

High Risk Pregnancies Perinatology



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Perinatology



- Perinatology in Human Medicine
- Origins of Veterinary Perinatology

High Risk Pregnancy

- History of previous problems
- Problems during current pregnancy



Previous Problems



High Risk Pregnancy

Current Problems

- Premature udder development
- Placentitis
- Twins
- Premature placental separation
- Overdue
 - Fescue toxicity



High Risk Pregnancy

Current problems

- Muscular skeletal problem
- Endotoxemia
- Recent hypotension/hypoxemia
- Recent abdominal surgical incisions
- Neurologic disease
- Hydrops allantois/amnion
- Pituitary hyperplasia
- Tumors



Perinatology

- What is the threat to the fetus/neonate?
- How can the threat be eliminated?



Fetal Resuscitation

- Identify the fetal problem
 - Direct therapy at the problem's source



Fetal Monitoring History



- Intrapartum fetal monitoring
 - Rational decision to hasten parturition - C-section
 - Explosive nature of parturition in the mare
- Prepartum fetal monitoring
 - Allow prediction of intrauterine distress
 - Result in effective fetal resuscitation
 - Rational decision about early delivery
- Will not predict all cases
 - Some fetal deaths no obvious cause
 - No detectable fetal, placental, maternal, or obstetrical etiology

Early Udder Development Precocious Lactation

Most reliable sign of fetal distress



Normal Fetal Physiology

- Late term fetus
 - Level of activity is on an erratic schedule
 - 25% time - quiet sleep state
 - Infrequent breathing movements
 - Startled movements
 - 60% to 70% - active sleep state
 - REM sleep
 - Regular breathing movements
 - Intermittent abrupt movements
 - Head, limbs, and trunk

Fetal Heart Rate (FHR)

- Active (REM) sleep
 - Increased variability
 - Frequent accelerations with movement
- Quiet (non-REM) sleep
 - FHR slows
 - Heart rate variability is reduced
- Active sleep/quiet sleep periods
 - Sheep – 20 min quiet/ 40 min active
 - Late pregnancy - not predictably proportioned
 - Lack of observed active periods not useful
 - Positive observations - "reassuring"

Changes with Acute Hypoxia

- Non-vital fetal activity decreased
 - Fetal movements
 - Fetal breathing
 - Fetal swallowing
- All occur during active sleep
 - Long periods of quiet sleep
 - Is it acute hypoxemia or quite sleep?
- Fetal breathing also influenced by
 - Maternal glucose levels, other influences
- Adaptation to hypoxemia – hour or so
 - Resumption of fetal breathing/movements

Fetal Monitoring

Biophysical Profile

- Fetal Physical Examination
- Fetal Apgar Score
- A collection of observations (ultrasound)
 - Fetal CNS health
 - FHR - Doppler
 - Breathing – episode > 30 sec
 - Fetal movement, tone
 - Fetal perfusion/chronic asphyxia
 - Amnionic fluid volumes

Fetal Monitoring

Biophysical Profile

- Correlate with fetal health or fetal distress
- With fetal hypoxemia - order of occurrence
 - Alterations in FHR
 - Loss of fetal breathing
 - Decreased fetal movement
 - Loss of fetal tone
- In man
 - Any single test – high rate false positive (50% to 79%)
 - Combining abnormal variables – false positive 20%
 - False-negative rate - very low

Equine Biophysical Profile

- Fetal activity
- Fetal heart rate
- Amniotic/allantoic fetal fluid depth
- Fetal aortic diameter
- Uteroplacental thickness
- Uteroplacental contact

ID:52422 SCREENED
27/MAR/00 15:33 6.0TCE/5.0MHZ

NEW BOLTON CENTER ID:52422 SCREENED
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FR 186

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NEW BOLTON CENTER
P 60% G 60% II 18
FR 80

DAY 319
L CRA

DAY 319
F MID

DAY 319
L MID

1
DIST 2.84 CM

1 2
DIST 3.54 1.57 CM

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FR 252

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NEW BOLTON CENTER
P 60% G 60% II 30
FR 2

DAY 319

1
DIST 21.44 CM

HA 88 BPM

Fetal Monitoring Equine Biophysical Profile

- Not sensitive
 - Fetus with normal profiles may be suffering from life threatening problems



- ❖ Not specific
 - ❖ Occasionally extreme values in normal fetuses

Fetal Monitoring

Ultrasound Examination

- Serial transabdominal/transrectal US
 - Detect extremes of fetal fluid volumes
 - Detect placental abnormalities
 - Sensitivity and specificity poor
 - Follow Changes
 - Sensitivity and specificity poor
- Only “see” part of placenta
- Part of assessment
 - Should not trump all other observations
 - Udder - better predicting fetal stress level



