Tikrit University
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Placentation

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PREGNANCY AND PARTURITION

(Placentation, and Endocrinology of gestation)

Chapter 14: Pathway to pregnancy and Parturition

I. Types Of Placental Attachment

The chorion is the fetal contribution to the placenta. The functional unit of the fetal placenta is the chorionic villus which are small, figure-like projections that appear on the surface of the chorion.

A. Placenta type based on based on anatomical appereance and chrionic villi distribution:

1. **Diffuse**
   - Horses and pigs
   - Entire placenta attaches to the uterus
2. **Cotyledonary**
   - In ruminants
   - Allantochorion attaches to uterus at specialized areas called placentomes

     Placentomes consist of

     Cotyledons: Located on the placenta

     Caruncles: Located in the endometrium
3. **Zonary**
   - In carnivores (dogs and cats)
   - Placenta attaches to uterus by a zone (belt) that circles the placenta

   Attach by villi and villi located only in the zone

4. Discoid

- In primates, rodents and rabbits
- Area of attachment is small disc-shaped area
- Umbilical cord runs from the disc

B. Placenta classification based on type based on microscopic appearance and placenta layers that separate fetal blood from the maternal blood

(Figure 14-3)

*** Maximum number possible is as follows:**

1. Endothelial layer: Lines fetal blood vessels (chorionic capillary)
2. Connective tissue: Surrounds blood vessels (Basement membrane)
3. Epithelium of the chorion
4. Epithelium of the endometrium
5. Connective tissue: Surround maternal blood vessels (basement membrane)
6. Endothelial cells : Line maternal blood vessels (endometrial capillary)

Number of layers present varies with species

**** Common classes of placentas based on the placenta layers:**

1. Epitheliochorial

- Has all **<u>six</u>** layers; so six layers separate maternal and fetal blood
- Fetal chorion epithelium contacts epithelium of uterus

- Found in **horses, pigs and ruminants**

2. **Endothelial chorial**
   - Has only **five** layers
   - Maternal epithelial layers are eroded away
   - Endothelium of maternal blood vessels in contact with the chorion epithelium

   Found in **dogs and cats**

3. **Hemochorial**
   - Has only **three** layers
   - Maternal epithelium, connective tissue and endothelium are lost
   - Fetal chorion epithelium is in direct contact with maternal blood
   - Found in **primates, including humans**

4. **Hemoendothelial**
   - Has only **one** layer
   - Maternal epithelium, connective tissue, endothelium, fetal epithelium and connective tissue lost
   - Walls of placental blood vessels (capillaries) are in direct contact with maternal blood
   - Found in **rodents and rabbits**

II. Endocrinology Of Pregnancy

general profile

A. Progesterone

1. High during most of pregnancy
2. Prevents uterine contractions **(Progesterone block)**

3. Levels decline a few days prior to birth

B. Estrogen

1. Usually low until just before birth
2. Increase the excitability of the uterus

C. *Exceptions To The General Profile*

- Horses:
    - Progesterone levels high until after foal is born
    - Unknown why uterus contracts with high progesterone
- Humans
    - Have high progesterone levels until after birth like horses

D. Relaxin

1. Produced by the ovary
    - Also the placenta in mares
2. Functions
    - Cervical dilation
    - Relax pelvic ligaments
3. Levels increase just prior to parturition
    - Horses may show high levels during last 1/2 of pregnancy

E. Placental lactogen

1. Produced by the placenta
2. Has actions similar to growth hormone & prolactin
3. Possible roles
    - Fetal growth

- Mammary development
- .Milk production

F. eCG (equine chorionic gonadotropin or Pregnant Mare Serum Gonadotropin, PMSG)

1. It is produced by endometrium cups of the placenta
2. It is produced at the time of fetus attachment to the endometrium wall3. It is important for the CL maintenance4. It is responsible for controlling the formation and maintenance of the accessory CLs- eCG-induced ovulation during 40-70 days of pregnancy

G. hCG (Human chorionic gonadotropin)

1. It can be detected in blood and urine as early as days 8-10 of gestation
2. It is produced by trophoblastic cells immediately after blastocyst hatching- its presence in the urine constitutes the basis for the home pregnancy test

D. Role of the corpus luteum (Table 14-1)

1. Cattle
   - CL removal causes abortion up to 7 month of pregnancy
   - Placental produces only small amts of progesterone
2. Sheep
   - CL needed only during first half of pregnancy
   - After the first 1/2, placenta make enough progesterone
3. Pig: CL is needed for the entire pregnancy

4. Horses

- CL required only very early in pregnancy
- Placenta produces enough progesterone

5. Humans

- CL required only until the placenta forms

III. Parturition;

(Figures 14-10 and 14-11)

A. Fetal stress is the key

1. corticotropin releasing hormone is released from the fetal hypothalamus

2. ACTH is released from the fetal pituitary

3. Cortisol is released from the fetal adrenals

4. Fetal cortisol promotes the removal of the "progesterone block"

- Enzymes are synthesized by the placenta which convert placental progesterone to estradiol (therefore, the level of progesterone goes down; the level of estradiol goes up)
- The formation of prostaglandins are promoted by enzymes sensitive to the decrease in progesterone and the increase in estradiol.- therefore, PGF2α is produced and Luteolysis begins, resulting in a further decrease in progesterone.

5. Estradiol and PGF2-alpha promote myometrial contractions

IV. The Stages Of Parturition In The Cow:

The preparatory stage:

- Increased mammary development, increased size of the vulva, increase in udder and abdominal edema, and relaxation of the pelvic ligaments, and the symphysis pubis

A. Initiation of myometrial contractions/cervical dilation **(1st stage)**

1. initiated by the fetus: usually 2 to 6 h in duration
2. Uterine contractions push the fetus towards the cervix
3. Pressure by fetal fluids from the 1st water bag (chorioallantois) assists in dilation of the cervix
4. Interval between rupture of the 1st water bag and the 2nd water bag (amnion) averages about 1 h; "slimy fluid" from the amnion helps with lubrication
5. Complete dilation occurs when the presenting part of the fetus enters and exerts pressure on the cervix; therefore oxytocin is released (Ferguson's reflex) from the posterior pituitary causing an increase in myometrial contractions

B. Expulsion of the fetus **(2nd stage)**

1. Usually .5 to 1 h in duration
2. Distention of the cervix and vagina by the fetus increases abdominal straining; therefore oxytocin is released from the posterior pituitary causing an increase in myometrial contractions
3. Once the head is past the vulva, usually the rest of the body follows easily

C. Expulsion of the fetal membranes **(3rd stage)**

1. Usually within 12 h of calving
2. Separation of the fetal cotyledons from the maternal caruncles due to

- Structural changes in the placenta following rupture of the umbilicus and decreased blood flow leads to a collapse of the placentome