❑ **Breathing**

- **Ventilation of the lung helps to create a negative thoracic pressure, this opens the pulmonary circulation and thus diverts blood from ductus arteriosus which then gradually closes.**

❑ **What maintains patency of ductus arteriosus in utero?**