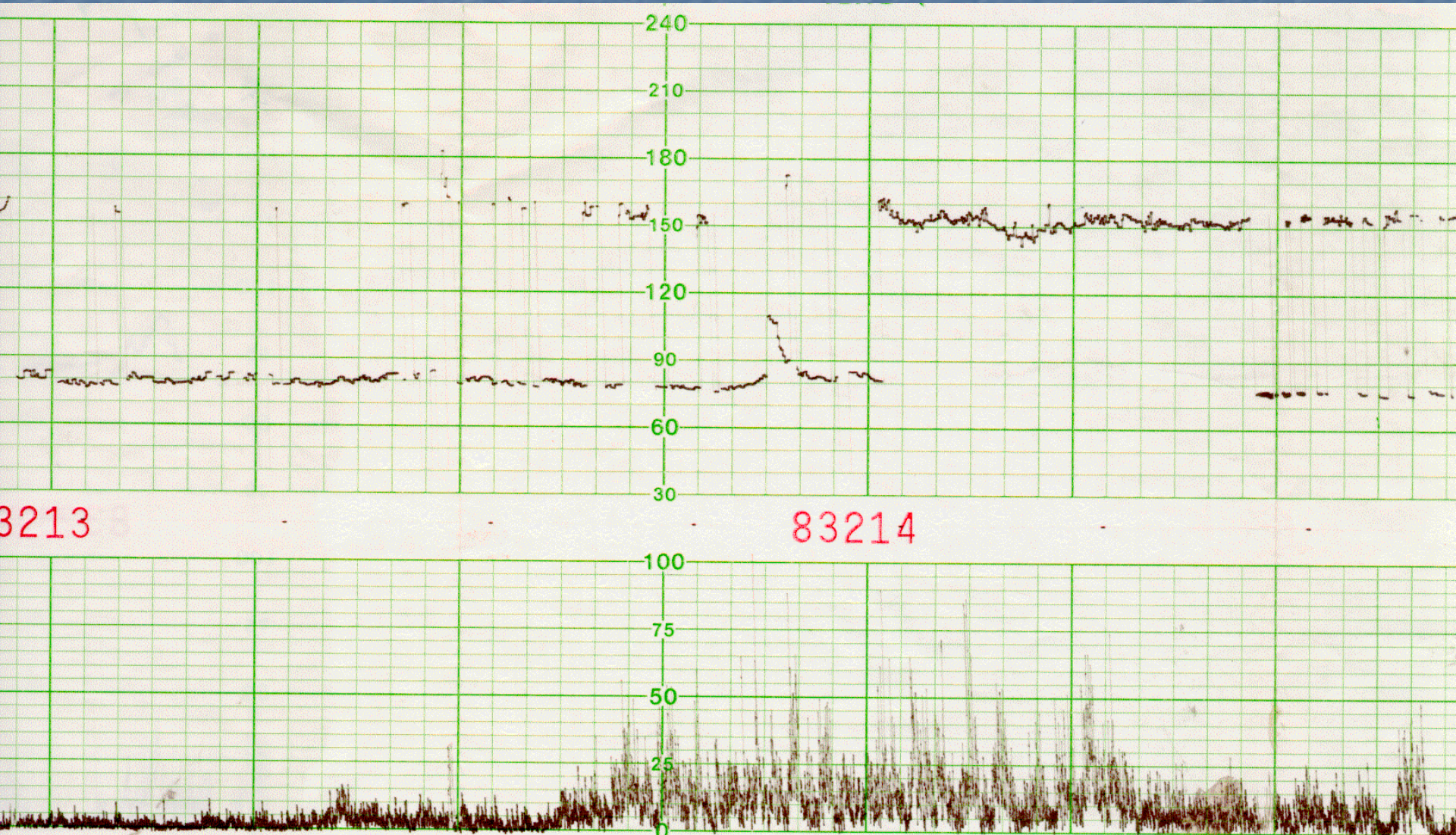
Fetal Heart Rate Response

Fetal Monitoring

Fetal Heart Rate

- Methods of measurement
 - Transabdominal fetal ultrasound
 - Fetal Doppler
 - Fetal ECG
- Fetal ECG
 - Any ECG with recording capabilities
 - Telemetry
 - 6-8 observations during the night

Toitu Doppler Fetal Heart Rate/Activity Tracing







FHR Patterns

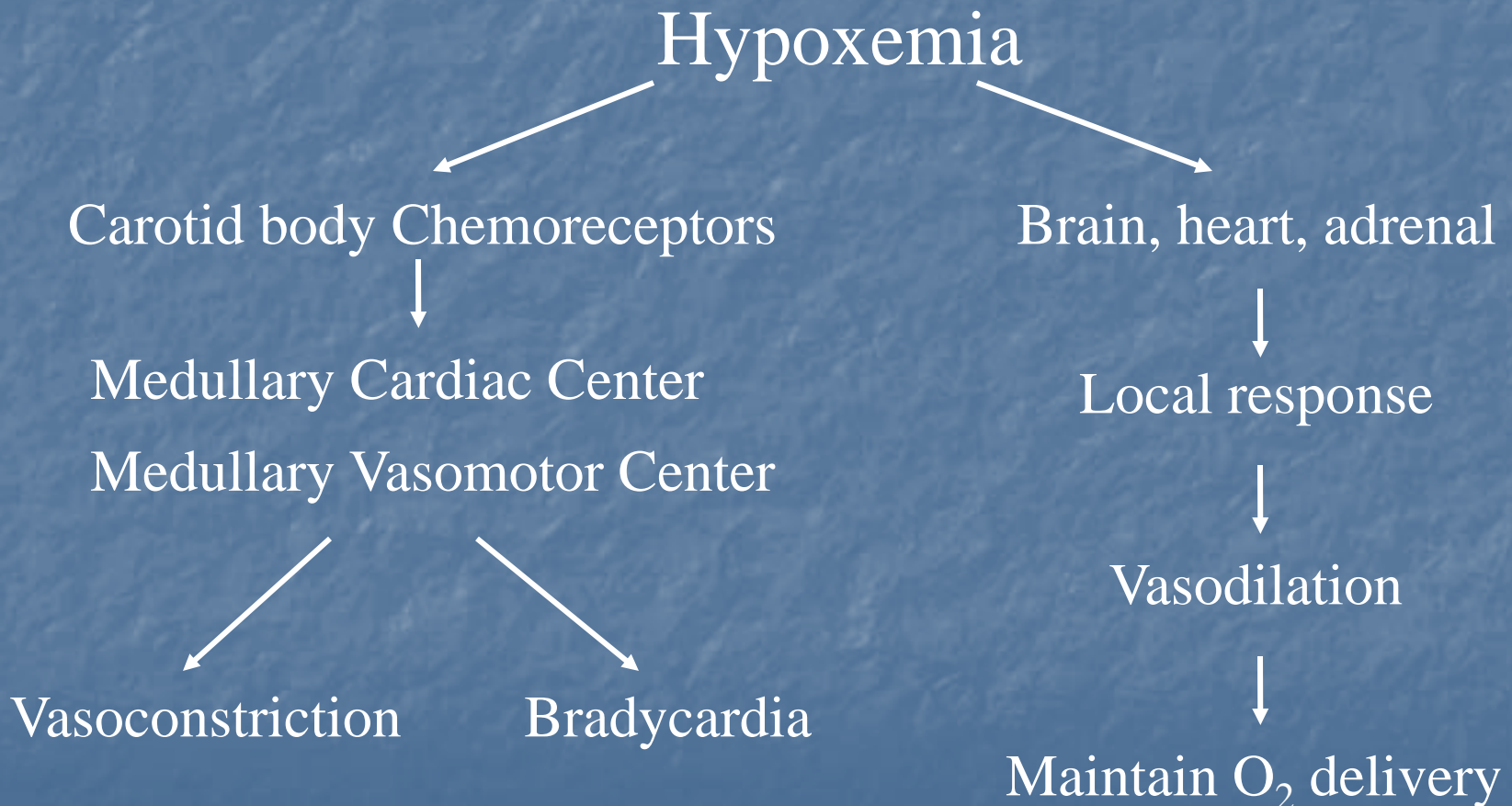
- Observations
 - Heart rate
 - Occurrence of accelerations/decelerations
 - Beat to beat variability
 - Changes in the complex
 - Arrhythmias
 - Presence of 2 distinct patterns - twins

FHR Patterns

What's Normal?

