Obstetrics

Marrow Edition 8

MARROW

Instructions

- Notes are to be used in conjunction with Marrow videos.

Please note:

- The information in this book has been printed based on the transcript of the Marrow videos. This book has to be used in conjunction with the Marrow videos and not as a standalone material.
- The information contained in this book is for educational purposes only. The content provided is not intended to substitute for professional medical advice, diagnosis or treatment.
- This book cannot be sold separately. It has been made available to only select eligible users who have an active subscription to Marrow videos.
- The text, images, slides, and other materials used in this book have been contributed by the faculty, who are subject matter experts. We have merely reproduced them as video transcripts in this book.
- The notes have been consciously designed in a way that is concise and revisable. To ensure this, we have intentionally added only the most relevant modules and images that are needed for you.
- Reasonable care has been taken to ensure the accuracy of the information provided in this book. Neither the faculty nor Marrow takes any responsibility for any liability or damages resulting from applying the information provided in this book.

// ME821-PPL

Contents

Gynaecology

General Gynaecology

Gynaecologic Infections

Infertility and Contraception

Gynaecologic Oncology

Obstetrics

Fundamentals of Reproduction

Normal Pregnancy and Antenatal Care

Medical and Surgical Complications in Pregnancy

Obstetric Complications

Labor and Puerperium

GAMETOGENESIS

----- Active space -----

Primordial germ cells :

- Gametogenesis begins with the primordial germ cell (PGC).
- Derived from :
  - Epiblast.
  - Ectoderm.
- Bipotent cells : They can form spermatogonia/oogonia.

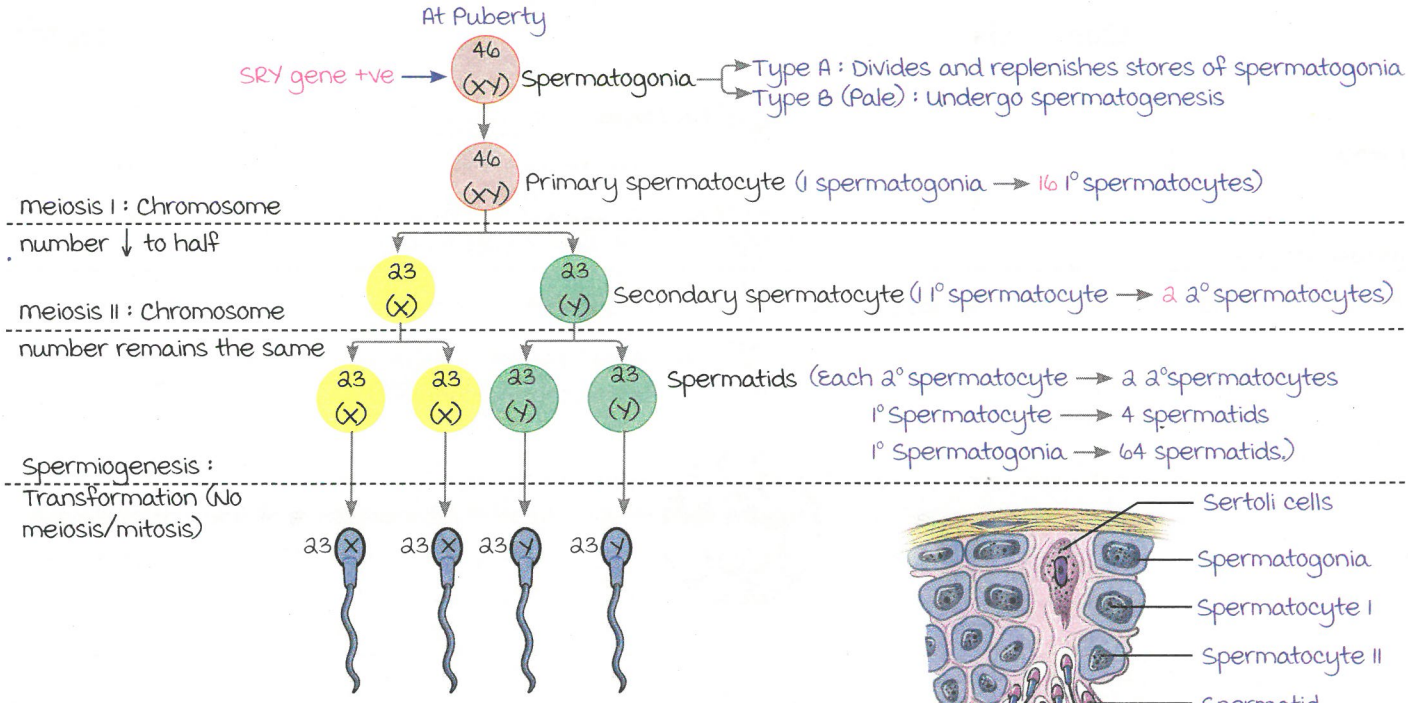
Differentiation : Determined by the SRY gene (Sex related gene on chromosome Y).

