Fetal Diagnosis & Counseling of Pregnancy Options
Overview

• What is prenatal (fetal) diagnosis?
• Options Available for Fetal Diagnosis
  – Screening
  – Diagnostic
  – Pictures, Examples
• Options for Pregnancy Management
  – Termination
  – Continuation
  – Hospice
  – Adoption
What is a Birth Defect?

• “Congenital anomaly”: Any abnormality of structure and/or function present at birth
  – > 4,000 different known birth defects ranging from minor to serious
• Serious abnormalities lead to mental or physical disabilities or even death
• Birth defects are the leading cause of infant mortality & significant cause of premature death, chronic illness and long-term disability
What is the Risk of Having a Fetus with an Abnormality?

• Overall risk – ~ 4%
• Worldwide - 6 million affected babies born/year
• U.S. - 150,000 affected babies born/year
• Most common abnormalities (in order)
  – Congenital Heart Disease -- 8/1000
  – Trisomy 21 – 1/700
  – Neural Tube Defect -- 1/1000
  – Cystic fibrosis – 1/3000
History of Prenatal Diagnosis

• Ultrasound (US)
  – Introduced in the 1950s

• Amniocentesis
  – First done in 1877
  – First done for chromosomal studies in 1966
  – Common since the 1970s

• Chorionic villus sampling (CVS)
  – First done in 1968
  – Greater acceptance in 1980s-90s

• Rapid expansion of serum & US screening options
  – 1990s to present
What Can Be Done Prior to Conception?

• Identify women/couples at risk
  – Family history: birth defects or genetic dz
  – Medications: Coumadin, Accutane
  – Exposures: smoking, EtOH, drugs

• Refer to genetic counselor

• Consider carrier testing
  – Cystic Fibrosis, Sickle Cell, Tay-Sachs

• Folate - ↓ risk of NTD
What Options During pregnancy?

• Screening vs. diagnostic testing
• Provide information early
• Factors that may be considered
  – Desire to terminate if an abnormality is found
  – Desire to have as much information for preparation
  – Delivery planning
What is a Screening Test?

- A test done to identify the possibility of a disease or defect by the application of tests, examinations or other procedures.
- Provides individual RISK ASSESSMENT.
- Pro: ↓ number of procedures done for diagnosis & therefore ↓ procedure-related complications.
- Con: not diagnostic, may miss target.
What is a Diagnostic Test?

• A test that will definitively identify a disease or defect

• Prenatal diagnostic test
  – Chromosomal abnormality (aneuploidy), gene change (Sickle cell)

• PRO: DEFINITIVE ANSWER

• CON: Risks associated with the diagnostic procedure
What Screening Tests Are Available?

- Ultrasound at any time
- 1st trimester – 10-14 weeks
  - Serum analytes: PAPP-A, free β-hCG
  - Ultrasound evaluation of nuchal translucency
- 2nd trimester – 15-21 weeks
  - Serum analytes: AFP, uE3, hCG, inhibin A
- “Non invasive” prenatal diagnosis
  - Maternal Serum – cell free DNA
## Screening Options

<table>
<thead>
<tr>
<th>Test</th>
<th>When Done</th>
<th>Detection Rates</th>
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<tbody>
<tr>
<td>1st trimester (NT + 2 serum)</td>
<td>10-14 weeks</td>
<td>T21 -- 83%</td>
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<tr>
<td></td>
<td></td>
<td>T18 – 80%</td>
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<tr>
<td>Ultrasound</td>
<td>18-20 weeks</td>
<td>T21 -- 60%; T18 -- 85%</td>
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<tr>
<td></td>
<td></td>
<td>NTD -- 70-98%</td>
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<tr>
<td>Quadruple screen (4 serum analytes)</td>
<td>15-21 weeks</td>
<td>T21 -- 75-80%; T18 -- 60%</td>
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<tr>
<td></td>
<td></td>
<td>NTD -- 80-90%</td>
</tr>
<tr>
<td>*Integrated screen (1st trimester screen + quadruple screen)</td>
<td>10-14 weeks</td>
<td>T21 -- 92%</td>
</tr>
<tr>
<td></td>
<td>15-21 weeks</td>
<td>T18 -- 90%</td>
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<tr>
<td></td>
<td></td>
<td>NTD -- 80%</td>
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<tr>
<td>Maternal serum</td>
<td>&gt;7 weeks</td>
<td>T21 - &gt;99%</td>
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<tr>
<td></td>
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<td>Other aneuploidy?</td>
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</tbody>
</table>
What if the Screen is Abnormal?

- Discussion with patient and her family
- Discussion with primary provider
- Referral to genetic counselor
- Detailed anatomical US
  - 50% of T21 fetuses have a normal US!
- Offer diagnostic testing
What Diagnostic Tests Are Available?