- Average FHR decreases with gestational age
 - 170 – 240 days about 115 bpm
 - Term decreases to 60 - 80 bpm
- Accelerations - reassuring sign
 - During active sleep 22-25/hr
 - Intact neurologic coupling CNS and heart
 - 85% accelerations associated movement
 - 90% movement associated acceleration
 - Quiet sleep – no accelerations (human 40-80 min)
 - Maternal sedation

FHR Response to Hypoxia



FHR Patterns

Adaptation to Hypoxemia

- Initial protective response
 - Bradycardia
 - Redistribution of cardiac output
 - Acidosis required for decreased CO
- Sudden hypoxemia
 - Increased vagal tone
 - Bradycardia & increased variability
- Hypoxemia > 30-60 min
 - Increasing circulating adrenergics
 - Modulation of vagal activity
 - Endogenous opiates
 - FHR return to baseline or higher
- Late decelerations

FHR Patterns

Normal Fetus

- Baseline HR
 - 60 - 75 bpm
 - Can be in the 50s
- Low HR
 - 40 - 75 bpm
 - 80% < 70 bpm
 - 55% < 60 bpm
 - 14% < 50 bpm

FHR Patterns

Normal Fetus

- Transient low heart rates
 - Common
 - Not ominous
 - High vagal tone - uterine contraction
 - Highest beat to beat variation
 - During Stage II can drop to 25-35 bpm

FHR Patterns

Normal Fetus

- High FHR
 - 80 - 250 bpm
 - 86% > 100 bpm
 - 50% > 120 bpm
 - 20% > 200 bpm
- Transient high heart rates
 - Common – reassuring
 - Fetal activity
 - Not ominous unless consistent

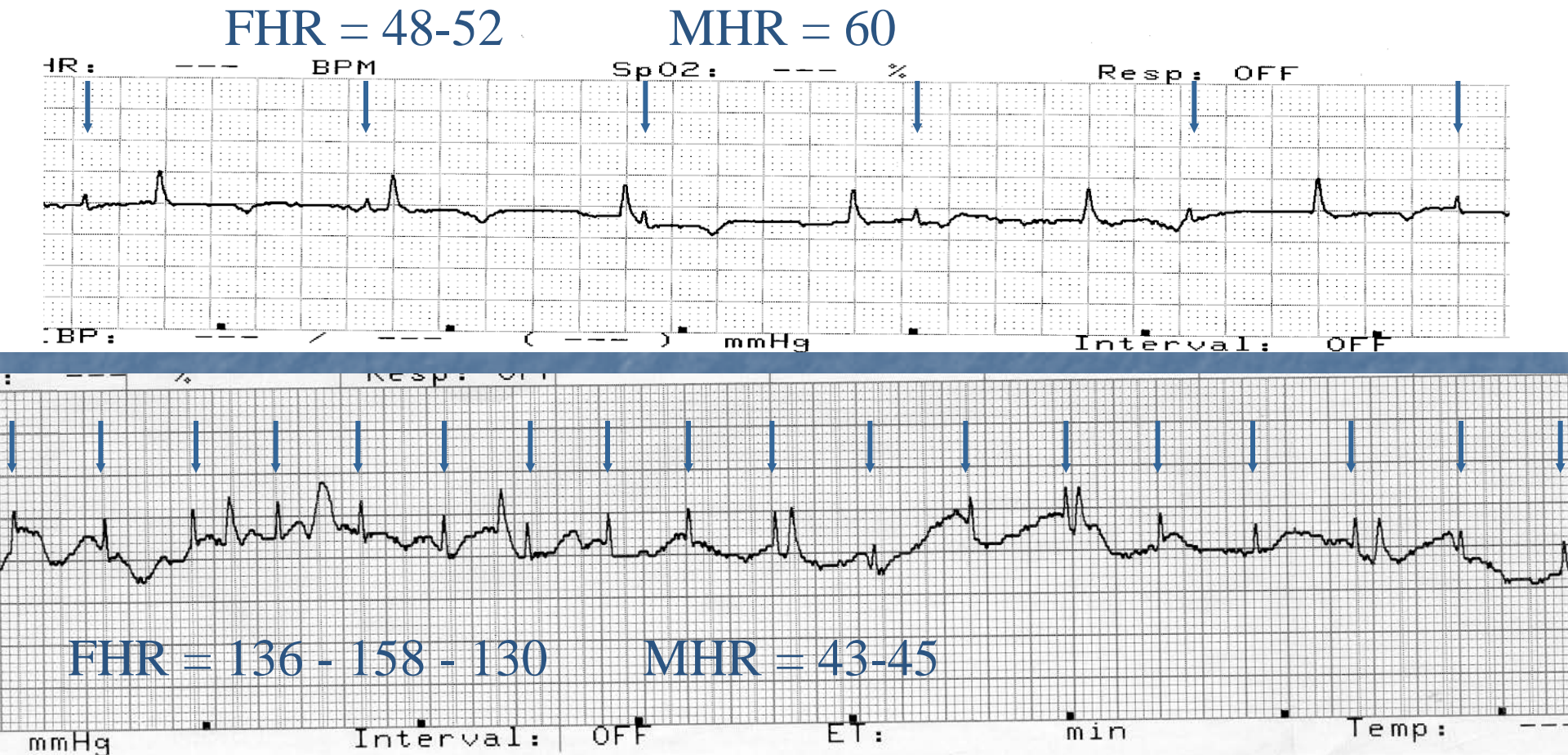
FHR Patterns

Abnormal Fetus

- Consistent low HR – usually normal
 - Unless no beat-to-beat variation
 - IUGR
- Consistent tachycardia
 - Often 160 – 180
- Atrial fibrillation-like pattern
- Sudden changes in QRS complex
 - Size, orientation, timing
 - Premature ventricular contractions
 - Runs of V-tach

