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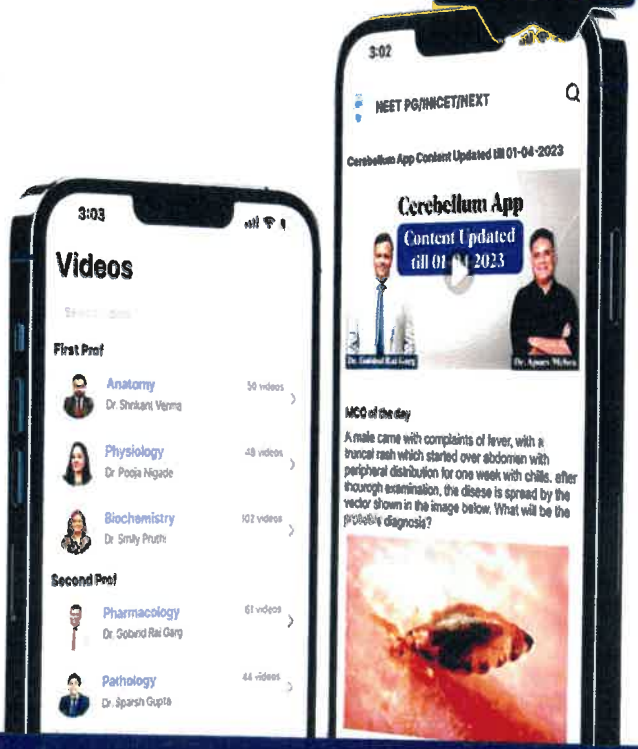

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Table of Content

List of Topics NOT-SO-IMPORTANT for FMGE-Aspirants:

- Epilepsy in Pregrancy
- Thyroid disorders in pregnancy
- Renal and Urinary Tract in Pregnancy
- Placenta Accreta Syndromes (PAS)/Morbidity Adherent Plancenta
- Treatment of Fistulas
- Benign Diseases of the Vulva
- Vulvar Carcinoma
- Injuries to Birth canal (Only classification is important)
- In 3rd stage complications: Retained placenta and uterine inversion not importent
- In physiology of menstruation: Puberty Physiology not required
- Post term pregnancy

Unit 1

Basic Obs & Gynae

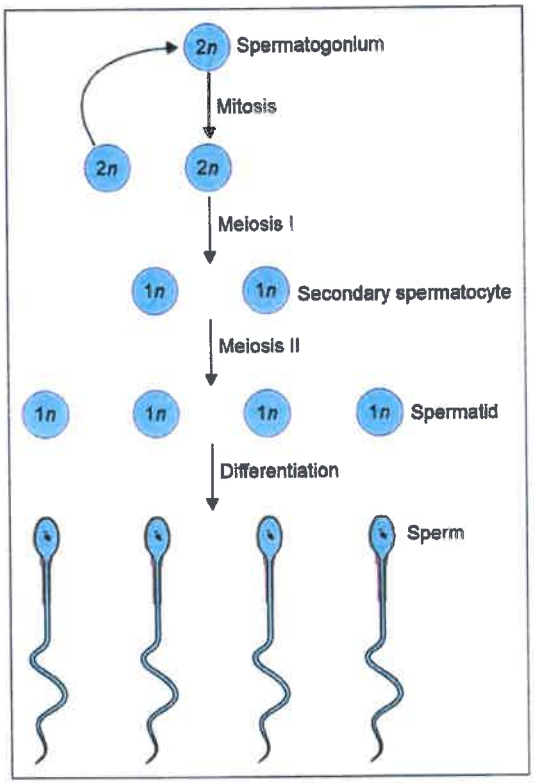
1 Chapter

BASIC OBSTETRICS

PHYSIOLOGY OF REPRODUCTION

Gametogenesis: The process of maturation of spermatozoa in male and ovum in female is called gametogenesis

