ULTRASOUND IN THE EVALUATION OF MULTIPLE GESTATION

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OVERVIEW
Ultrasound in Multiple Gestations

- Complications of multiple gestation
- Zygosity and chorionicity
- Fetal growth assessment
- Conditions unique to monochorionic twins
- Fetal surveillance
- Intrapartum ultrasound
- Recommendations for ultrasound evaluation

COMPLICATIONS OF MULTIPLE GESTATION

- Fetal / Perinatal Complications
  - "Vanishing" twin
  - Congenital anomalies
  - Prematurity
  - Fetal growth restriction
  - Fetal demise of 1 twin
  - Cord accidents
  - Malpresentation

MULTIPLE GESTATION

"Vanishing" and "Appearing" Twins

- "Vanishing" twin – first trimester demise
  - incidence ~ 20%
  - more common in DC twins < 8 weeks
  - first trimester bleeding common
  - prognosis similar to singleton
- "Appearing" twin – undercounting fetuses
  - up to 14% when evaluated < 6 wks
  - more common in MC twins, 5.0-5.4 wks

MULTIPLE GESTATION

Fetal Anomalies

- Higher incidence than singletons
  - overall risk in twins 1.2-2x higher
  - dizygotic – risk per fetus same as singletons
  - monozygotic – 2-3x higher
    - cardiac (2.3%, 3x higher in TTTS recipients, esp. pulmonic stenosis)
    - neural tube defects
    - facial clefts
    - gastrointestinal defects
    - abdominal wall defects
MULTIPLE GESTATION
Fetal Anomalies

• Anomalies in multiples are usually discordant
  – dichorionic 90%
  – monochorionic 80%
• Management of discordant anomalies depends upon:
  – chorionicity
  – gestational age at diagnosis
  – type of defect (lethal vs nonlethal)
  – potential for pregnancy complications

MULTIPLE GESTATION
Zygosity and Chorionicity

• Zygosity
  – number of zygotes (fertilized eggs)
  – assessment requires invasive testing
• Chorionicity
  – number of chorions (placentas)
  – can be assessed sonographically
  – main determinant of risk in multiples

MULTIPLE GESTATION
Zygosity and Chorionicity

• 2/3 of twins are dizygotic
• 1/3 of twins are monozygotic
• All dizygotic are dichorionic
• All monozygotic are monochorionic
• 90% of dichorionic are dizygotic

ZYGOSITY AND
CHORIONICITY

Gynecology and Obstetrics

MONOZYGOTIC TWINS

Gynecology and Obstetrics

MULTIPLE GESTATION
Assessment of Chorionicity

• Sac number & appearance – 6-9 weeks
  – dichorionic – thick septum between sacs
• Placental number
  – one – either mono or dichorionic
  – two – dichorionic
• Fetal gender
  – same – either mono or dichorionic
  – different – dichorionic

Gynecology and Obstetrics
MULTIPLE GESTATION Assessment of Chorionicity

6-9 weeks

- Dividing membrane
- Thickness
  - Monochorionic: thin
    (mean 1.4 mm, range 1.0-2.0)
  - Dichorionic: thick
    (mean 2.4 mm, range 1.2-4.0)

- Number of layers
  - Two: monochorionic
  - Three or four: dichorionic

10-14 weeks

- Dividing membrane
- Appearance of base
  - Monochorionic: "T"
  - Dichorionic: "twin peak" or "lambda"

Fused placenta
Separate placenta
Total
N       67       34       101
10-14 weeks 100% 100% 100%
16 weeks 100% 91% 97%
20 weeks 93% 74% 87%

Obstet Gynecol 1999;94:450

Ultrasound Obstet Gynecol 2002;19:350
MULTIPLE GESTATION
Assessment of Amnionicity

