Fetal Diagnosis & Pregnancy Counseling
Overview

• What is prenatal (fetal) diagnosis?
• Options Available for Fetal Diagnosis
  – Screening
  – Diagnostic
• Options for Pregnancy Management
  – Termination
  – Continuation
  – Hospice
  – Adoption
Periods of Fetal Development

- To understand the impact of teratogens, you need to know a little about fetal development.
- The dates shown at right are predictable events during the 40 week period of human gestation.
- Human viability is now possible as early as 24 weeks.
Infertility

Low sperm count, anatomic defects or disease and fallopian tube scarring are the most common factors that may cause infertility.

Sterility

Not being able to conceive

Implantation never occurs, or leads to miscarriage
Infertility Risk Factors

- Age
- Smoking
- Alcohol consumption
- Obesity
- Eating disorders
- STD’s
- Stress
Increasing Infertility?

• 1 in 6 couples have difficulty conceiving.

• Sperm counts have fallen by almost half in the last 60 years.
  – Millions of healthy, motile sperm are needed for 1 to fertilize an egg
  – Not only are counts going down, sperm are more abnormal in shape and motility

• Increased rates of chlamydia resulting in PID

• More women waiting until later in life to start a family.
Treating Infertility

- Induce ovulation
- Surgery to unblock Fallopian tubes
- IVF
- ICSI
Infertility Definitions

• Inability to
  – **Conceive** after 12 consecutive months of regular intercourse without use of “unmentionables”
  – **Produce gametes**
  – **Carry a pregnancy to term**
• ~20% are due to issues with the man
• 50% are due to issues with the woman
• ~30% are unidentified/unexplained
What is a Birth Defect?

• AKA “Congenital anomaly”
  – 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

• Leading cause of infant morbidity & 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 – ~ 3%
- Worldwide - 6 million affected babies born/year
  - U.S. - 150,000 affected babies born/year
- Common abnormalities
  - Congenital Heart Defect -- 14/10,000
  - Trisomies (13, 18, 21) – 18/10,000
  - Neural Tube Defect -- 6/10,000
  - Orofacial defects– 17/10,000
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

• Folic Acid supplements - ↓ 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
- 1\textsuperscript{st} trimester – 10-14 weeks
  - Serum analytes: PAPP-A, free β-hCG
  - Ultrasound evaluation of nuchal translucency
- 2\textsuperscript{nd} trimester – 15-21 weeks
  - Serum analytes: AFP, uE3, hCG, inhibin A
- “Non invasive” prenatal diagnosis
  - Maternal Serum – cell free DNA
<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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<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>
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<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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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 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

• Moderate to severe anomalies
  – Heart defects
  – Neural tube defects
  – Gastroschisis, Omphalocele

• 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/Omphalocele
Bilateral Cleft Lip & Palate
Club Foot & Polydactyly
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
• May consider cord/intracardiac injection of KCl prior to termination or induction

Derbyshire SWG BMJ 2006;332:909-912