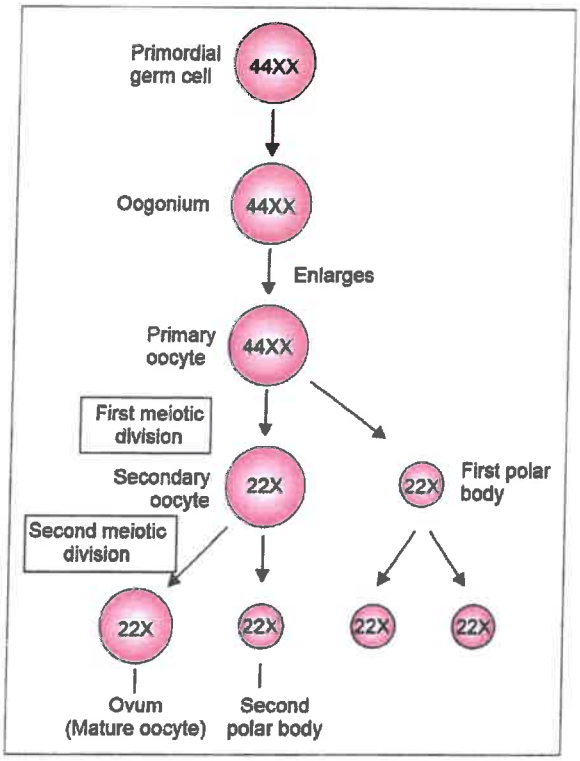
1. Spermatogenesis



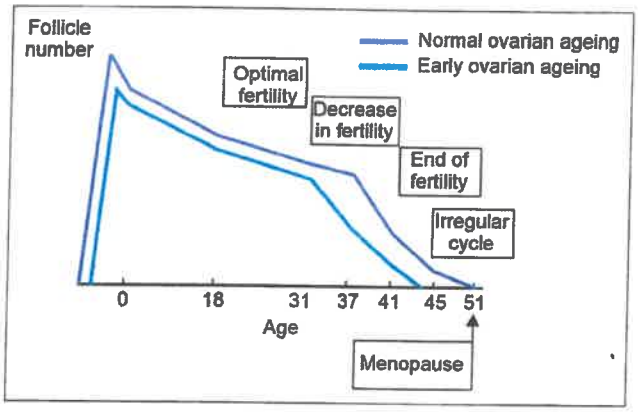
The process of formation of spermatozoa from the primordial male germ cells is called spermatogenesis.

- Just prior to puberty, the dormant primordial cells convert into spermatogonial stem cells from which spermatogonia arise
- The spermatogonia undergo Mitosis to form primary spermatocyte (46XY) which then enter the 1st meiotic division
- Primary spermatocytes rest for about 22 days in prophase and then rapidly complete the 1st meiotic division to form 2 secondary spermatocytes (23X or 23Y)
- During the 2nd meiotic division, these form 4 spermatids (23X, 23X, 23Y, 23Y)
- A total of 4 spermatids are formed
- These undergo further differentiation to form 4 spermatozoa: This is known as spermiogenesis
- In spermiogenesis the following take place
  - Formation of acrosome
  - Formation of neck, middle piece and tail
  - Condensation of nucleus
  - Shedding of most of cytoplasm
- Spermatogenesis depends on LH and FSH
- Time: 60-64 days
- Spermatozoa further undergo more maturation in the epididymis
- Changes in sperm before fertilization
  - CAPACITATION: Biochemical changes enabling them to bind and fertilize with the ovum. Only a capacitated sperm can penetrate the corona radiata
  - ACROSOME REACTION: Occurs after the sperm binds to the zona pellucida (ZP). The glycoprotein of the ZP is responsible for this. It results in release of acrosin and trypsin needed to penetrate the zona

2. Oogenesis



- Oogenesis is the process of formation of a mature ovum form the primordial female germ cell
- The primitive germ cells migrate from the yolk sac to the gonadal ridge by the end of the 4th week
- In the female gonads, the germ cells multiply by mitosis to differentiate into oogonia to reach a maximum of about 7 million at 20th week.
- Then they steadily undergo atresia and apoptosis and decline in number
- At birth: 1 to 2 million
- 400 000 at puberty
- 100 follicles at menopause



- About 15-20 primary oocytes begin to mature under the influence of FSH during each menstrual cycle
- Only 1 of these will reach maturity and ovulate
- The rest will degenerate (corpus atreticum)
- The primary oocyte undergoes meiotic division to produce 2 unequal daughter cells under the influence of the mid-cycle LH surge
- Each daughter cell has haploid (23X) number of chromosomes
- The large cell which receives most of the cytoplasm is called the secondary oocyte and the smaller one is called the 1st polar body
- The secondary oocyte immediately enters the 2nd meiotic division and gets arrested in METAPHASE of meiosis II.
- Thus ovulation takes place when the oocyte is still in metaphase
- This ovum travels along the fallopian tube towards the uterus
- The 2nd meiotic division is completed only AFTER FERTILIZATION by sperm resulting in the formation of again 2 unequal daughter cells: The MATURE OVUM (23 X) and the 2nd POLAR BODY (23X)
- If fertilization does not happen, the secondary oocyte degenerates in 12-24 hours without proceeding for MEIOSIS II.

