Maternal Complications in Twin Gestation

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## 2012 TWH Multiple Delivery Statistics

<table>
<thead>
<tr>
<th></th>
<th>Total Deliveries</th>
<th>Delivery &gt; 34 weeks</th>
<th>Deliveries &gt; 37 weeks</th>
</tr>
</thead>
<tbody>
<tr>
<td>2012</td>
<td>330</td>
<td>216 (65%)</td>
<td>67 (20%)</td>
</tr>
<tr>
<td>First Quarter 2013</td>
<td>78</td>
<td>55 (71%)</td>
<td>19 (24%)</td>
</tr>
</tbody>
</table>

*Delivery statistics from The Women’s Hospital (TWH), Houston, TX*
<table>
<thead>
<tr>
<th>Time</th>
<th>Number</th>
<th>PTL/Prom</th>
<th>IUGR/Placental Insufficiency</th>
<th>PIH</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 34 Weeks</td>
<td>12</td>
<td>6 (50%)</td>
<td>3 (25%)</td>
<td>3 (25%)</td>
</tr>
<tr>
<td>34-36 Weeks</td>
<td>15</td>
<td>5 (33%)</td>
<td>3 (20%)</td>
<td>7 (47%)</td>
</tr>
<tr>
<td>36+ Weeks</td>
<td>17</td>
<td>8 (47%)</td>
<td>4 (24%)</td>
<td>5 (29%)</td>
</tr>
<tr>
<td>Total</td>
<td>44</td>
<td>19 (43%)</td>
<td>10 (23%)</td>
<td>15 (34%)</td>
</tr>
</tbody>
</table>

*Delivery statistics from The Women’s Hospital (TWH), Houston, TX*
Twin gestation complications compared to singletons

- Hypertension 2.5 x increase
- Anemia 2.5 x increase
- Abruption 3 x increase
- UTI 1.5 x increase

- Spellacy 1990
Twin Gestation Maternal Complications

• Preeclampsia
• Other hypertensive disorders
• Antepartum hospitalization for preterm labor
• Abnormal bleeding
• Nutritional deficiencies
• Cesarean delivery
• Postpartum hemorrhage

  • Young BC: Semin Perinatol.2012
Maternal Complications in Twin Gestation

• Maternal physiologic changes of pregnancy
  – Cardiovascular
  – Hematopoetic
  – Renal
  – Metabolic
• Hypertensive disease
• Nutritional deficiencies
• Complications of treatment of preterm labor
Maternal cardiovascular changes in pregnancy

• Total blood volume increase 45 %.
• In twins blood volume increase up to 60 %
• Protection of mother against blood loss
• Hemodilution and decreased viscosity may be protective of thromboembolism
• Hemodilution may be important in intervillous perfusion
Maternal cardiovascular changes in pregnancy

• Blood volume increase:
  • Increase in plasma volume
  • Increase in RBC mass
Maternal Cardiovascular changes in pregnancy

- Plasma volume increases from 6 weeks to 32 weeks, by 1.2-1.6 liters (to 4.7-5.2 liters)
- Increase in twin gestation greater
- Mechanism of increase related to estrogen stimulation of renin/angiotensin/aldosterone system, leading to stimulation of retention of sodium and water
Maternal cardiovascular changes in pregnancy

- RBC mass increases by 20-30%
- RBC increase stimulated by placental somatotropin, progesterone, prolactin
- Maternal demand on iron increased by 500 mg: additionally, 300 mg iron transferred to the fetus. Multiple gestation thus demands more iron
- Erythrocyte 2.3 DPG increase in RBC leads to decreased affinity of oxygen for maternal hemoglobin
- This increases transfer of oxygen from mother to fetus
Maternal cardiovascular changes in pregnancy

- Cardiac Ventricular wall muscle mass increases
- End-diastolic volume increases
- No increase in end systolic volume or end diastolic pressure
- Results in increased cardiac compliance: physiologically dilated heart
- Myocardial contractility increases, thus no change in cardiac EEF
Maternal cardiovascular adaptation in pregnancy

- Cardiac output (CO) increases up to 50%
- Twins have more increase in CO
- Increase in CO due to increased stroke volume and heart rate.
- 50% increase of CO by 8 weeks gestation
- Maximum increase by 32 weeks gestation
- Maternal posture affects CO
- Twin CO increase up to 60%
Cardiovascular changes in pregnancy

