

- Prenatal Diagnostic Tests
- Summer 2008
- Learning Objectives
- Identify indications for fetal diagnostic procedures
- Discuss the purpose, procedure, advantages and risks of each diagnostic procedure presented
- Provide information in response to common question parents have about procedures
  
- Concepts
- Oxygenation/Perfusion
- Comfort/Pain
- Skin Integrity
- Safety
- Communication
- Health Maintenance/Promotion
- Immunity/Infection
- Psychosocial
  
- Introduction
- Testing that is normal is reassuring to parents

- Testing may raise questions about fetal health, increasing parents anxiety and requiring difficult decisions

- Can cause emotional conflict and raise ethical dilemmas that increase stress level

- Indications for Prenatal Diagnostic Tests

- Three general reasons

- To detect congenital anomalies

- To evaluate the condition of the fetus if the pregnancy is high risk and allow necessary intervention

- Provide baseline information such as accurate gestational age

- Box on page 324 of McKinney text with specific indications

- Ultrasound

- Use of high frequency sound waves to obtain picture of fetus

- Can obtain a great deal of information with minimal risk to fetus and mother

- Reasons for use vary by trimester

- First Trimester

- Transvaginal

- Used because uterus, gestational sac, embryo, ovaries, and tubes deep in pelvis

- Woman in lithotomy position and probe inserted

- Common uses

- Determine presence, location of pregnancy

- Detect multi-fetal gestations
- Estimate gestational age – crown rump length most reliable
- Confirm fetal viability – heart beat visible at 38 days
- Identify need for follow up testing
- Identify characteristics that suggest fetal abnormality
- Adjunct for trans-cervical or trans-abdominal chorionic villus sample

- Second and Third Trimesters

- Usually use abdominal since uterus out of pelvis and accessible
- Mother on back and slightly tilted to one side, gel to abdomen, transducer moved over abdomen
- Full bladder is usually needed
- Purpose
  - Evaluate fetal anatomy
  - Confirm fetal viability
  - Estimate gestational age
    - use biparietal diameter, femur length and abdominal circumference
    - Not accurate after 32 weeks
  - Assess fetal growth with serial scans
  - Compare growth of fetuses in multi-fetal pregnancy
  - Evaluate amniotic fluid volume
  - Assess placenta and umbilical cord
  - Determine fetal presentation
  - Guide needle placement for amniocenteses or percutaneous umbilical blood sampling

- Alpha-Fetoprotein Screening
- AFP produced by fetus, is excreted into amniotic fluid, some crosses placenta into maternal circulation

- Allows AFP to be measured in maternal serum and amniotic fluid

- Abnormal levels of AFP associated with fetal anomalies

- Requires additional testing

- Level based on

- Gestational age
- Number of fetuses
- Maternal weight
- Race
- Diabetes

- Purpose

- Low levels correlate with chromosomal problems like Down Syndrome

- Elevated levels associated with failure of neural tube or abdominal wall to close

- Box on page 327 has other conditions linked to AFP levels

- Procedure

- All women should be offered test between 16-18 weeks

- Inform is screening test, not diagnostic

- If abnormal, f/u is ultrasound, then amniocentesis

- Limitations

- Is screening test, requires couple to choose whether to have test or not, and if abnormal then decide about next step

- Fetus can be normal, test abnormal, if f/u tests indicated, results in extra cost and anxiety
- Time limit prevents women who don't seek prenatal care early from having test
- Is not a guarantee that baby will be free of anomalies even if normal levels

## ● Triple Marker Screening

- Two other markers hCG and estriol added to MSAFP to screen for chromosomal abnormalities trisomy 18 and 21
  - Abnormal if MSAFP and estriol low and hCG high
  - Fourth marker being investigated to evaluate for trisomy 21

## ● Chorionic Villus Sampling (CVS)

- CV microscopic projections from outer membrane, the chorion, that will become part of placenta
  - Cells are of fetal origin
  - Can be used for diagnosis of fetal chromosomal, metabolic or DNA abnormalities
  - Done between 10-12 weeks
  - Can't be used for NTD since no amniotic fluid obtained

## ● Indications

- Only in women with high risk for giving birth to infant with genetic anomalies
  - Previous fetus with anomalies
  - Women over 35 years of age
  - Couple who are carriers of genetic or exhibit genetic disease
  - Rh sensitized mothers