- Number of yolk sacs in 1st trimester does not predict monoamnionicity in MC twins
- 15% of MC/DA twins have 1 yolk sac
- Visualization of dividing membrane
- serial scans if not visualized
- Other findings in monoamniotic twins
  - umbilical cord entanglement
  - proximity of placental cord insertions

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Assessment of Amnionicity

Proximity of placental cord insertions

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MULTIPLE GESTATION
Fetal Growth Assessment

- ↑ incidence of IUGR in multiples
  - MC risk 4x higher than DC
- Main factors determining growth – genetic potential & placental function
  - usually the same in monochorionic
  - may be different in dichorionic
- IUGR vs discordance

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MULTIPLE GESTATION
Fetal Growth Assessment

- Multiples and singletons grow similarly to 28-30 weeks, then multiples slow
  - triplet growth curve deviates from twin curve at ~ 35 weeks
- Normal growth curves affected by:
  - chorionicity
  - fetal gender
  - ethnicity

Gynecology and Obstetrics
MULTIPLE GESTATION
Fetal Growth Assessment

IUGR – diagnosis
- EFW below 10th percentile for ga

Discordance – diagnosis
- ≥ 20 mm difference in AC after 24 wks
  - 83% PPV for ≥ 20% BW discordance
- ≥ 20% difference in EFW

% Discordance = \frac{\text{EFW larger twin} - \text{EFW smaller twin}}{\text{EFW larger twin}} \times 100

- Greater morbidity than dichorionic
  - overall fetal survival 78%

- Distinguish from TTTS by normal AFV in sac of appropriately grown fetus

- Principal factors influencing MC growth:
  - degree of placental sharing
  - implantation of each placental portion
  - angioarchitexture
  - anastomoses
  - placental cord insertions

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Causes of Discordance

- Structural anomalies
- Chromosomal abnormalities
- Genetic syndromes
- Discordant congenital infection
- Unfavorable placental implantation
- Unfavorable cord insertion site
- Placental abruption
- Complication of monochorionic placentation

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Management of IUGR & Discordance

- Serial sonograms for growth & AFV
- Fetal surveillance
  - NST, BPP, modified BPP, Dopplers
- Steroids for fetal lung maturity
- Timing of delivery depends upon:
  - chorionicity
  - gestational age
  - fetal surveillance results
MULTIPLE GESTATION
Management of IUGR & Discordance

- Monochorionic more problematic
  - Dopplers may have lower prognostic value
  - IUFD of 1 twin may cause twin “embolization” syndrome
  - selective feticide by cord occlusion may be appropriate for imminent IUFD
  - selective photocoagulation of vascular anastomoses under investigation

MULTIPLE GESTATION
Conditions Unique to MC Twins

- Twin “embolization” syndrome
- Twin-twin transfusion syndrome (TTTS)
- Twin reversed arterial perfusion (TRAP)
- Monoamniotic twins
- Conjoined twins

CONDITIONS UNIQUE TO MONOCHORIONIC TWINS

MULTIPLE GESTATION
Twin “Embolization” Syndrome

- Tissue necrosis or death of living fetus after IUFD of monochorionic co-fetus in 2nd or 3rd trimester
- Occurs in up to 25% of surviving co-fetuses
- Mechanism – hemodynamic shifts from live to dead fetus causing acute severe hypotension in survivor (“embolization” is misnomer)
- Manifestations most common in brain (ventriculomegaly, porencephaly, cerebral atrophy, cystic encephalomalacia, microcephaly), kidneys, bowel (atresias), abdominal wall (gastroschisis)

Survivor at 18 Weeks

Survivor at 23 Weeks
**MULTIPLE GESTATION**

**Twin-Twin Transfusion Syndrome (TTTS)**

- Occurs in up to 15% of monochorionic twins
- Caused by chronic imbalance in net flow of blood across placental vascular anastomoses
- Donor twin develops hypovolemia, oliguria and oligohydramnios
- Recipient twin develops hypervolemia, polyuria and polyhydramnios

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**Sonographic Predictors of TTTS**