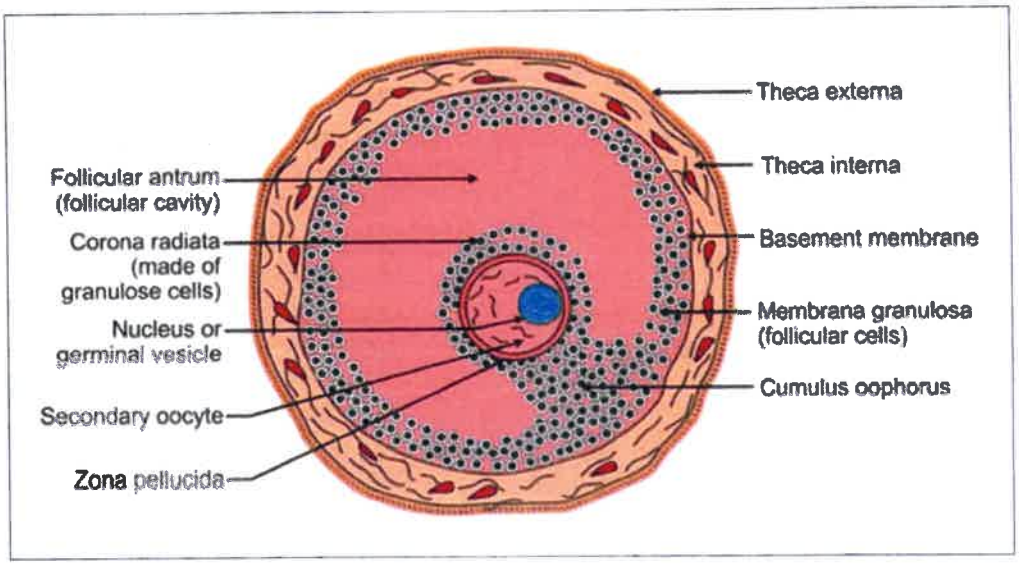
Structure of the Mature Graafian Follicle:

- The primary follicle (also called pre-antral follicle) is basically the follicular cells surrounding the oocyte
- This then matures into a secondary (or antral follicle) which has an antrum (containing follicular fluid) and an outer layer called the theca interna

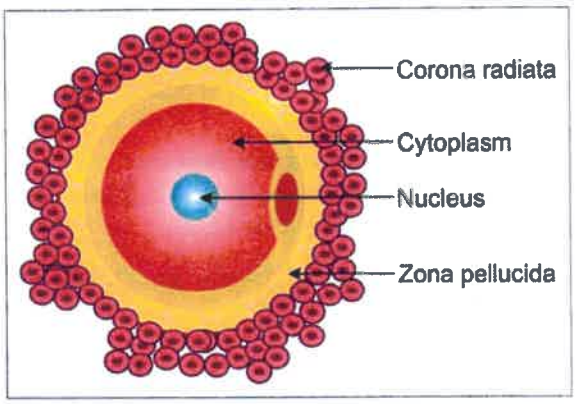
- The cavity gradually increases in size and finally forms a pre-ovulatory follicle (Mature Graafian follicle)
  - The cavity is eccentric
  - The granulosa cells surrounding the oocyte are called the cumulus oophoricus.
  - The granulosa cells attached to the wall of the oocyte is called discus proligerus
  - Inner lining is called theca interna
  - Outer is called theca externa

STRUCTURE OF A MATURE OVUM

- Diameter: 130μ in diameter
- Largest cell in the body
- Ooplasm is the cytoplasm
- Nucleus is eccentric
- Haploid (23X)
- Enveloped by a vitelline membrane and an outer thick zona pellucida (mucoprotein)
- The ovum is alecithal
- Follicular cells surround the ova and are called the corona radiata



Structure of a Mature Graafian Follicle



Structure of the human ova

Ovulation

- Process by which a secondary oocyte is extruded from the ovary after rupture of a mature ovarian follicle
- Usually occurs 14 days before the next cycle is due
- Causes of ovulation
  - LH surge: This is due to sustained raised estradiol levels
  - FSH rise
- Timing: Ovulation occurs
  - 24-36 hours after onset of LH surge
  - 48 h from the estradiol peak
  - 12-18 from peak of LH surge
- After ovulation, the corpus luteum is formed which will degenerate to form the corpus albicans if pregnancy does not occur