SRY gene on distal end of short arm of Chr. Y

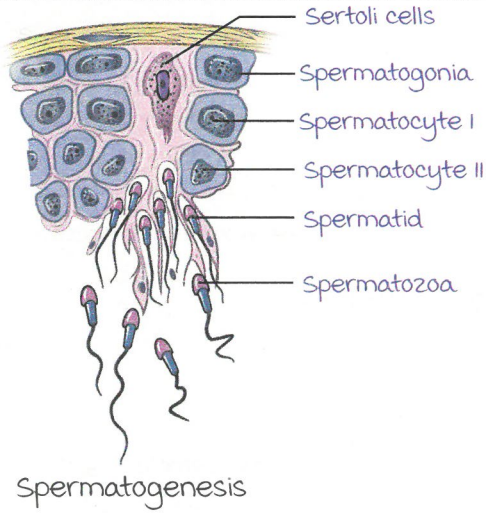
- Present → PGC → Spermatogonia
- Absent → PGC → Oogonia

Spermatogenesis

00:03:46



- Site : Seminiferous tubules in testis.
- Spermiation : Process of release of sperm into the lumen of seminiferous tubules.
- Spermatogenesis begins at puberty.
- Time taken for spermatogenesis : 70–74 days (~ 72 days).
- Time taken for spermiogenesis : 10–14 days.



Spermatogenesis

----- Active space -----

Compartments of seminiferous tubules :

i. Basal compartment : Spermatogonia + 1° Spermatocyte (Early stages of development).

ii. Adluminal compartment : 2° Spermatocyte + Spermatid + Sperms.

Spermiogenesis : Transformation of spermatid to sperm.

Structural analogues :

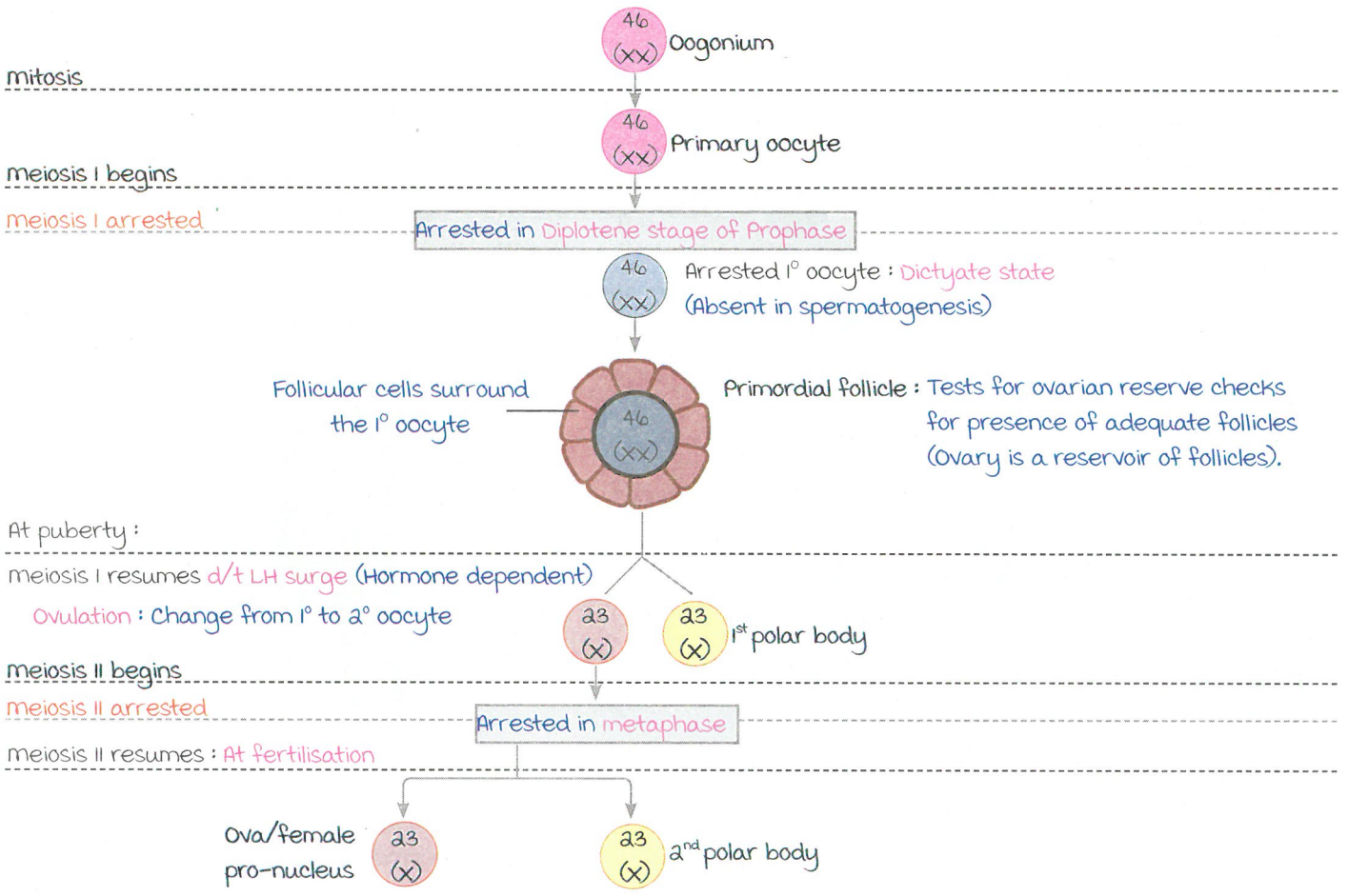
Spermatid	Sperm
Nucleus	Head
Mitochondria	Middle piece (Powerhouse of the sperm)
Golgi Apparatus	Acrosomal Cap
Centriole	Axial filament/Tail