- Blood pressure (BP) decreases
- Decrease in peripheral vascular resistance leads to decrease in diastolic BP
- Systolic BP remains stable
- In twin pregnancy, peripheral vascular resistance decrease is more pronounced
Maternal physiologic changes in twin pregnancy: cardiac function

• Prospective study: uncomplicated pregnancies
• 20 twin gestations /10 singletons
• Echocardiogram 20-23wks, 26-30wks, 30-33wks
• Cardiac output increased (L/min)
  • 20-23 wks: 6.55 vs 5.62 (p=.007)
  • 26-29 wks: 7.31 vs 6.39 (p=.003)
  • 30-33 wks: 7.5 vs 6.68 (p=.015)
• Total vascular resistance decreased (dyness/cm5)
  • 1005 vs 1179 (p=.009), 924 vs 1070 (p=.003), 929 vs 1031 (p=.018)

• Kuleva M et al Ultrasound Obstet Gynecol 2011
Normal cardiac function in twin pregnancy

• Cross-sectional study
• 119 twin pregnancies, 10-40 weeks GA
• 2-D Echocardiography
• 128 singleton controls
• Results:
  – Maternal CO increased by >20 %
  – Stroke volume increased 15 %
  – Heart rate increased 3.5 %
  – LVED mass increased 13.5 %
  – LVEF increased 2.5 %
  – Mean arterial pressure and shortening fraction decreased 2 % first trimester, 5.8 % term
• Study demonstrates more hyperdynamic circulation in twin gestation compared to singletons.

• Kametas NA: Obstet Gynecol 2003
Maternal adaptation to pregnancy

• Renal functional changes:
  – Increased blood volume and decreased renal artery resistance
  – Increase in glomerular filtration rate
  – Resultant increase in creatinine clearance and decrease in creatinine
  – In twin pregnancy GFR and creatinine clearance increased compared to singleton
Maternal physiologic changes in pregnancy

• Renal tubular function Sodium metabolism

• Sodium excretion control:
  1. Aldosterone competitively inhibited by progesterone
  2. vasodilatory prostaglandins
  3. Atrial natriuretic factor ANF

• Sodium retention control:
  1. aldosterone production increased
  2. increase in renin angiotensin hormones
  3. estrogen stimulates renin substrate production in the liver

• RESULTANT net increase in total sodium
Physiologic benefits of decreased physical activity in the face of PIH

- Decreased renal blood flow
- Decreased angiotensin/renin stimulation
- Decreased sodium retention
- Decreased water retention
- Increased diuresis
- Decreased fluid overload
- Increased intravascular oncotic pressure
- Further decrease in angiotensin/renin stimulation
Hypertensive disease in twin pregnancy

- chronic hypertension incidence increased with advancing maternal age
- Pregnancy induced hypertension incidence increased in twin gestation
- Physiologic adaptation to twin pregnancy leads to greater risk for cardiovascular maladaptation and thus greater risk for complications
Twin gestation maternal complications
AMA 35

- 238 twin gestations
- 57 AMA 35 years old, 181 <35 years old controls
- Retrospective cohort study
- Spontaneous conception higher in controls
- No difference in GA in delivery
- No difference in PIH
- VLBW < 1500gm increased in AMA
- No other perinatal outcome differences

Prapas N et al: Arch Gynecol Obstet. 2006
Twin gestation maternal complications
AMA 40 with Donor Egg

• Retrospective review, single center
• DE twin gestation associated with significant maternal and fetal morbidity
• 42 gravidas >40 yrs old, with DE (mean age 49.2)
  – Gestational hypertension 50%
  – Gestational Diabetes 31%
  – Hospitalization 69%
• Compared to 417 twin gestations AMA >40 with autologous egg
  – GA at delivery: 35.2 vs 35.7 wks
  – Delivery prior to 34 wks: 35.7 % vs 21 %
  – Mean BW < 2500 gm: 77 % vs 60 %

Pregnancy related cardiomyopathy

- USC Keck
- Retrospective review of patients with cardiomyopathy
- 123 patients
- Mean age 31 6/7 weeks
- Mortality 9 %
- Early vs late cardiomyopathy same outcome
- Associated risk factors:
  - Gestational hypertension 47 %
  - Tocolysis 19%
  - Twins 13 %