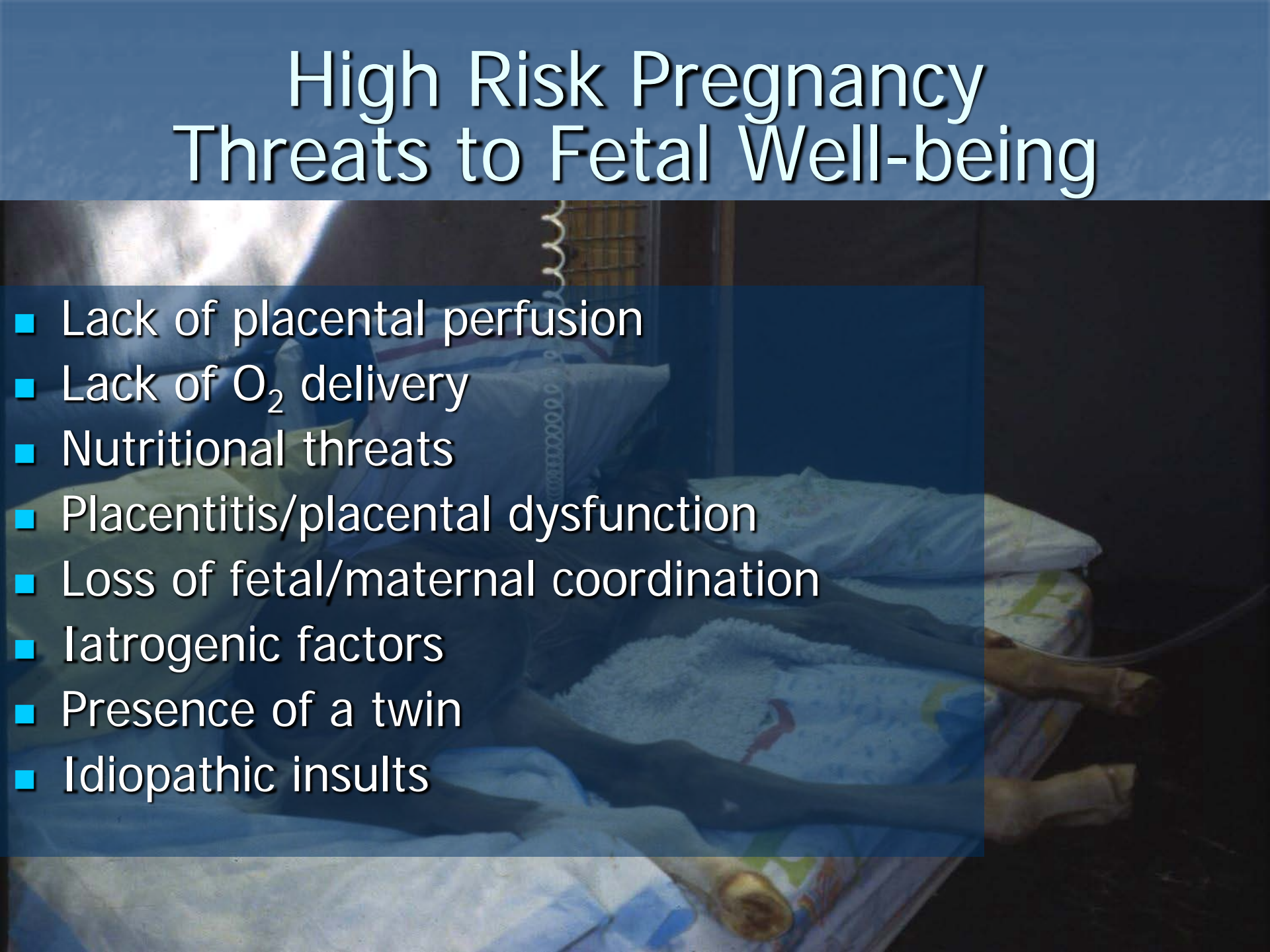
Fetal heart rate measurements

Fetal ECG





High Risk Pregnancy Threats to Fetal Well-being

- 
- A pregnant woman is lying in a hospital bed, covered with a blue blanket. Her legs are slightly raised and supported by a wedge. In the background, medical monitors and equipment are visible, suggesting a clinical setting. The overall tone is serious and clinical.
- Lack of placental perfusion
 - Lack of O₂ delivery
 - Nutritional threats
 - Placentitis/placental dysfunction
 - Loss of fetal/maternal coordination
 - Iatrogenic factors
 - Presence of a twin
 - Idiopathic insults

Threats to Fetal Well-being

Lack of Placental Perfusion

- Normal physiology – late term
 - Maternal Blood volume increases 30-50%
 - Maternal cardiac output increases 30-50%
 - Uterus
 - Git
 - Kidneys
 - Skin
- At term
 - Maternal placenta 15% mare's CO
 - Fetal placenta 40% fetal foal's CO

Threats to Fetal Well-being

Lack of Placental Perfusion

- Late term fetus
 - High oxygen demand
 - Must receive constant perfusion
 - Margin of safety in late pregnancy small
- Maternal compromise
 - Dehydration/Shock
 - Decreased perfusion for any reason
- Placental response limited
- Compromised placental circulation
 - Hypoxic ischemic insult

Fetal Resuscitation

Maintenance of Placental Perfusion

- Aggressively treat hypovolemia
- Avoid adrenergics in pregnancy
 - No central control placental circulation
 - Sensitivity and response changes – complex
 - Uterine blood flow in pregnancy
 - Decrease – dobutamine, epinephrine and norepinephrine
 - Variable – dopamine
 - Increase – ephedrine
 - Maintaining blood pressure with adrenergics \neq uterine perfusion
- Avoid anesthesia in late term mares