Sperms :

- Size of sperm : 50–60µm.
- Tail of the sperm has a 9+2 arrangement. (Formed by centriole)
- Fertilisable span of sperm : 48–72 hours.
- Maturity attained in : Proximal epididymis.
- Motility attained in : Distal epididymis.
- Time taken to reach fertilisation site after ejaculation : 30 mins.
- Total time taken to form mature sperms (Spermatogenesis + maturation) : 90 days.
- Time taken for epididymal maturation : 12–14 days.

Oogenesis

00:15:04



Salient points :

----- Active space -----

- Oogenesis begins in intrauterine (IU) life.
- Size of ovum : 120µm.
- Fertilisable life span of ova : 12-24 hrs.
- Size of follicle just before ovulation : 18-20mm.
- Follicle formation begins at : 14 weeks.
- Follicle formation is complete by : 22-24 weeks.
- Each oogonia gives rise to : 1 ova/female pronucleus.

No. of follicles in ovary based on age :

Age	No. of follicles
5m of IU life	6 - 7 million (max.)
At birth	1 - 2 million
At puberty	4 - 5 lakh
Every month	1000 follicles undergo atresia
At menopause	No follicles in ovary

Note :

- Germ cells : Pluripotent (Ability to form all 3 germ layers).
- Zygote (After 8 cell stage) : Totipotent (Ability to form embryonic + extraembryonic tissue).
- Germ cells —migrate→ Yolk sac → Genital ridge → Gonads formed.
  - —migrate→ Failure of migration (Aberrant location) → Form teratomas.

----- Active space -----

FERTILIZATION AND IMPLANTATION

Events Prior to Fertilization

00:01:30

Capacitation :

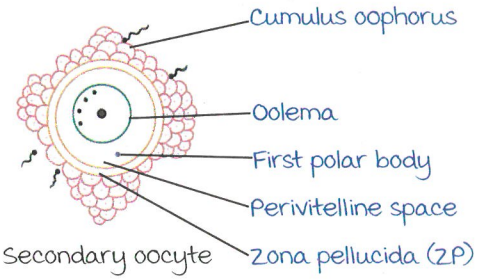
Process by which sperms become capable of fertilizing the ova.

Site : Female reproductive tract.
- Begins at : Cervix.
- Main site : Fallopian tube (FT).

Time taken : 6 - 8 hours.

In vitro capacitation : 2 hours.

