Neonatal/Pediatric Cardiopulmonary Care

Fetal Assessment & Transition

Fetal Heart Rate

- Indicator of fetal well-being

- Normal: 
  - 140 bpm (early gestation)
  - 120 bpm (late gestation)

<table>
<thead>
<tr>
<th>Pattern</th>
<th>Problem</th>
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</thead>
<tbody>
<tr>
<td>severe bradycardia</td>
<td>fetal hemorrhage asphyxia</td>
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<tr>
<td>sustained tachycardia</td>
<td>infection</td>
</tr>
<tr>
<td>late decelerations</td>
<td>asphyxia</td>
</tr>
<tr>
<td>severe, variable decelerations</td>
<td>asphyxia &amp; hypovolemia</td>
</tr>
<tr>
<td>sinusoidal</td>
<td>severe anemia asphyxia</td>
</tr>
</tbody>
</table>
Methods to Monitor HR

• Stethoscope
• External abdominal transducer
• Electrodes
• Fetal scalp electrode

Methods to Monitor Uterine Contractions

• Tocodynamometer
• Intrauterine pressure catheter

Fetal Heart Patterns

• Baseline heart rate
  – 120 - 160 bpm normal
  – Trend is important
Fetal Heart Patterns

Variability

- Constantly changing FHR normal
- Decreased variability = CNS depression

Fetal Heart Patterns

Bradycardia

- FHR < 100 bpm
- Caused by asphyxia
- Need scalp pH to r/o asphyxia

Fetal Heart Patterns

Tachycardia

- FHR > 180 bpm
- Caused by:
  - maternal fever, dehydration, anxiety
  - Infection
  - Asphyxia
  - Sympathomimetic drugs used to stop labor
Fetal Heart Patterns

Accelerations
FHR > 160 bpm for < 2 minutes
Good sign

Decelerations
FHR < 120 bpm for < 2 minutes
Threatening or harmless
3 types

Decelerations

• Early (Type I)
  – Closely follow uterine contraction
  – FHR may drop to 60-80/min.
  – Caused by compression of fetal head on cervix
  – Benign
Assessment & Transition

Decelerations

• Late (Type II)
  – Do not follow uterine contraction
  – Occur 10-30 sec. after contraction begins
  – Does not return to baseline until contraction over
  – Caused by placental insufficiency

Decelerations

Variable (Type III)
  Independent uterine contraction
  Caused by placental insufficiency
  May be dangerous
  May be relieved by repositioning

Fetal Scalp pH Assessment

Indications
  Absence of variability
  Late decelerations
  Abnormal tracings
  pH determined by placental function
  Blood exchange disrupted → pH falls
  Rising PaCO₂
  Lactic acidosis
Fetal Scalp pH Assessment

- To obtain
  - Lithotomy position
  - Fetal head visualized through cervix
  - Incision made
  - Blood sample collected in heparinized cap. tube

- Normal = > 7.25

High-Risk Pregnancy

High Risk Factors

- Socioeconomic Factors:
  1. Low income and poor housing
  2. Severe social problems
  3. Unwed status, esp. adolescent
  4. Minority status
  5. Poor nutritional status

- Demographic Factors:
  1. Maternal age <16, >35
  2. Obese or underweight prior to pregnancy
  3. Height less than 5 feet
  4. Familial history of inherited disorders
High Risk Factors

- **Medical Factors: Obstetric History**
  - History of infertility
  - History of ectopic pregnancy
  - History of miscarriage
  - Previous multiple gestations
  - Previous stillbirth or neonatal death
  - Uterine/cervical abnormality
  - High parity (many children)
  - History of premature labor/delivery
  - History of prolonged labor
  - Previous cesarean section
  - History of low birth weight infant
  - Previous delivery with forceps
  - History of infant with malformation, birth injury, or neurologic defect
  - History of hydatidiform mole or carcinoma

- **Medical Factors: Maternal Medical History**
  - History of seizure disorder
  - History of venereal or other infectious disease
  - Weight loss greater than 5 pounds
  - Surgery during pregnancy
  - Major anomalies of the reproductive tract
  - History of mental retardation and emotional disorders

- **Medical Factors: Current Obstetric Status**
  - Absence of prenatal care
  - Rh sensitization
  - Excessively large or small fetus
  - Premature labor
  - Preeclampsia
  - Multiple gestations
  - Poly- and oligohydramnios
  - Premature rupture of the membranes
  - Vaginal bleeding
  - Placenta previa
  - Abruptio placentae
  - Abnormal presentation
  - Postmaturity
  - Abnormalities in tests for fetal well-being
  - Maternal anemia
Assessment & Transition

High Risk Factors

Medical Factors: Habits
- Smoking
- Regular alcohol intake
- Drug use and abuse

Neonatal/Pediatric Cardiopulmonary Care

Labor & Delivery

Parturition
- = labor and childbirth
- Is a complicated process
Assessment & Transition