Fertilization

- Happens in the fallopian tube (ampulla)
- 3 main steps
  1. Penetration of the corona radiata: Hyaluronidase and acrosin are secreted from the acrosomal cap of the capacitated sperm help it penetrate the corona radiata
  2. Penetration of the Zona Pellucida (ZP)

a. ZP has sperm receptor zona proteins (ZP1,2 and 3) which mediate the acrosomal reaction and binding

b. Once 1 sperm enters, there is a zona reaction or vitelline block which disallows other sperms from entering. This happens because

i. Cortical reaction: Causes hardening of the ZP

ii. Depolarization

3. Fusion of the oocyte and sperm and formation of the pro-nucleus

Post Fertilization Events

- Cleavage: Subdivision of the fertilized ovum into smaller cells
- 2-cell stage at 30 hours
- 4-cell stage at 40-50 hours
- Morula (16-cell stage): 72 hours: Cluster of cells resembling a mulberry
- The inner cells of the morula form the inner cell mass or the embryo proper (Embryoblast)
- Outer cells: Trophectoderm (future trophoblast) which later forms the placenta and membranes
- Blastocyst: 4th-5th day

Implantation

- 6^{th}-7^{th} day after fertilization (20^{th}-21^{st} day) of a regular menstrual calendar
- 4 steps
  - Apposition (disappearance of the ZP and ecape of embryo - zona hatching)
  - Adhesion
  - Penetration
  - Invasion

Decidua

- Thickened vascular endometrium of the pregnant uterus is called the decudua
- It has 3 parts
  1. Superficial compact layer: Role in trophoblastic invasion and penetration
  2. Immediate spongy layer: Layer of placental separation
  3. Thin basal layer
- The decidua can also be divided into 3 areas
  - Decidua basalis: site of attachment of placenta
  - Decidua capsularis: Portion of decidua between the embryo and uterine cavity
  - Decidua parietalis (or vera): Portion of the placenta not related to implantation
- The decidua capsularis and parietalis fuse and obliterate the decidual space by around 10-12 weeks of gestation