## Procedure

- Needs genetic counseling, explanation of procedure
- Can be done transvaginal or transabdominal approach
- Cells are aspirated by way of flexible catheter or a needle to collect chorionic tissue
- Afterward
  - FHR assessed
  - Mother assessed for heavy bleeding , passage of amniotic fluid, clots
  - Mom should rest at home for several hours



## Advantages

- Done earlier with earlier results



## Limitations

- Pregnancy loss rate 1% or <
- Limb reduction if done before 10 weeks
- Risk for uterine infection present, but low
- Rh sensitization could result, should receive Rh immune globulin after procedure if mom Rh neg



## Amniocentesis



Is aspiration of amniotic fluid from sac for examination



May be done in 2<sup>nd</sup> or 3<sup>rd</sup> trimester depending on purpose

- 2<sup>nd</sup> trimester – between 15-20 weeks for fetal genetic anomalies, biochemical abnormalities, AFP levels, diagnose intrauterine infection (amnionitis) and evaluate fetal condition in Rh sensitization

- 3<sup>rd</sup> trimester –done to determine fetal lung maturity or fetal hemolytic disease caused by Rh incompatibility and for reduction of fluid in hydramnios

- Tests for lung maturity

- Done if delivery may be done @ < 38 weeks
- L/S ratio
  - Lecithin/sphingomyelin are lipoproteins in surfactant
    - Surfactant keeps alveoli open by reducing inner surface tension, prevents collapse of alveoli, reduces effort used to breathe
  - Until 30 weeks, levels of L/S equal, after that S remains same, but L rises
  - L/S ratio of 2:1 indicates surfactant adequate, lung mature in most cases (mothers with DM exception)
- Can also do PG (phosphatidylglycerol) or PI (phosphatidylinositol)
  - Presence of either means lungs mature

- Tests for Fetal Hemolytic Disease

- Measures amount of bilirubin in amniotic fluid
  - Reflects the amount of fetal RBC destruction

- Amniocentesis procedure

- Supine with slight lateral tilt
- Baseline maternal BP and FHR obtained
- U/S used to locate fetus/placenta/cord, to identify pockets of amniotic fluid and guide needle
- Skin is prepped and numbed with local anesthetic
- Mother may experience mild cramping as needle enters myometrium
- About 20 mL fluid removed

## — Afterward

- FHR electronically monitored for 30-60 minutes
- Mother should rest for first 24 hours
- Educate to call if persistent cramping, vaginal bleeding, leakage of amniotic fluid or fever
- Administer Rh immune globulin if mother Rh neg

## ● Advantages

- Simple, safe
- Brief, relatively painless
- Few complication

## ● Disadvantage

- Length of time for results (2 weeks +)
- Higher risk of loss when done early

## ● Risks

- Injury to cord, placenta, fetus minimal with U/S
- Infection
- Fetal loss < 1 %

## ● Antepartum Fetal Surveillance

## ● Three goals

- Determine fetal health or compromise
- Guide interventions

- Reduce perinatal morbidity and mortality



#### Common methods

- Nonstress test

- Contraction stress test

- Biophysical profile



#### Nonstress Test (NST)



#### Purpose

- Assess fetal well being by evaluating ability of fetal heart to accelerate with fetal movement

- Accels associated with adequate oxygenation of autonomic nervous system

- If no accels, then do contractions stress test or biophysical profile



#### Procedure

- Explain test to client who sits in recliner or semi-fowler in bed

- External monitor applied to detect accels with movement



#### Interpretation

- Either reassuring (reactive) or non-reassuring (non-reactive)

- Reactive

- 2 accels within 20 minute period, peaking at least 15 beats above baseline and lasting 15 seconds from baseline to baseline (15x15)

- Sleep wake cycles of fetus may extent test time

- Non-reactive

- Tracing does not show any of above requirements

- Test only applicable over 32 weeks

- Before that, look for 10 x 10 over 30 minutes

- Advantages

- Not invasive

- Painless

- Easy to do

- Disadvantages

- False positives often occur, usually d/t fetal sleep

- Can use vibroacoustic stimulation

- Reduces test time, false positives

- Apply over fetal head for 3 seconds, repeat @ 1 minute intervals x 3

- Contraction Stress Test (CST)

- Purpose

- Use when NST findings non-reactive

- Fetal oxygenation stressed by contractions

- CST records response of FHR to stress of contractions

- Fetus with adequate oxygen reserves tolerates temporary hypoxia from contractions

