Pregnancy Loss and Parturition
John Parrish

Distribution of Prenatal Losses
- Fertilization → 100%
  » Under optimal conditions
- 2/3 loss during embryonic development
  » Imprinting
  » Compaction
  » Blastocyst hatching and formation
  » Failure to prevent CL regression
    - Maternal recognition of pregnancy

Distribution of Prenatal Losses (cont.)
- 1/3 loss during fetal stage
  » Crowding
  » Placental insufficiencies
  » Not the fetus directly

Embryonic and Fetal Loss in Cattle
- (Graph showing percentage of loss over different intervals from breeding)

Embryonic and Fetal Loss in Pigs
- (Graph showing survival percentage over different stages of gestation)

Increased Prenatal Loss
- Nutritional Stress
  » Energy shortages
  » Mineral imbalances
  » Vitamin deficiencies
- Disease of the reproductive tract
- Endocrine imbalances
- Aging of gametes prior to fertilization
Effect of Oocyte Age on Fertilization and Embryo Viability

Parturition

Mechanism For Parturition
- Skunk Cabbage
  - Prolonged gestation in Sheep
  - Hypoplasia of Anterior Pituitary
- Gene Defect
  - Autosomal recessive in Holstein cattle
  - Large calves, 1-2 months beyond due date
  - Hypoplasia of Anterior Pituitary

Fetal Adrenal Changes with Age

Hormonal Changes Associated with Parturition

Parturition
Parturition

Fetal Nutritional Demands

Placental Insufficiency

CRH → Hypothalamus → Anterior Pituitary → Adrenal Cortex

Fetal Corticosteroids (Cortisol)

Lung (surfactant) → Liver (glycogen) → Thyroid (metabolism) → Placenta

Progesterone → Estrogen → PGF\(_{2\alpha}\)

Uterine Myometrium → Gap junctions

Oxytocin from Posterior Pituitary

Final Role of Oxytocin

Sensory Neurons in Cervix

Orientation of Fetus

• Fetus must reorient prior to parturition
  » Initially on back
  » Reorient so feet and head will exit first
  » Breech
    • Rear of fetus comes first
  • Orientation not important in pig
  • Abnormal orientation results in dystocia

Orientation of Fetus

Ovary

Uterine horn

Cervix

Vagina

Fetal Orientation

Fetal Orientation
Stages of Labor

- Preparative (2 to 12 hours)
  - Myometrial contractions
  - Uterine pressure
  - Abdominal discomfort
  - Cervical dilation

Stages of Labor (cont.)

- Expulsion of fetus (30 to 180 min)
  - Strong uterine contractions
  - Rupture of the allantochorion
  - Appearance of the amnion
  - Maternal recumbence and straining
  - Not only uterine but abdominal contractions as well
  - Rupture of the amnion and delivery

Stages of Labor (cont.)

- Expulsion of the placenta (1 to 12 hours)
  - Uterine contractions
  - Chorionic villi loosen
  - Expulsion of the placenta
  - Delayed in ruminants due to presence of cotelydons separating independently
  - Suckling induces oxytocin release which triggers further uterine contractions

Dystocia

- Difficult birth
- Excessive fetal size (90% for cattle)
- Abnormal presentations (5% for cattle)
- Multiple births (twins)
  - Twins presented at the same time
  - One is usually blocking the other
  - Uterus becomes fatigued
Perinatal Fetal Changes

- Cardiovascular
  - Ductus arteriosus
  - Foramen ovale
  - Ductus venosus
Perinatal Fetal Changes

• Cardiovascular
  » Ductus arteriosus
  » Foramen ovale
  » Ductus venosus

• Thermoregulatory
  » Must regulate own temperature
  » Increase metabolism (thyroid activity)
  » Brown fat - metabolism of produces heat

• Energy metabolism
  » Until suckling, relies on own stores of glycogen
Perinatal Fetal Changes (cont.)

• Immune status
  » Has no antibodies to protect
  » Gets passive immunity from mother
    • Gut permeable to antibodies in colostrum
    • Only first 1 - 2 days
    • In rabbit, rat, man get some antibodies absorbed through placenta

Return to Estrus

• Fertility increases with # of estrous cycles
  » First = 35% pregnancy rate
  » Second = 50%
  » Third = 73%
  » Fourth = 72%

• Lactational anestrus or Lactational amenorhea

Return to Estrus (cont.)

• Special postpartum estrus
  » Mare - foal heat, 6 - 13 days postpartum
    • Fertility depends on body condition
  » Sow
    • Anovulatory estrus 3 - 5 days post-farrowing
    • Weaning induces estrus 3 - 5 days latter

Retained Placenta

• Definition
  » If not expelled within 24 hr it may be retained for 5 - 6 days

• Most common in cattle (5 - 15 %)
  » Not seen in sows or ewes
  » Sometimes seen in mares (retained = > 4 hrs)
Retained Placenta (cont.)

• Cause
  » Normally get lack of blood flow to chorionic villi and this causes them to regress
  » High incidence in premature or early delivery
  » High milk producers
  » Twins
  » Dystocia
  » Induction of parturition
  » Nutritional deficiencies
    • Vitamin A
    • Selenium

Retained Placenta (cont.)

• Treatment
  » Manual removal not recommended
  » Daily antibiotics
  » Large single antibiotic bolus
  » Oxytocin or PGF
• Major concerns in humans and mares
  » Can cause death of mother from septicemia

Induction of Parturition

• Dexamethasone
  » Potent synthetic cortisol
  » Works in all species
  » Takes 2 to 3 days
• PGF<sub>2α</sub>
  » Swine, cattle and sheep
• Oxytocin
  » Human, horse

Induction of Parturition in the Cow

• Restrictions
  » Do not induce before day 269 of gestation
• Methods
  » Dexamethasone
    - Parturition in 48 hours
    - Dex + PGF induces within 35±2 hrs
    - Live fetus required
    - High incidence of retained placenta
      - Anticipate and treat appropriately
      - Estrogen given before Dex decreases problems
  » PGF
    - Works near term but may require long acting or 2 doses
    - Needed to remove mumified fetus.

Induction of Parturition in the Ewe

• Dexamethasone
  » Parturition within 24 – 72 hrs
  » No retained placenta problem
• Lutalyse
  » Works best to abort prior to day 50
  » Multiple injections will work to induce parturition near term

Induction of Parturition in the Sow

• Survival only after day 111 of gestation
• PGF
  » Parturition within 29 – 48 hrs
  » PGF at 8 AM followed by oxytocin 24 hrs latter
    » Sows farrow between 8 AM and 5 PM following oxytocin
• General Info
  » Piglets should be born within 1 to 8 hours with 15 min interval between piglets
  » Oxytocin can be given if delays in next piglet born to decrease stillborns – occurs in large litters or after extendend parturition

Review Remaining Slides for Species Specific Procedures!
Induction of Parturition in the Mare

• Do not do this unless absolute need!!!
  » Variable length of gestation in mare
  » Not sure of foal maturity
• Oxytocin after day 320
  » Problems
    • Foal may require extensive veterinary care in first few weeks of life – impact on social maturity of foal
    • Colostrum in mare
    • Lung maturity in foal