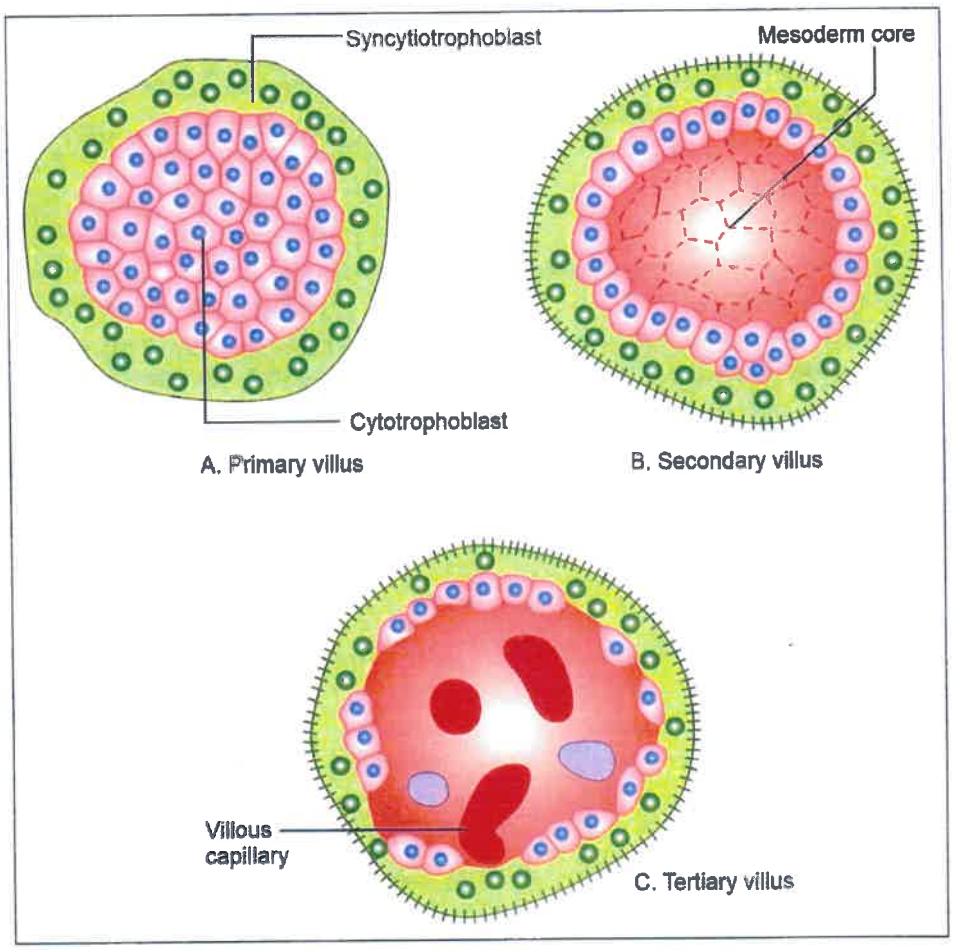
2 Chapter

PLACENTA

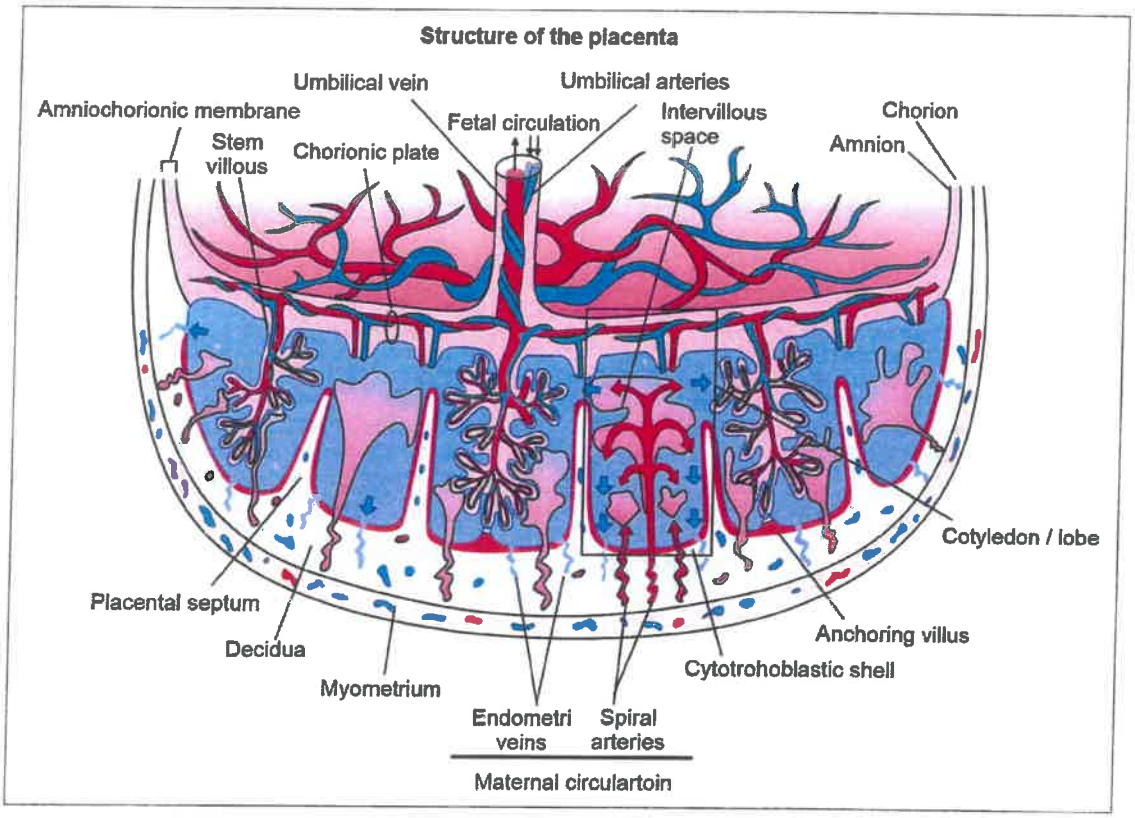
DEVELOPMENT OF PLACENTA

- The human placenta is
  - Hemochorial (Direct contact of the chorion with maternal blood)
  - Discoid in shape
  - Deciduate (i.e. it is shed at delivery)
- Development of the placenta

1. Formation of chorionic villi
   a. Primary villus
   B. Secondary villus
   C. Tertiary villus



STRUCTURE OF THE PLACENTA:



Placenta at Term:

- Fleshy Discoid
- 500g in weight
- Diameter: 15-20 cm
- Thickness: 2.5 cm
- Volume: 500ml
- 2 surfaces: Fetal and Maternal
- 4/5th of placenta is fetal origin and 1/5th is maternal origin (decidua basalis and blood in the intervillous spaces)
- 15-20 cotyledons on the maternal surface
- Separation occurs at the spongy layer