- Chorionic villus sampling – 10-13 weeks
- Amniocentesis – > 15 weeks
- Fetal Blood Sampling – rarely done
- Ultrasound
Chorionic Villus Sampling

- 10-13 weeks
- Trophoblasts cultured
- **Advantages**
  - Early diagnosis
- **Disadvantages**
  - Loss rate 0.5-1%
  - 1% risk of confined placental mosaicism

http://www.pennhealth.com/health_info/pregnancy/000242.htm
Amniocentesis

- > 15 weeks
- Remove 15-20 ml of amniotic fluid
- Amniocytes cultured
- **Advantages**
  - Can test AFP levels.
- **Disadvantages**
  - Loss rate 0.1-0.5%
  - Later diagnosis
ACOG’s Stance on Prenatal Screening & Diagnosis

- All women should be offered aneuploidy screening before 20 weeks, regardless of maternal age
- All women should have the option of invasive testing regardless of age
- Primary provider should be able to discuss the detection rates, false positive rates, disadvantages & limitations

ACOG Practice Bulletin #77: Screening for Fetal Chromosomal Abnormalities
Fetal Blood Sampling (Cordocentesis)

- Removal of blood from umbilical cord
- Rarely done
- Done when diagnostic information cannot be obtained through amniocentesis, CVS, US or the results of these tests were inconclusive
- Performed after 17 weeks
- Potential indications: suspected fetal infection, anemia, thrombocytopenia
- Loss rate - 2%
How is Ultrasound Used for Screening & Diagnosis?
1st Trimester US
What Can We See?

• Markers of Aneuploidy & Congenital Heart Disease
  – ↑ Nuchal translucency
  – Absent nasal bone
  – Tricuspid regurgitation
1st Trimester US
What Can We See?

Normal Fetus

Anencephaly
1st Trimester US
What Can We See?

Multiple Gestation
2nd Trimester Ultrasound
What Can We See?

- Lethal anomalies
  - Anencephaly
  - Skeletal dysplasias
  - Renal agenesis
- Moderate to severe anomalies
  - Congenital diaphragmatic hernia
  - Heart defects
  - Neural tube defects
  - Gastrochisis, Omphalocele
2nd Trimester Ultrasound
What Can We See?

• Relatively minor abnormalities
  – Cleft lip/palate
  – Club foot
  – Polydactyly
Anencephaly

http://i.b5z.net/i/u/909479/i/med_sketch500.gif
http://www.obgyn.net/us/cotm/0006/Anencephaly%205.jpg
Neural Tube Defects
Gastrochisis
Bilateral Cleft Lip & Palate
Club Foot & Polydactyly

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What Happens Once a Diagnosis is Made?

- Breaking the bad news.....
- Difficult
- US technologists often the 1st to recognize - awkward for them & patient
- Acknowledge concern
- “Ruined the pregnancy for me”
What Are The Options for Management?

- Termination by D&C or D&E
- Termination by induction of labor
  - Can be done anytime after 15 weeks
  - Always done after 24 weeks
  - Allows parents to spend time with fetus
  - Allows complete autopsy
- Continuation of the pregnancy
  - Preparation, adoption, delivery planning
Do Fetuses Feel Pain?

- Hotly debated
- Neuroanatomical system complete by 26 weeks
- A developed neuroanatomical system is necessary but not sufficient for pain experience
- Pain experience also requires development of the mind to accommodate the subjectivity of pain
- Unclear
- May consider cord/intracardiac injection of KCl prior to termination or induction

Derbyshire SWG BMJ 2006;332:909-912
Thank You!
Preimplantation Genetic Diagnosis

- Alternative to conventional prenatal diagnosis
- Diagnose cytogenetic or single gene disorders prior to embryo implantation
- Biopsy of 1-2 cells from an in vitro embryo
- Allows couples to avoid intrauterine transfer of affected embryos
Preimplantation Genetic Diagnosis

• **Advantages**
  – Avoid pregnancy termination
  – Avoid procedure related pregnancy loss
  – Improve ongoing pregnancy rates

• **Disadvantages**
  – Must undergo IVF
  – Expensive
  – Can only be done for anomalies associated with cytogenetic or single gene disorders
"All women, regardless of age, should have the option of invasive testing. A woman's decision to have an amniocentesis or CVS is based on many factors, including the risk that the fetus will have a chromosomal abnormality, the risk of pregnancy loss from an invasive procedure, and the consequences of having an affected child if diagnostic testing is not done. Studies that have evaluated women's preferences have shown that women weight these potential outcomes differently. The decision to offer invasive testing should take into account this preference and should not be solely age based. The differences between screening and diagnostic testing should be discussed with all women. Thus, maternal age of 35 years alone should no longer be used as a cutoff to determine who is offered screening versus who is offered invasive testing."
Multifetal Pregnancy Reduction & Selective Termination

• Goal of MPR is to reduce the risk of complications associated with higher order pregnancies by decreasing the number of fetuses in the gestation

• Goal of ST is to prevent the survival of a severely impaired fetus of a multiple pregnancy in which the fetuses are discordant for anomalies
How Can Prenatal Diagnosis Be Useful?

• Managing the remaining weeks of the pregnancy
• Determining the outcome of the pregnancy
• Planning for possible complications with the birth process
• Planning for problems that may occur in the newborn infant
• Deciding whether to continue the pregnancy
• Finding conditions that may affect future pregnancies