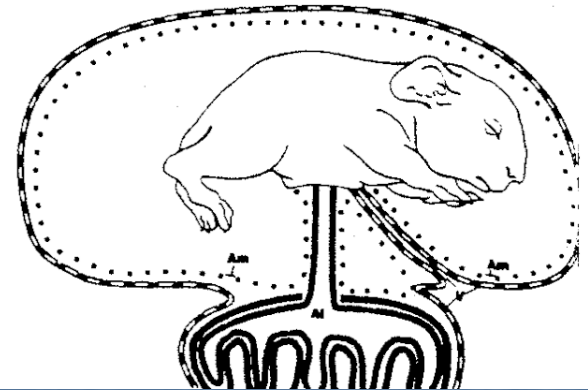
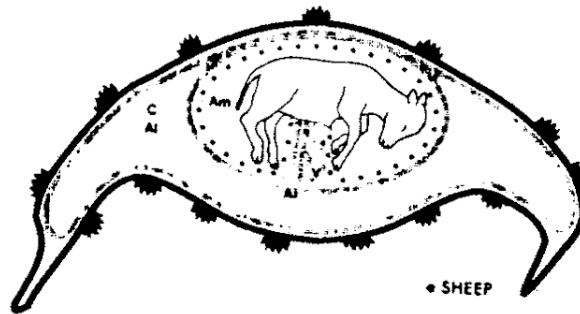
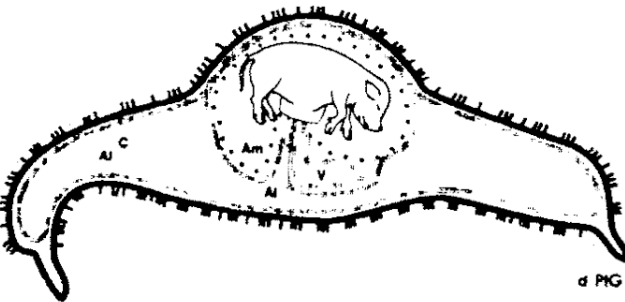
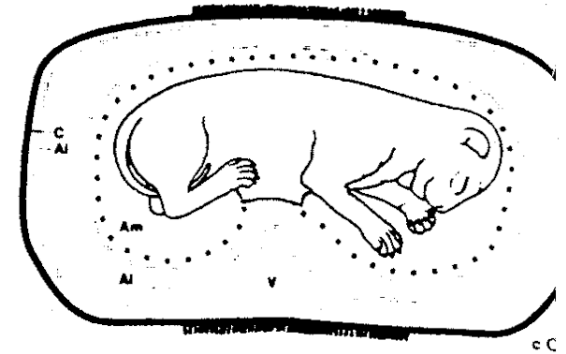
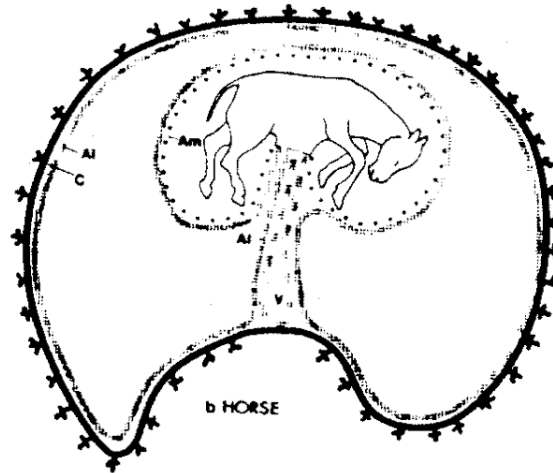
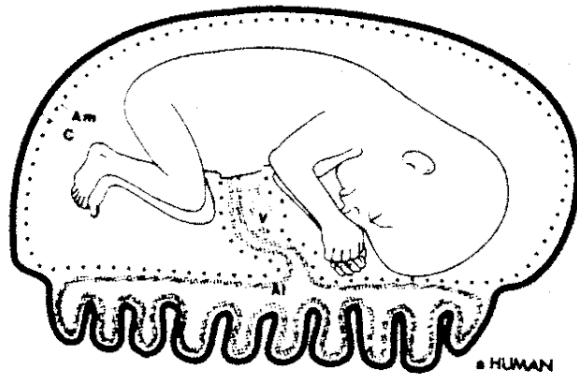
Threats to Fetal Well-being

Lack of O₂ Delivery

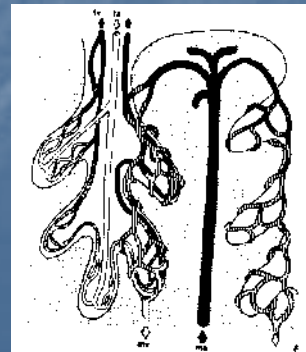
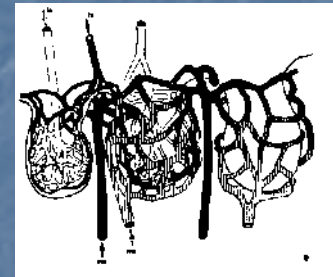
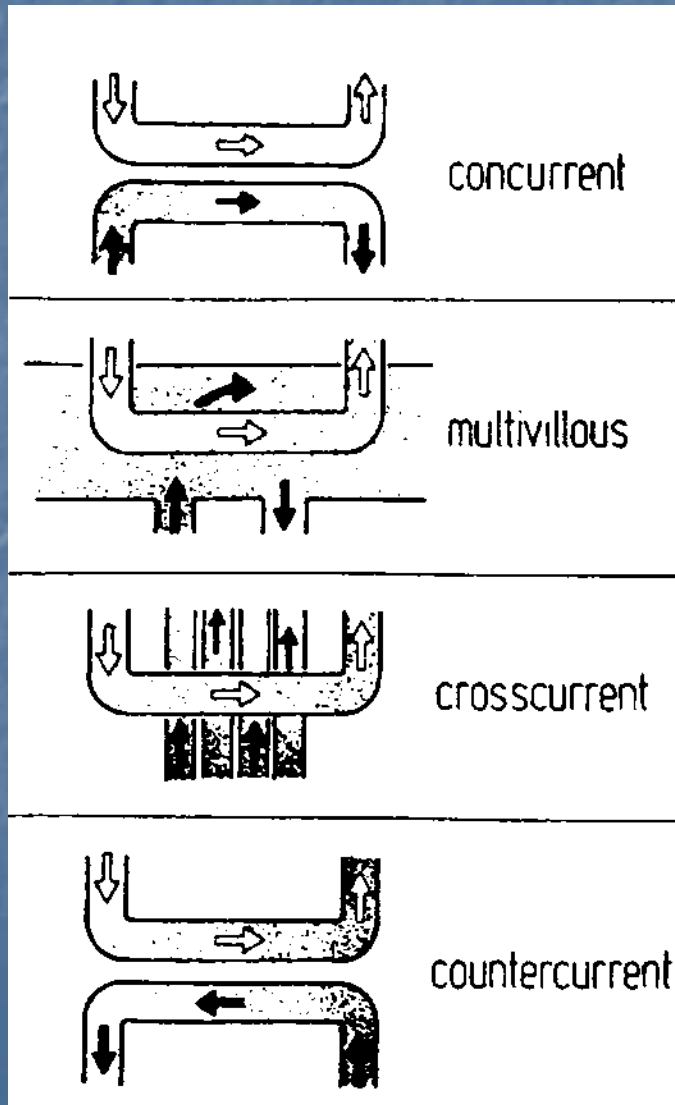
- Maternal threats
 - Maternal anemia
 - Maternal hypoxemia
 - Decreased perfusion
- Fetal response
 - Unique aspect of placentation
 - Placental oxygen transport mechanisms