- Placental circulation consists of
  1. Uteroplacental circulation (Blood enters from the spiral arterioles; circulates in the intervillous space and is drained by the uterine veins)
  2. Fetoplacental circulation (Oxygenated blood travels to the fetus through the umbilical vein and deoxygenated blood flows through 2 umbilical arteries to the placenta)

3
Chapter

FETAL PHYSIOLOGY

FETAL HEMATOPOIESIS

- Fetal Hematopoiesis: Demonstrable in the yolk sac by the 14th day followed by the liver between 6-10 weeks.
- Hematopoiesis in the bone marrow begins at 15-16 weeks and spleen at 19-20 weeks
- At 40 weeks: 75-80% of total Hb is HbF, 20% is HbA and 5-10% id HbA2
- By 6-12 months of birth, fetal Hb is totally replaced by adult Hb
- HbF has higher affinity for O2 due to less binding of 2,3-diphosphoglycerate as compared with HbA.
- Thus fetal Hb binds with O2 even at lower pressures of O2
- HbF is also more resistant to denaturation with alkaline reagents: Basis of Apt Test
- Ways of differentiating fetal Hb and adult Hb
  - Rosette test
  - Apt test (alkaline denaturation test)
  - Kleihauer Betke test
  - Flow cytometry
- Lifespan of fetal RBS: 80 days

Fetal Urinary System

- Fetal kidneys start producing urine at 12 weeks

GIT

- Fetal swallowing if amniotic fluid appears at 12 weeks, gradually increases to 250ml/ day at term
- Fetal bowel contains intestinal secretions, deswuamated fetal cells, lanugo, scalp hair, vernux and undigested debris from swallowed amniotic fluid. Its dark green color is from biliverdin secreted by the lover.
- Meconium may be passed at term as part of normal bowel peristalsis but is also released due to fetal hypoxia

Respiratory System

- Surfactant production: Produced by type 2 pneumocytes
- The main active component of surfactant is a lecithin: Dipalmitoyl phosphatidyl choline
- Fetal cortisol is the natural trigger for surfactant production
- Begins to be produced at about 24 weeks
- By 34 weeks, adequate surfactant has been produced
- Both dexamethasone and betamethasone (maternal administration) can accelerate surfactant production

Fetal Thyroid

- First endocrine gland to develop
- Develops around the 4th week, is secreting T3 and T4 by 11th week

Fetal Circulation

Umbilical Vein: Carries oxygenated blood from the placenta to the fetus

↓

Umbilical vein divides into the Ductus Venosus and the Portal Sinus

↓

Ductus venosus: Major branch; Traverses the liver and enters the IVC directly; i.e. it carries well oxygenated blood directly to the heart;

↓

The IVC contains mixture of oxygenated blood (ductus venosus) and deoxygenated blood returning from the liver and lower body: Thus the O2 content of blood delivered to the fetal heart is less than that leaving the placenta

↓

The Right Atrium directs the blood to the Left atrium or the Right ventricle depending on the oxygen content

Well oxygenated blood is preferentially shunted to the left side of the heart (through the foramen ovale) and then to the heart and brain

Less oxygenated blood enters the RA - RV

The deoxygenated blood returning from the brain and upper body also enters the RA and then the RV.

Blood in the RV is 15-20% less oxygenated than the LV

↓

90% blood from the RV is shunted to the descending aorta through the Ductus Arteriosus. Due to high pulmonary resistance; only 8% blood enters the lungs