- \( \uparrow \) NT in at least 1 twin at 11-14 weeks
  - sensitivity 28%, PPV 33%
- Folding of dividing membrane at 15-17 weeks
  - sensitivity 28%, PPV 33%
- Absence of arterioarterial anastomoses
  - detected by color flow mapping & pulsed Doppler from 12 wks, most detected \( \geq 18 \) wks
- Velamentous cord insertion
  - postnatal studies – 60% MC twins with velamentous insertion developed TTTS

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**Natural History of MC Twins**

- \( n=83 \)
- \( n=23 \) (28%)
- \( n=12 \) (14%)

Sebire et al 1997

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**Zygosity and Chorionicity**

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**Diagnosis and Evaluation of TTTS**

- Diagnosis
  - 16-26 weeks, monochorionic
    - polyuric polyhydramnios in recipient
      - \( \geq 8.0 \) cm DVP before 20 weeks
      - \( \geq 10.0 \) cm DVP after 20 weeks
    - oliguric oligohydramnios in donor
      - < 2.0 cm DVP
  - Fetal condition assessed by staging
### TTTS Staging: Current System

**Stage I:**
- Polyhydramnios in recipient (dvp > 8 cm)
- Oligohydramnios in donor (dvp < 2 cm)
- Donor bladder visible

**Stage II:** stage I criteria plus:
- Donor bladder not visible at any point during preoperative evaluation
- Umbilical artery diastolic flow present
- Forward flow in ductus venosus

**Stage III:** stage II criteria plus:
- Critically abnormal Doppler studies (at least one)
  - Absent or reversed end-diastolic velocity in the umbilical artery
  - Reversed flow in the ductus venosus
  - Pulsatile umbilical venous flow

**Stage IV:**
- Atypical presentation: donor bladder visible
- Sub-staging by affected fetus
  - III-donor, III-recipient, III-donor-recipient
  - IV-donor (rare)

**Stage V:**
- Demise of either fetus

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### Multiple Gestation

**TTTS Treatment Modalities**

- Expectant management
  - Up to 90% mortality
- Septostomy
- Amnioreduction
- Endoscopic laser ablation of vascular anastomoses
- Selective feticide

**Laser therapy** is the best first line therapy for TTTS < 26 weeks

Management after 26 weeks should be individualized
- Expectant, serial amnioreduction, laser, delivery
- Management of stage I debated
MULTIPLE GESTATION
Twin Reversed Arterial Perfusion (TRAP)

- AKA acardiac twinning
- Extreme form of TTTS
  - paired A-A and V-V placental anastomoses
  - lack of heart development in acardiac twin
  - retrograde perfusion of acardiac twin by pump twin through anastomoses
- Incidence 1/35,000 pregnancies
  - 1% of monochorionic twins
  - 1/30 monochorionic triplets

MULTIPLE GESTATION
Prenatal Assessment of TRAP

- Poor prognostic factors
  - acardiac to pump twin weight ratio > 70%
  - CHF or hydrops in pump twin
  - polyhydramnios
  - umbilical artery RI difference < 0.20
  - delivery < 32 weeks
- Calculation of acardiac weight:
  \[
  \text{weight (g)} = (-1.66 \times \text{length}) - (1.7 \times \text{length}^2)
  \]
  \text{length} = \text{longest linear measurement (cm)}

MULTIPLE GESTATION
Management of TRAP

- Expectant management if twin weight ratio < 70% and no evidence of compromise
- Consider interruption of vascular supply to acardiac twin if poor prognostic factors present
  - funicular (cord) approach
  - intrafetal approach

MULTIPLE GESTATION
Monoamniotic Twins

- 1-2% of twins
- Fetal mortality rate 30-70%
  - recent series lower (10-20%)
  - most common causes – cord accidents, acute TTTS
- Diagnosis based upon
  - non-visualization of dividing membrane on serial scans
  - cord entanglement (> 80%)
  - proximity of placental cord insertions
## Multiple Gestation