Sequence of events :



Step 1 : Capacitation - Sperms become hypermotile (In FT).

Step 2 : Sperms bind to zona pellucida.

Step 3 :

Acrosomal reaction : Release enzyme → Digest zona pellucida.
(Hyaluronidase)

Step 4 : Head of single sperm (male pronucleus) fuses with oolema.

Step 5 :

a. 2nd meiotic division complete → Female pronucleus + 2nd polar body.

b. Cortical reaction : Cortical granules (Cytoplasm of 2° oocyte)
↓ Release
Ca^{2+} + other substances

Step 6 : Substances released by cortical granules
↓
Zona reactions : Hardening of zona pellucida (Doesn't allow entry of any other sperm)

Note :

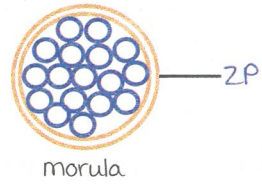
- Polyspermy is prevented by : Cortical reaction, Zona reaction.
- Time taken by sperms to reach the site of fertilization : 30 mins.
- Male sperm attain mobility in epididymus (Distal part).
- Sperm attain hypermotility in female reproductive tract.
- Zona pellucida :
  - Acellular membrane.
  - Made of glycoprotein.
  - Receptors for sperm head : ZP_3 receptor.
  - Function : To prevent polyspermy.

Process of Fertilization

00:14:00 ----- Active space -----

Male pronucleus (23) + Female pronucleus (23) → Zygote (46 : Diploid)

- Occurs in : Ampulla of fallopian tube.
- Day of fertilization = Day of ovulation = Day 14 (In a 28 day cycle) :
  - Fertilisable span of 2° oocyte : 24 hours.
  - In IVF : Day of ovulation = Day of oocyte retrieval = Day of fertilization.
- Zygote formation —(After 30 hours)→ 2 Cell zygote → 4 Cell zygote → 8 Cell zygote → 16 Cell zygote
- 16 cell morula enters the uterine cavity.



Note :

- Ectopic pregnancy :
  - ↓ peristalsis of FT.
  - Cilia absent.
  - Blockage in tube

  } Morula implanted in FT

  (D/t adhesion formation).
- High chances of ectopic pregnancy :
  - Immotile cilia syndrome (Kartagener syndrome).
  - Adhesion inside tube (E.g. PID, salpingitis).
  - Failure of contraceptive (with progesterone containing pills).
    (Smooth muscle relaxant action → ↓ peristalsis).

Morula :

- Moves towards uterine cavity.
- Morula is pushed towards uterine cavity due to :
  - Peristalsis in tube.
  - Movement of cilia (FT lined by ciliated columnar epithelium).

↓

Till 3 days after fertilization : Stays in FT (Nutrition by secretory cells).

↓

4th day after fertilization : Enters uterine cavity (16 celled).
(Day 18 of cycle)

↓

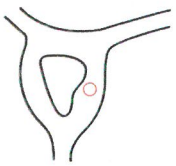
5th day after fertilization :

- Zona hatching : ZP is lost.
- Fluids enter morula → Converted to blastocyst.

----- Active space -----

Implantation

00:25:50



Interstitial implantation

Salient features :

- Attachment of blastocyst to endometrium.
- On day 6 after fertilization (Day 20 of cycle).

Implantation window : Time period (Day 20 – Day 24) when endometrium/uterus is most receptive for blastocyst.

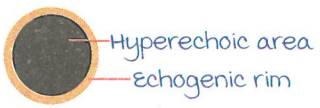
Type of implantation : Interstitial implantation deep inside endometrium.

Placental/Hartmann sign : Few experience bleeding at the time of implantation.

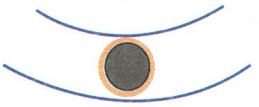
Applied aspect : USG in pregnancy :

1st structure seen :

Gestational Sac (G. sac)

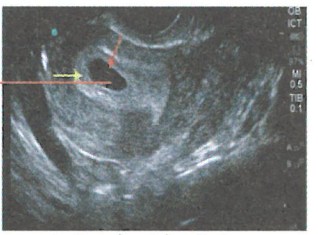


First sign seen :



Intradecidual sign :

Presence of G. Sac deep inside endometrium.