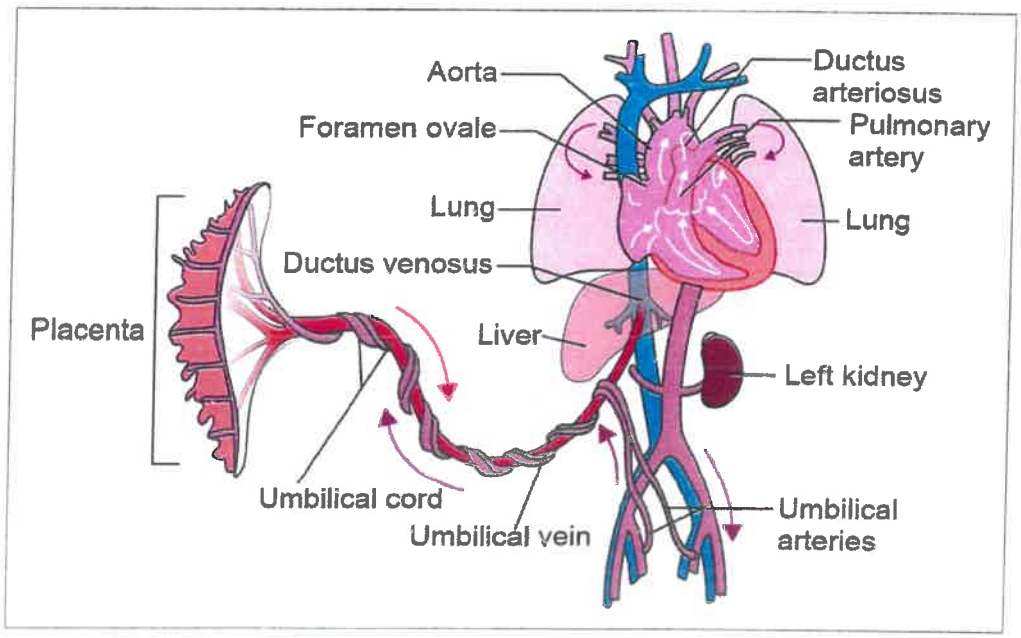
↓

Blood exits the fetus through the 2 hypogastric arteries - these 2 arteries course from the bladder along the abdominal wall and into the umbilical cord as the umbilical arteries.

Remember

- Oxygenated blood enters the fetus through: Umbilical Vein
  - Functional closure: Occurs after closure of umbilical artery
  - Forms the ligamentum teres
- Deoxygenated Blood exits the fetus through Umbilical arteries
  - Functional closure of umbilical arteries: immediately after birth
  - Anatomical closure: 2 - 3months
  - Proximal part form the superior vesical arteries
  - Distal part form the lateral umbilical ligaments
- Ductus venosus: Shunts blood from umbilical vein to IVC
  - Functional closure 10 - 96h after birth
  - Anatomic closure: 3 -7 days
  - Forms the ligamentum venosum
- Ductus arteriosus: Shunts blood from Pulmonary artery to Aorta
  - Functional closure: 12 - 24 h
  - Anatomic closure: 2 - 3 weeks
- Foramen ovale
  - Functional closure soon after birth
  - Anatomical closure at 1 year

Fetal circulation



Unit 2

Antenatal Care

4 Chapter

ANATOMICAL AND PHYSIOLOGICAL CHANGES IN PREGNANCY

Vagina

- Hyperemic: Jacquemier/ Chadwick sign: bluish discoloration of the vagina

Vaginal pH: - Depends on the estrogen levels
Newborn: 5.6
Children: 6 - 8
Puberty: 4
Pregnancy: 4
Menopause: 7

- pH: Acidic (3.5-6)

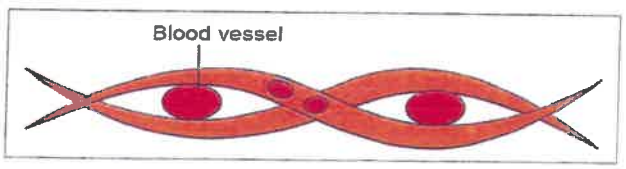
Increased estrogen
↓
Lactobacillus acidophilus
↓
Glycogen → Lactic acid
↓
Acidic vagina (pH is low)

- Increased thick white secretions
- Cytology: Navicular (ovoid) epithelial cells (Effect of Progesterone)

Uterus

	Non-Pregnant	Pregnant (Term uterus)
Size	7.5 x 5 x 2.5 cm	35 x 25 x 20 cm
Weight	50-70 g	1000g (20 times increase)
Shape	Pyriform	Globular and spherical
Position	Anteverted and Anteflexed	Dextrorotation (To the right because of the rectosigmoid on the left)
Consistency	Firm	Becomes softer
Capacity	5-10 ml	4000 ml

- The uterine musculature undergoes both hypertrophy and hyperplasia
- Middle layer: figure of 8; prevention of PPH