### Monoamniotic Twins – Management
- Patient counseling about risks
  - consider pregnancy termination
- Serial sonograms
- Intensive fetal surveillance ≥ 26 wks
- Indomethacin to reduce AFV
- Antenatal steroids for lung maturity
- Delivery at 32-34 weeks

### Gynecology and Obstetrics

## Conjoined Twins

### Typical or Symmetric
- 8 types
  - Thoracopagus 40%
  - Xipho- or omphalopagus 34%
  - Pygopagus 18%
  - Ischiopagus 6%
  - Craniopagus 2%
  - Parapagus, rachipagus, cephalopagus

### Atypical or Asymmetric
- AKA heteropagus or parasitic
  - dependent portion (parasite) attached to or included in host (autosite)
  - *fetus in fetu* – imperfect fetus contained completely within body of sibling

## Ultrasound Obstet Gynecol

### Parasitic Twins

### Epigastric Heteropagus

### Gynecology and Obstetrics

### Incidence
- 1/50,000 – 1/200,000
- Joined at identical anatomic points
- Name based upon site of union
- Classification:
  - typical or symmetric
  - atypical or asymmetric

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### Gynecology and Obstetrics

### Ultrasound Obstet Gynecol 2001;17:534

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### Ultrasound Obstet Gynecol 2002;20:192

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### Ultrasound Obstet Gynecol 2002;20:192
MULTIPLE GESTATION

Conjoined Twins

• Prognosis
  – 40% stillborn
  – 35% liveborns die within 24 hours
  – 60% survive surgical separation

• Management
  – consider pregnancy termination
  – prenatal imaging – 2-D & 3-D sono, MRI
  – team approach for continuing pregnancies
  – Cesarean delivery

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MULTIPLE GESTATION

Intrapartum Management

• Twins – presentation in labor
  – vertex / vertex – 45%
    • vaginal delivery
  – vertex / nonvertex – 35%
    • external cephalic version (60% success)
    • breech extraction if EFW 1500-3500 gm
  – nonvertex / vertex or nonvertex – 20%
    • Cesarean delivery

Gynecology and Obstetrics

RECOMMENDATIONS FOR

ULTRASOUND EVALUATION

Gynecology and Obstetrics

MULTIPLE GESTATION

Intrapartum Ultrasound

• On admission:
  – presentation and lie
  – estimated fetal weight

• At delivery:
  – reassess presentation of twin B
  – assist with external cephalic version
  – assist with breech extraction
  – monitor heart rate of twin B

Gynecology and Obstetrics

MULTIPLE GESTATION

Recommendations for

Ultrasound Evaluation

<table>
<thead>
<tr>
<th>GA (weeks)</th>
<th>Examination</th>
<th>Monochorionic</th>
<th>Dichorionic</th>
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<tbody>
<tr>
<td>6-9</td>
<td>viability, number, dating, chorionicity</td>
<td></td>
<td></td>
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<tr>
<td>11-14</td>
<td>viability, number, dating, chorionicity</td>
<td>nuchal translucency</td>
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<td>15-26</td>
<td>q2 wks: TTTS predictors and signs</td>
<td>q4 wks: fetal growth</td>
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<td>15-28</td>
<td>assessment of cervical length</td>
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modified from Sperling & Tabor 2001
# MULTIPLE GESTATION Recommendations for Ultrasound Evaluation

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<tbody>
<tr>
<td>18-20</td>
<td>screen for structural anomalies</td>
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<tr>
<td>20-22</td>
<td>fetal echocardiogram</td>
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<tr>
<td>26 to delivery</td>
<td>serial growth scans (normal q4 wks, abnormal q2-3 wks) fetal surveillance as indicated</td>
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<tr>
<td>Intra-partum</td>
<td>as indicated</td>
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*modified from Sperling & Tabor 2001*