Stages of L & D

• Stage 1
  – Begins with onset of 1st true contraction
  – Cervix begins to efface and dilate
  – Result of fetus pushing cervix
  – Stage ends when 100% effaced & 10 cm dilated

Stages of L & D

• Stage 2
  – Actual delivery of fetus
  – Occurs by uterine, abdominal, diaphragmatic contractions
  – 20 minutes - 2 hours

Stages of L & D

• Stage 3
  – Expulsion of placenta
  – 5 to 45 minutes
  – Uterus continues to contract
Assessment & Transition

Stages of L & D

- Stage 4
  - Uterus shrinks and returns to normal

Abnormal L & D

Confucius say:

- No incubator better than uterus
- No ventilator better than placenta
- May take many nails to make crib but only one screw to fill it
Tocolysis

toco = labor, birth

lysis = stop, breakdown

Drugs Used for Tocolysis

• Beta-sympathomimetics
  – Relax smooth muscle
  – Brethine (terbutaline), Yutopar (ritodrine)
  – Side-effects
    • Tachycardia
    • Hyperglycemia
    • Hypokalemia
    • Anxiety
    • N & V
    • Rebound hypoglycemia

Drugs Used for Tocolysis

Anticonvulsants
  Decrease muscle contractility
  Magnesium sulfate
  Side-effects
    Decreased muscle tone
    Drowsiness
    Decreased serum calcium
### Assessment & Transition

#### Drugs Used for Tocolysis

**Prostaglandin inhibitors**
- Prostaglandins play major role in inducing labor
- Indocin (indomethacin)

**Side-effects**
- Constriction of Ductus Arteriosus
- Pulmonary hypertension
- Decreased urine output

#### Drugs Used for Tocolysis

**Calcium channel blockers**
- Relax smooth muscle
- Nifedipine (Procardia)

**Side-effects**
- Nausea
- Flushing
- Dizziness
- Decreased umbilical & uterine blood flow

### Indications for Tocolysis

- When Stage I labor begins < 37 weeks
Requirements for Tocolysis

- True labor must be present
- Cervix cannot be dilated > 4 cm and effaced > 50%
- Intact amniotic membranes

Requirements for Tocolysis

- Fetus must be between 20 - 36 weeks
- No signs of fetal distress
- Mom willing and able to give Informed Consent

Neonatal/Pediatric Cardiopulmonary Care

Fetal/Neonatal Transition
Initiation of Respiration: Chemical

- Normal birth process † placental circulation is impaired † transient asphyxia
- Affects chemoreceptors † stimulus to breathe

Initiation of Respiration: Sensory

- Warm, wet † cold, dry environment
- Tactile stimulus (handling newborn)

Fluid replaced by air in lungs:

- Vaginal delivery “squeezes” thoracic cage † elastic recoil introduces air to lungs
- Respirations † expansion of thoracic volume (establishment of FRC) † decreases neg. pressure required for subsequent breaths
- Requires presence of surfactant
Fluid leaves lungs:

- Vaginal “squeezing”
- Absorption by pulmonary capillaries
- Absorption by pulmonary lymphatic system

Transition from Fetal Circulation:
Increased pulmonary blood flow (® PVR)

- Why is PVR so high?
  1. Fluid in alveoli compress capillaries
  2. Capillaries are kinked
  3. PaO2 is low ◊ pulmonary vasoconstriction

Transition from Fetal Circulation:
Increased pulmonary blood flow (® PVR)

- Less pressure on pulmonary vessels as fluid leaves
- Pulmonary vessels straighten as air fills alveoli
- (PaO2 ◊ pulmonary vasodilation
**Assessment & Transition**

**Transition from Fetal Circulation:**
**Closure of Foramen Ovale**

As blood flows to pulmonary vasculature ↓ more blood returns to left atrium ↓ LA pressure > RA pressure
Loss of placental circulation = loss of outlet for aortic blood flow ↓ (left heart pressures

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**Transition from Fetal Circulation:**
**Closure of Foramen Ovale**

Functional closure almost immediately
Anatomic closure in weeks to months
At any time before anatomic closure, if RAP > LAP ↓ f.o. will reopen

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**Transition from Fetal Circulation:**
**Closure of Ductus Arteriosus**

® PVR ↓ more blood from RV/PA to pulmonary circulation
® blood through d.a.
® PaO₂ ↓ systemic vasoconstriction

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Assessment & Transition

Transition from Fetal Circulation: Closure of Ductus Arteriosus

Functional closure in 15 hours
Anatomic closure in 3 weeks

Transition from Fetal Circulation: Closure of Ductus Venosus

Clamp cord ◊ no blood flow
Anatomic closure in 3 - 7 days