Intradecidual sign

Stages of implantation :

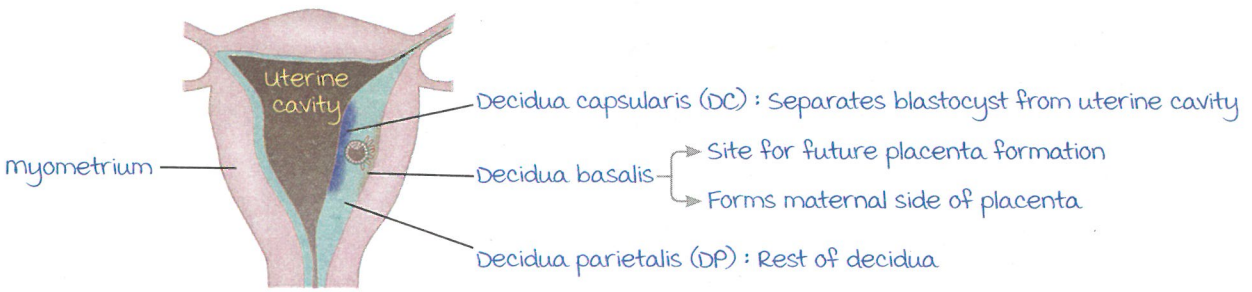
Stage	Factor responsible
1. Stage of Apposition	Selectin
2. Stage of Adhesion	Integrin (most important)
3. Stage of Penetration	Matrix metalloproteinases enzymes

Implantation is eccentric :

- Piskacek sign : Growth of uterus in early pregnancy is asymmetrical.
- True gestational sac (Of intrauterine pregnancy) : Always eccentric.

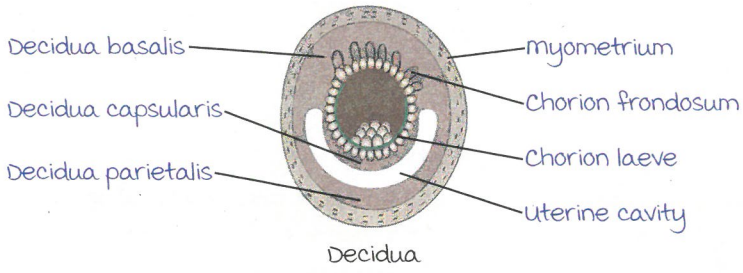
DECIDUALISATION

After implantation, endometrium is called decidua.



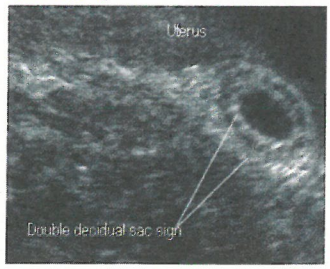
Types of decidua

As blastocyst grows :



Decidua

On USG :



Double decidual sac sign

----- Active space -----

Obliteration of uterine cavity :

As blastocyst grows → DC comes closer to DP → DC fuses with DP (14–16 weeks of pregnancy) ↓ Leads to Obliteration of uterine cavity (14–16 weeks of pregnancy)

Dizygotic Twin Pregnancy :

Both ova released and fertilized at the same time by same act of coitus.

Superfetation :

- Not seen in humans.
- 2 ova released in 2 different cycles & fertilized by 2 different acts of coitus.
- In humans : Superfetation possible till 14–16 weeks of pregnancy (Only theoretical).

Changes in decidualization :

Hormone responsible : Progesterone

1. Secretory changes in endometrium.
2. ↑ thickness of endometrium (10–12mm) d/t stromal edema (most important histological finding).
   - In non-pregnant female during secretory phase (6mm).