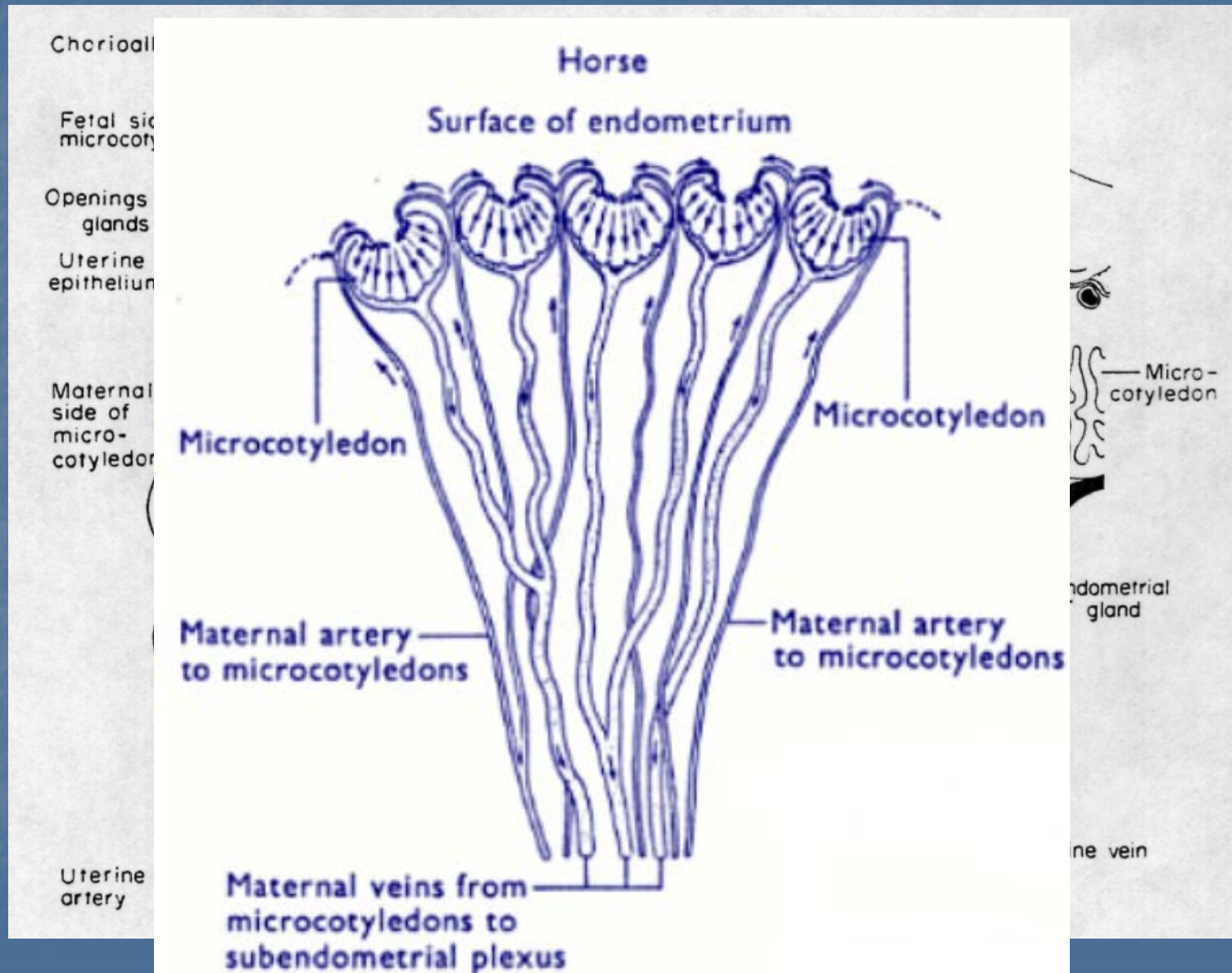
Placentation



Placental Circulation



Equine Placentation



Effect of Maternal Oxygen Therapy

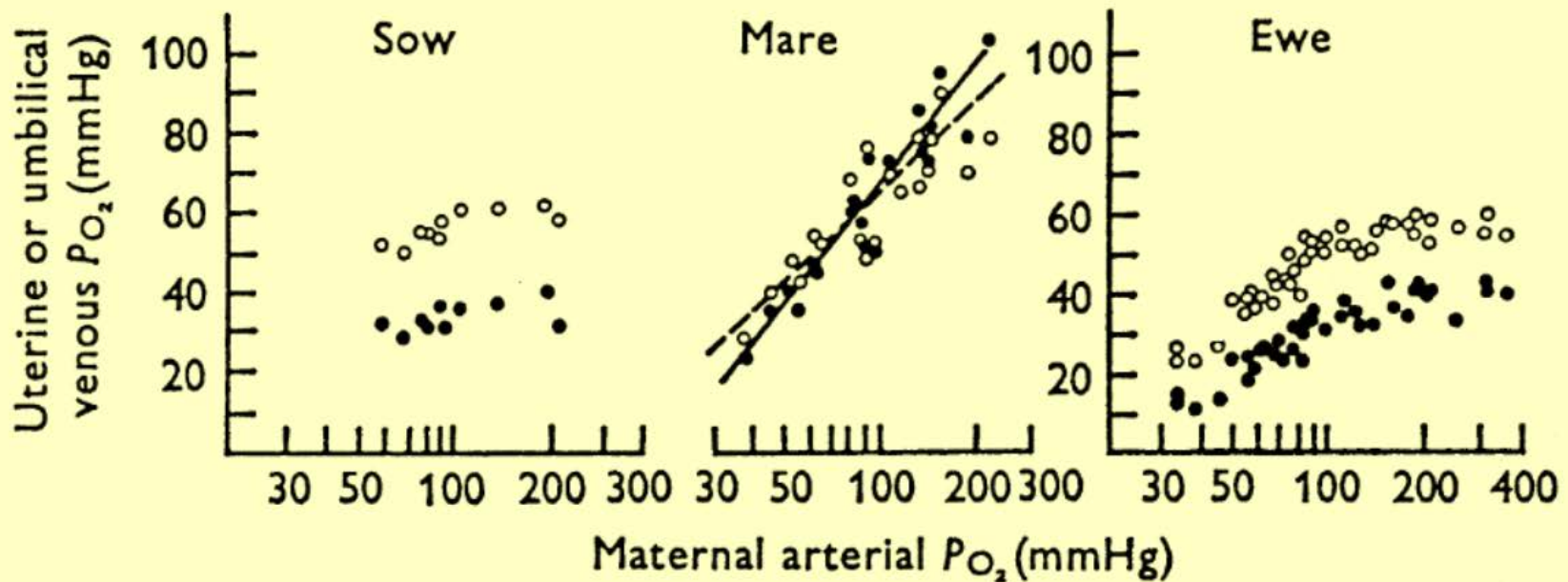
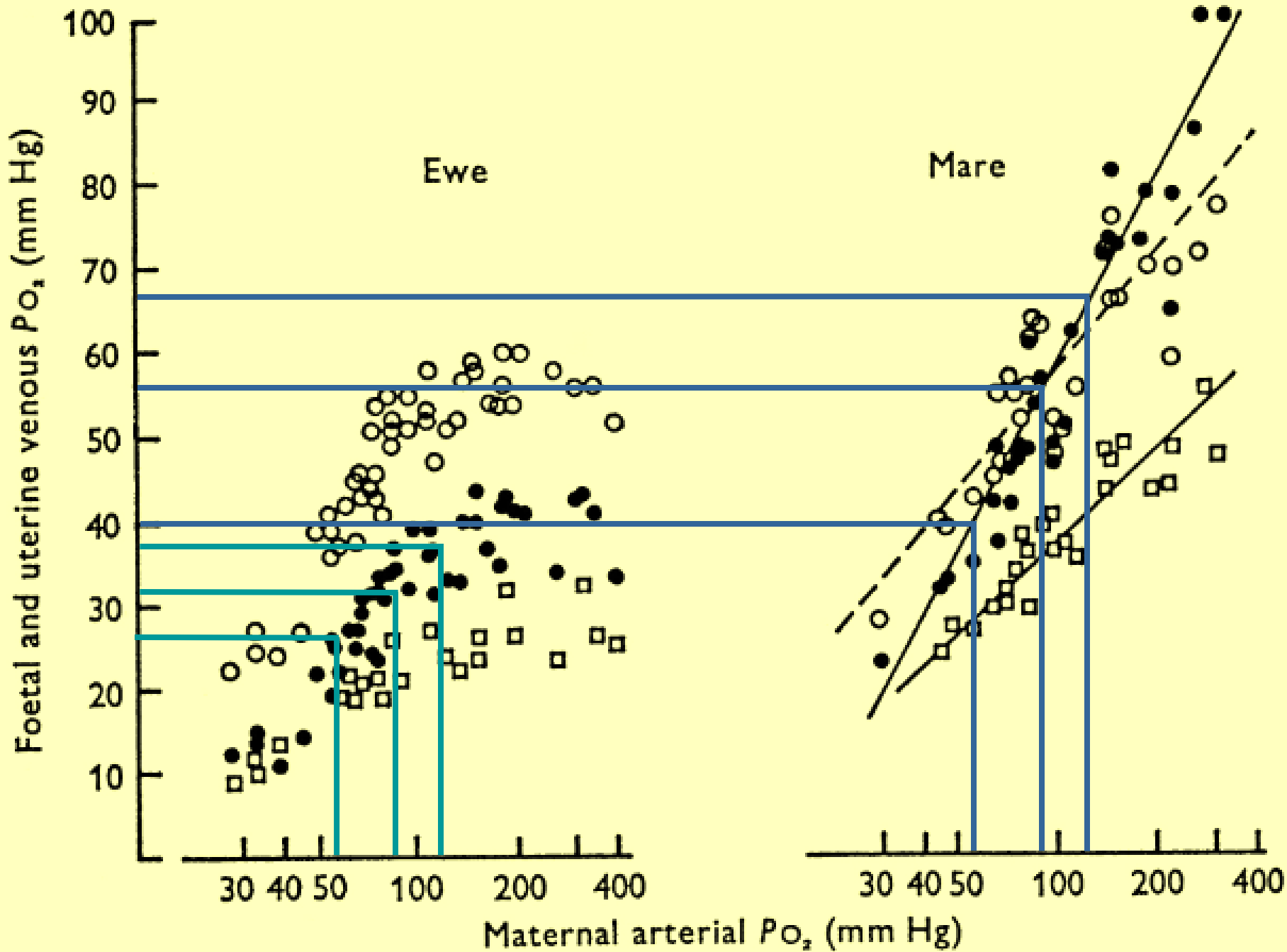


Fig. 4. The relationship between P_{O_2} in maternal arterial blood (log scale) and that in the uterine vein (\bigcirc) and umbilical vein (\bullet) in seven ewes and seven mares (data from Comline & Silver 1970b), and in five sows.



Fetal Resuscitation

Lack of O₂ Delivery

- Fetal hypoxemia - supplement with INO₂
 - Take advantage of the countercurrent system
 - Even if normal Pao₂ in mare, foal may benefit
 - Important with generalized placental disease?
 - May see improved FHR parameters

Maternal Oxygen Therapy



Placental Functions

Glucose Transport

- Predominant source of energy for fetus
- Glucose transport
 - Carrier mediated passive transport
- Low or high maternal glucose levels
 - Fetus is protected



Nutritional Threats

Glucose Utilization

- The placenta
 - Actively metabolic tissue
 - High glucose utilized by placenta in horse
 - Glucose for placenta can also come from fetus
- Maternal distress – less glucose
 - More glucose delivered from fetus
 - Negative net glucose transport to fetus



IUGR

Intrauterine Growth Restriction



Threats to Fetal Well-being

Nutritional Threats

- Chronic malnutrition of the dam
 - Lack of intake
 - Malabsorption
 - Tumor cachexia
- Acute fasting of the dam
 - Forced fasting
 - Capricious appetite - late gestation



Threats to Fetal Well-being

Nutritional Threat of Acute Fasting

- Fasting the mare for 30-48 hr
 - Must be complete fasting
 - Decreased glucose delivery
 - Rise in plasma FFA
 - Increased PG's in uterine and fetal tissues
- Increased risk of preterm delivery
 - Within one week of ending the fast
 - Myometrial sensitivity to hormones