- Fetus with inadequate reserves has myocardial depression, shows as late decels on tracing

- Procedure

- Nurse administers test

- Performed with semi-Fowlers, external electronic monitor applied to record contractions and FHR
- Must have 3 contractions lasting 40 seconds within 10 minutes
- Can initiate contractions with oxytocin or nipple stimulation



#### Interpretation

- Negative
  - No late decels
- Positive
  - Late decels with 50% or more of contractions
- Equivocal
  - Some decels, but not 50% or greater
  - Hyperstimulation of uterus, some decels result
- Unsatisfactory
  - Inadequate contractions



#### Advantages

- Other tests have reduced original advantages
  - Follow up for nonreactive NST
  - Allows physician to analyze options, plan for birth of potentially compromised infant



#### Disadvantages

- Can't do if contractions contraindicated
- Test is time consuming, tedious and expensive
- Errors in interpretation

- Biophysical Profile (BPP)
- Purpose
  - Evaluates several parameters for more accurate appraisal of fetal condition
    - First four done with ultrasound
      - Fetal breathing movements
      - Amniotic fluid volume
      - Fetal movement
      - Fetal tone
      - NST
    - Normal values suggest adequate neurologic function and oxygenation
- Central and autonomic nervous systems that control some parameters of BPP react differently to hypoxemia
  - Some require more oxygen, so disappear first, others need less O<sub>2</sub>, so are later to vanish
- Amniotic fluid provides info about long term hypoxia
  - During hypoxic episodes, fetus shunts blood from kidney and lungs to heart, brain
  - Lungs and kidney produce amniotic fluid, low amounts of amniotic fluid suggest sustained hypoxia
- Effects of gradual hypoxia and worsening fetal acidosis
- Interpretation
  - Five parameters measured, each worth either 0 or 2 points for total of 10 points
    - Score of 10 perfect, is reassuring
    - Score of 4 or < is non-reassuring
- Modified BPP versions

- Do everything except NST
- Do only NST and amniotic fluid volume

- Amniotic Fluid Volume

- Measure pockets of fluid in each of 4 uterine quadrants and add together
  - Measurements of > 5 cm and < 18 cm normal

- Advantages

- Noninvasive
- Less costly than some other tests that could be done
- Results immediately available
- Less false positive NSTs
- Allow conservative treatment of observation if test OK

- Disadvantages

- Each parameter given equal weight, although some may be more important, research needed to determine
- Relationship of low BPP scores to long term development of child uncertain

- Percutaneous Umbilical Blood Sampling (PUBS)

- Involves aspiration of fetal blood from umbilical cord for prenatal diagnosis or therapy

- Procedure

- Ultrasound used to locate fetus, placenta and cord.
- Needle inserted through maternal abdomen into uterus

- Umbilical vein (preferred vessel) punctured close to placental insertion site

- Risks

- Infections, fetal bradycardia, cord lacerations, cord hematoma, thrombosis, premature labor, premature rupture of membranes, fetal loss

- After procedure completed, bleeding from cord monitored by ultrasound, normally stops quickly.

- Maternal Assessment of Fetal Movement

- Also called “kick counts”

- Fetal movement associated with fetal condition, daily appraisal provides evaluation of fetal state

- Numerous protocols exist (examples)

- Count movements for 30 minutes three times /day, call provider if < 4 movements in half hour

- Count movements daily for 1 hour, if < 10 felt continue counting for another hour, if still less than 10 movements in 2 hours, call MD

- Advantages

- Inexpensive, noninvasive

- Convenient for client, involves her in care

- Disadvantages

- Fetal sleep decreases movement

- Maternal perception of fetal movement varies, even in same woman

- Time of day affects fetal movement

- Use of drugs may affect fetal activity

- Nursing Care of Client Who Has Diagnostic Testing
- Assessment
  - Collect information important to conducting test
- Diagnosis and Planning
  - Anxiety r/t lack of knowledge of procedure and unknown condition of fetus
  - Outcome – Couple will verbalize knowledge of test procedure before test initiated, couple will verbalize concerns and seek knowledge about fetus
- Interventions
  - Provide support
  - Provide information
- Evaluation
  - Did client verbalize knowledge of tests?
  - Did client seek information about fetal condition to relieve anxiety?