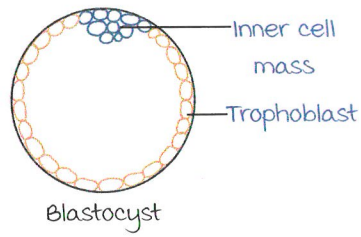
----- Active space -----

Blastocyst

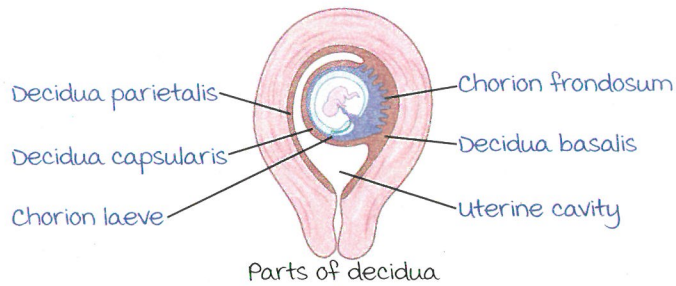
0:58:10

FATE OF BLASTOCYST

- Inner cell mass (Embryoblast):
  - Forms all 3 germ layers.
  - Embryo proper is formed by inner cell mass.
- Trophoblast
  - On day 8 after fertilization
    - Cytotrophoblast
      - Villous trophoblast
        - Near decidua basalis
          - Forms
          - Chorion frondosum: Villi like structure
            - Forms
            - Fetal side of placenta
        - Rest of villous trophoblast: called chorion laeve
          - Forms
          - Fetal membrane: Chorion
      - Extravillous trophoblast: Prevents pregnancy induced HTN
    - Syncytiotrophoblast:
      - Hormone factory of placenta.
      - Eg: hCG, hPL.



Blastocyst



Parts of decidua

Fetal Membranes

01:06:10

Chorion:

- Formed by chorion laeve (Cytotrophoblast).
- Outermost fetal membrane.
- Formed earlier than amnion (Day 8 after fertilization).

Amnion:

- Formed by ectoderm.
- Innermost fetal membrane.
- Day 10 after fertilization.
- Avascular.
- No nerves or lymphatics.
- Gives tensile strength.

Yolk Sac:

- First site for fetal hematopoiesis.
- Source of α fetoprotein.

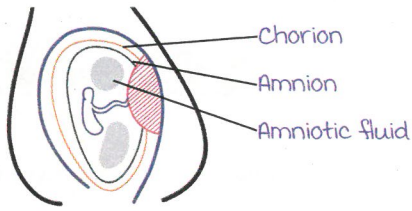
Allantois :

----- Active space -----

Diverticulum which connects hindgut to connecting stalk.

Note :

- Membrane rupture → Membrane releases PGE_2 → Accelerates labour.
  during labour
- Layers penetrated during amniocentesis (Outside to inside) : 16–18 weeks.
  1. Skin.
  2. Abdominal wall muscles.
  3. Uterine serosa.
  4. Myometrium.
  5. Endometrium (DC + DP : Decidua vera).
  6. Chorion.
  7. Amnion.



Preimplantation Genetic Testing 01:13:35

Done only in assisted reproductive techniques.

Indications :

If one or both parents are carriers of any genetic disorder : Advise IVF
↓
Genetic testing before implantation
↓
Only healthy zygotes will be transferred into uterus

Disease tested :

- Monogenic disorders :
  - Sickle cell anemia.
  - Thalassemia.
  - Cystic fibrosis.
  - Muscular dystrophy.
- Aneuploidy.
- Structural rearrangement of chromosomes.
  - Eg. Balanced translocation.
- HLA typing.

Specimen :

- Polar body :
  - Drawback : Only maternal inherited disorders can be tested.
- Blastomeres (Cells of inner cell mass) : May harm the fetus.
- Trophectoderm : Best material.

----- Active space -----

TERATOGENIC EXPOSURE OF FETUS

Fetal Growth Period & Radiation Exposure in Pregnancy 00:00:50

Fetal growth period :

Calculated from : Day of fertilization.

Growth Period	Definition	Applied aspect
1. Period of fertilised ova	Upto 2 wks after day of fertilization.	Teratogenic exposure : All or none law (fetus either escapes injury/aborts).
2. Embryonic period	3-8 wks after fertilization (5^{th}-10^{th} week of pregnancy).	most teratogenic period.
3. Fetal period	≥ 9 wks after fertilization.	

Radiation exposure in pregnancy :

maximum permissible exposure : 5 Rad (0.05 Gy).

Complications :

a. > 5 Rads exposure :

- ↑Risk of congenital anomalies.
- IUGR
- Intellectual disabilty.

b. ≥ 10 Rads exposure (≥ 0.1 Gy) :

- Fetal loss/abortion.

Absolute C/I in pregnancy :

- Gadolinium enhanced MRI.
- Radioactive iodine.
- Radio opaque/paramagnetic contrast agents.

Avoided in pregnancy → X-Ray, CT Scan

Accidental X-Ray in pregnancy :

- Continue the pregnancy.
- Upto 2 X-rays : <0.5 Rads.