Circulation 2005  Urin Elkayun MD
Gestational Hypertension

- Slovenia 1997-2009
- 181 twin deliveries with PIH/3885 twins
- Association with BMI and HTN
  - BMI 25-30: OR 1.8
  - BMI >30: OR 4.72
  - GDM: OR 2.19

Twin gestation maternal physiologic changes: nutritional requirements

• Accelerated depletion of nutritional reserves
• Rapid depletion of glycogen stores
• Resultant metabolism of fat between meals and overnight fast
• Overall reduced glucose availability to fetus
• Result: decreased fetal rate of growth, smaller fetal size, and associated increase in PTL/birth

• Luke B Semin Perinatol.2005
Twin gestation nutritional requirements

- BMI specific weight gain goals
- Increase in daily caloric intake
- Target weight gain 20 and 28 weeks
- Diabetic regimen:
  - 20% calories protein
  - 40% calories carbohydrate
  - 40% calories fat
  - Iron supplementation (+folate)
  - Multivitamins
  - Calcium supplementation
  - Magnesium, zinc
- Luke B: Semin Perinatol. 2005
# Estimated Nutrient Requirements

<table>
<thead>
<tr>
<th>Nutrient</th>
<th>Dietary Sources</th>
<th>Nonpregnant</th>
<th>Singleton Pregnancy</th>
<th>Twin Pregnancy</th>
<th>Triplet Pregnancy</th>
<th>Quadruplet Pregnancy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Calories</td>
<td>Proteins, fats, and carbohydrates</td>
<td>2,200 kcal</td>
<td>2,500 kcal</td>
<td>3,500 kcal</td>
<td>4,000 kcal</td>
<td>4,500 kcal</td>
</tr>
<tr>
<td>Protein (20%)</td>
<td>Meats, seafood, poultry, dairy products</td>
<td>110 g</td>
<td>126 g</td>
<td>176 g</td>
<td>200 g</td>
<td>225 g</td>
</tr>
<tr>
<td>Carbohydrate (40%)</td>
<td>Breads, cereals, pasta, dairy, fruits</td>
<td>220 g</td>
<td>248 g</td>
<td>350 g</td>
<td>400 g</td>
<td>450 g</td>
</tr>
<tr>
<td>Fat (40%)</td>
<td>Dairy products, nuts, oils</td>
<td>98g</td>
<td>112 g</td>
<td>155 g</td>
<td>178 g</td>
<td>200 g</td>
</tr>
</tbody>
</table>
Twin gestation preventive nutritional support

• Adequate caloric intake
• Increase in iron supplementation
• Adequate hydration
• Prenatal vitamins and additional folic acid
Twin gestation preventive nutritional support

• Aids in proper increase in blood volume
  – improved perfusion of the uterus, improved fetal growth
  – improved renal perfusion
  – increase in vasodilation
  – decrease in vasoactive proteins
  – decrease in hypertension

• Decrease in anemia
Maternal Health in Twin Gestation

• Adequate nutritional support
• Adequate hydration
• Adequate rest

• Monitoring
• Education
Preterm labor and maternal health

- Preterm labor incidence in twin gestation reported 30 %
- Standard of care is administration of betamethasone for pulmonary maturity and magnesium sulfate for neuro-protection
- Use of tocolytic agents to achieve steroid window
- Use of antibiotics in advanced cervical dilation or rupture of membranes
Complications of treatment of preterm labor

Pulmonary Edema

* Betamethasone increases fluid retention, negatively affects sodium excretion.
* Magnesium sulfate can affect pulmonary capillary integrity
* Tocolytic agents nifedipine increase maternal heart rate and can lead to decrease in cardiac output
  • Indomethacin interferes with renal excretion
  • Anemia promotes decrease in intravascular oncotic pressure
  • Infection increases membrane water permeability
Pulmonary Edema

PREVENTIVE MEASURES
- Limit fluids
- Monitor oxygen saturation, respiratory rate
- Low index of suspicion

PRESENTATION
- Cough
- Increased respiratory rate
- Tachycardia
- Decreased O2 saturation
- Rales

TREATMENT
- Discontinue tocolytics, magnesium sulfate, if O2 saturation falls
- Use diuretics judiciously
- Evaluate EEF by echocardiography to assess for cardiomyopathy
- Incentive spirometry, breathing treatments
Preterm Labor Treatment Risk
Cardiovascular

• Nifedipine and magnesium sulfate
• Betamimetics and arrhythmia
• Magnesium sulfate and cardiac function