Fetal Resuscitation

Nutritional Threats



- Support the mare's nutritional needs
 - Enteral supplementation
 - Parenteral supplementation
 - Encourage a high plain of nutrition
- Avoid acute fasting
 - Avoid elective procedures requiring fasting
 - Encourage anorexic late term mares to eat
- If acute fasting is unavoidable – colic, anorexia
 - Supplement with intravenous glucose therapy
 - Consider flunixin meglumine therapy

Threats to Fetal Well-being Placentitis/Placental Dysfunction

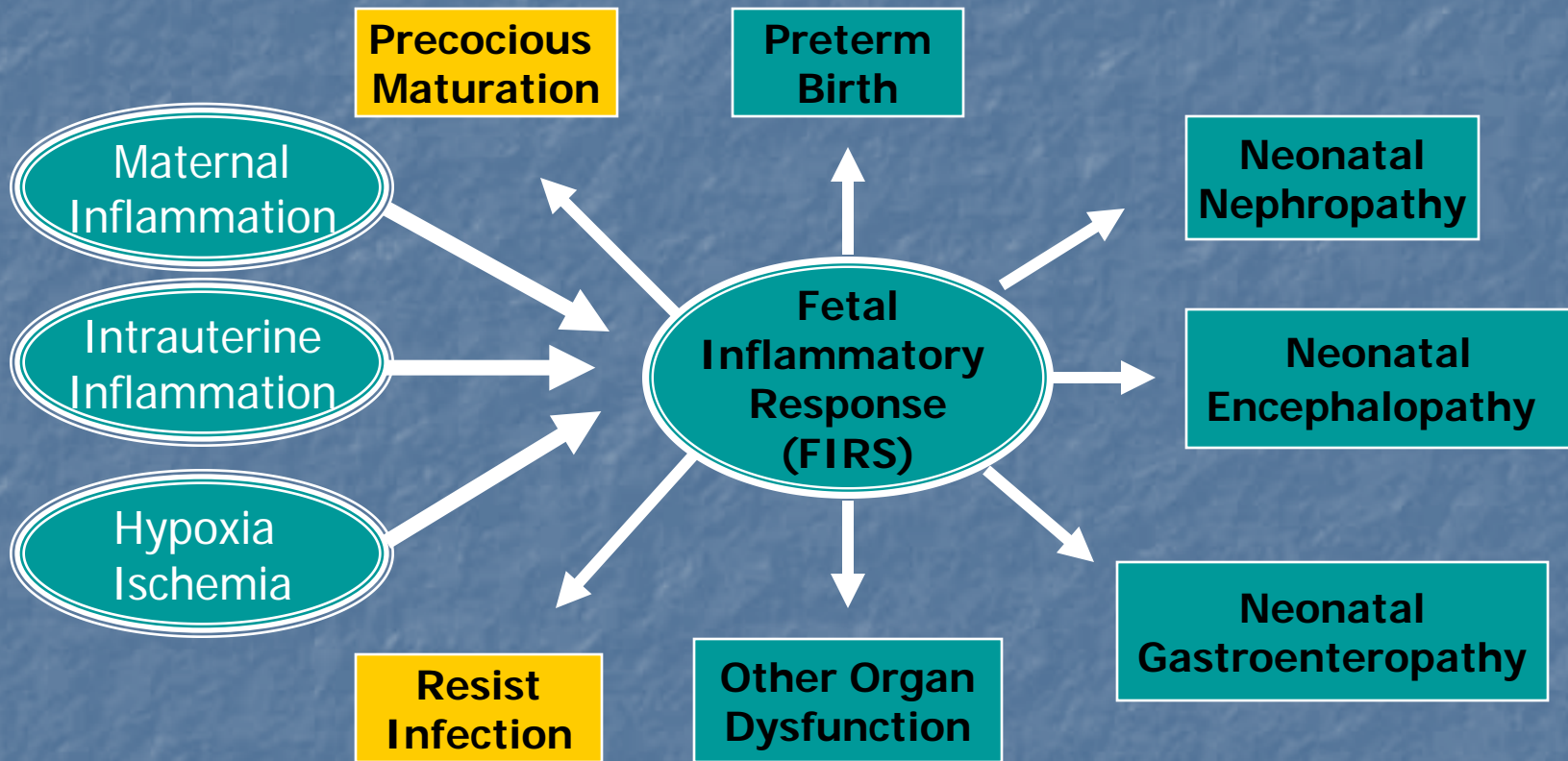
- Premature placental separation
- Infection
- Inflammation
 - Tent Caterpillar
- Degeneration
- Edema
- Hydrops



Threats to Fetal Well-being Placentitis

- Percentage of abnormal placenta
 - Not a predictor of fetal outcome
- Presence of abnormal placental tissue
 - Is enough to cause serious problems
 - Production of inflammatory mediators
- Fetal foals born with placentitis
 - More likely to have neonatal diseases





Placentitis Therapy?

- Anecdotal clinical experience
- Evidence from experimental models
- Lessons from sepsis therapy in man
- No large prospective clinical trials
- No solid evidence to direct therapy

Therapy?

Evidence Based

Traditions

Beliefs

Experience Based

Placentitis Therapy

- Treat as infectious
 - Trimethoprim potentiated sulfa drugs
- Try to minimize PG formation
 - NSAIDs - flunixin meglumine
- Hormone supplementation therapy
 - Altrenogest (ReguMate)

Treatment of Placentitis

- Increases odds of a normal foal
 - Retrospective
 - 108 pregnant mares
 - 48 with placentitis
- For normal foals from placentitis
 - Any treatment
 - $p=0.032$, OR 7.9, CI 1.2 - 53
 - Antimicrobials - TMS
 - $p=0.013$, OR 11.2, CI 1.7 - 75
 - NSAIDS - flunixin
 - $p=0.014$, OR 14.2, CI 1.7 - 119
 - Progestins - altrenogest
 - $p=0.043$ OR 7.1 CI 1.1 - 47



Threats to Fetal Well-being

- Iatrogenic Factors
 - Early delivery
 - Drugs
- Presence on a Twin
- Other peripartum events



Fetal Resuscitation

If Fetus Clearly in Distress

- Consider early induction, early delivery
 - Oxytocin induction
 - C-section



- These should be considered high risk procedures for the fetus and mare

No way back