Imaging studies with no effect on fetus :

1. USG.
2. MRI.
3. Dental X-Ray.
4. CT scan (Not involving pelvis/abdomen).

Teratogenic Drugs

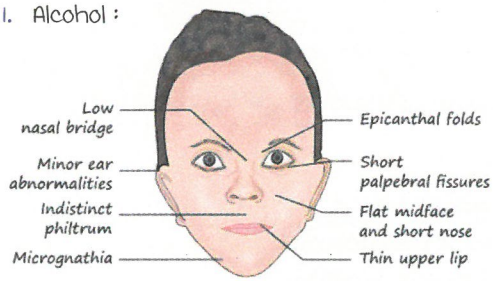
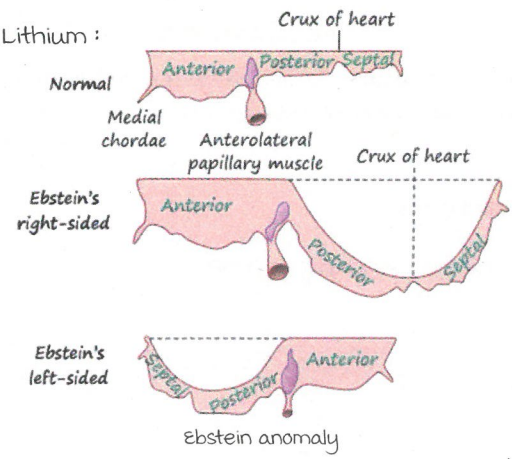
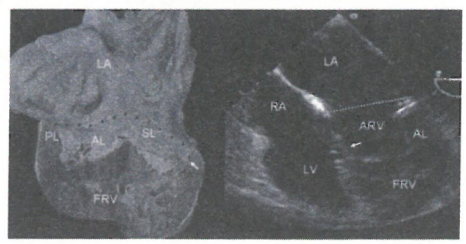
00:08:48 ----- Active space -----

CATEGORY X DRUGS

Teratogenic drugs absolutely C/I in pregnancy.

1. Androgens/Testosterone.
2. DES (Synthetic estrogen).
3. Warfarin.
4. ACE Inhibitors.
5. Tetracyclines : Discoloration of bone & teeth.
6. Thalidomide.
7. Lithium.
8. Valproate : CNS defects, NTDs, congenital heart disease, cleft lip/palate.

TERATOGENIC DRUGS & MALFORMATIONS

Drug	Teratogenicity
1. Alcohol :  Fetal alcohol syndrome	Fetal alcohol syndrome (FAS) : Mnemonic : Goa's famous beer bar. • Growth restriction. • Abnormal facial features : Smooth philtrum, thin vermillion border, small epicanthal folds. • Abnormal brain development, microcephaly. • Abnormal behavioral development : Cognitive impairment.
2. Phenytoin	Fetal hydantoin syndrome : a. Midfacial hypoplasia. b. Upturned nose. c. Distal digital hypoplasia ± cardiac defects.
3. ACE inhibitors/ARBs	Oligohydramnios in the 2nd trimester.
4. Lithium :  Ebstein anomaly	• Ebstein anomaly : – Apical displacement of tricuspid valve → Tricuspid regurgitation. – Right atrial enlargement. • Neonate : Floppy baby syndrome, diabetes insipidus & hypoglycemia.  Echocardiography : Tricuspid regurgitation

----- Active space -----

Drug	Teratogenicity
5. Isotretinoin	Microtia/anotia, CNS defects, cleftlip/palate.
6. Thalidomide	• Phocomelia (Proximal limb amputation). • Stillbirth.  Phocomelia
7. Warfarin :  Depressed nasal bridge  Stippled epiphysis	DiSala syndrome • Chondrodysplasia : Defective cartilage formation. • Stippled epiphysis. • Nasal hypoplasia. • CNS : Corpus callosum agenesis, microcephaly. • Cataract.
8. Methotrexate	Craniosynostosis : Clover leaf skull.
9. Tamoxifen (SERM) Note : Minimum time gap b/w stopppage of tamoxifen and pregnancy : 3 months	• Similar to DES : – Vaginal adenosis – Craniofacial defects. – Ambiguous genitalia. • Mother : Endometrial cancer.
10. Misoprostol	• Moebius syndrome : 6th & 7th nerve palsy. • Limb reduction defects. • Applied aspect : – C/I in T1 and T2. – T3 : can be used for cervical ripening.
11. Indomethacin	• >32 weeks : Premature closure of ductus arteriosus. • <32 weeks : Tocolytic of choice.

Note :
Distal digital hypoplasia/amputation → Phenytoin
Amniotic band syndrome