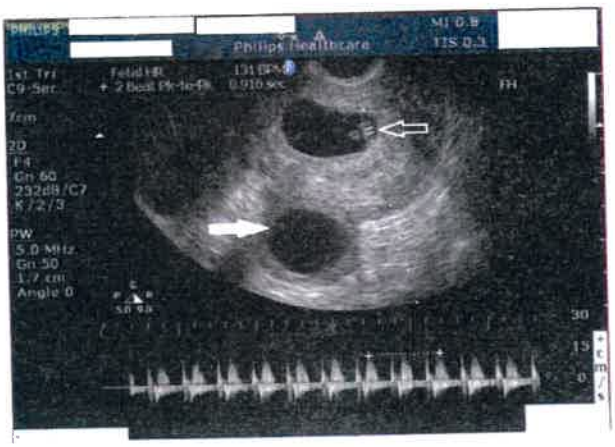


- Uterine vascularity
  - 10ml/ min at 10 weeks to 500ml/ min at term
- Braxton Hicks contractions:
  - 2nd trimester onwards
  - Infrequent, Irregular, Painless contractions
  - Don't cause cervical dilatation
  - 5-25 mmHg
  - Increase near term
  - ABSENT in Abdominal Pregnancy
- Formation of lower uterine segment from the isthmus
- Cervix:
  - > 2.5 cm
  - Firm in consistency; becomes soft near term

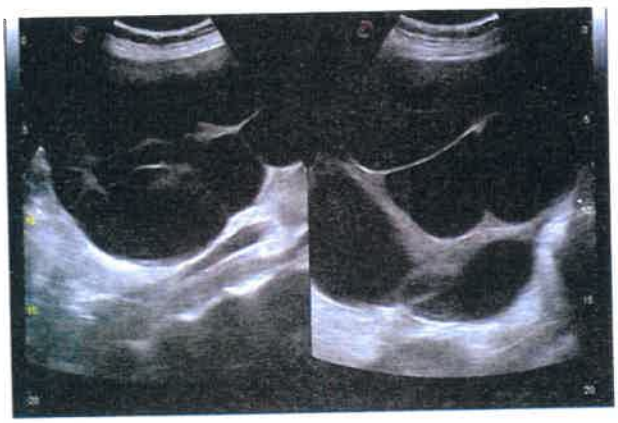
- Cervical erosion forms
  - Endocervical columnar epithelium everts out beyond the squamo-columnar junction
  - Also seen in (because of ↑ estrogen levels)
    - Young age
    - OCPs

Ovaries

- Corpus luteum cyst
  - Max in structure and function at **8 weeks**
  - Responsible for support of pregnancy till 8 weeks
  - Thereafter the placenta takes over
  - **Will show ring of fire sign on Doppler (Also seen in Unruptured tubal ectopic)**



- Theca lutein cysts:
  - Molar pregnancy (Complete mole > Partial mole)
  - Due to very high beta hCG levels
  - No treatment required; evacuation of molar pregnancy and once Beta hCG levels come down, the cysts disappear

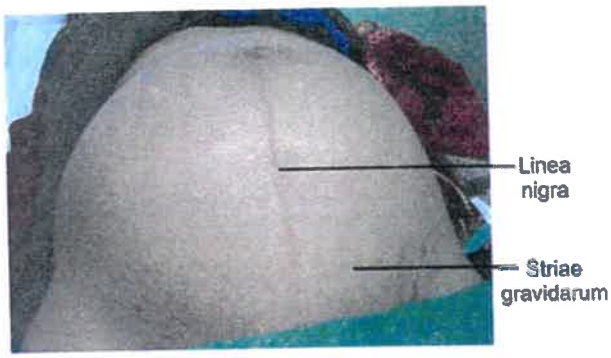


Breast

- High Estrogen: Hypertrophy and proliferation of breast ducts
- **High Estrogen and Progesterone: Proliferation of alveoli**
- Montgomery's tubercles: Hypertrophic sebaceous glands
- Formation of secondary areola
- Colostrum production: **3-4 months of pregnancy**

Skin

- **Chloasma**
- Linea Nigra (Hyper pigmented line from xiphisternum to pubic symphysis)
- Striae gravidarum (Reddish striae of present pregnancy)
- Striae albicans (Silvery striae of previous pregnancies)



Hematological Changes

- ↑ Blood volume (by 40%) Q
  - **Max at 32-34 weeks Q**
  - Higher in multigravida, multiple pregnancy and large babies
- ↑ Red cell volume (20%) Q
- This disproportionate increase in plasma and RBC volume; produces a state of hemodilution during pregnancy - fall in Hb by about 2g% at term - physiological anemia
  - ↓ Hb (13.5 g% to 11.5g%)
- ↓ Hematocrit
- ↓ RBC count
- Slight ↓ in MCV, MCH and MCHC