Intra-partum Management of Patients with Diabetes

Kathleen M. Berkowitz, M.D.

The goal

- Term vaginal delivery of normally sized infant, bonding at bedside, with no evidence of jaundice, hypoglycemia, respiratory distress
- Breastfeeding established
- Planned simultaneous discharge home of mom/baby couplet

Achieving the goal

- Strategies to decrease early elective and cesarean delivery
- Strategies to decrease neonatal metabolic complications
- Strategies to improve breastfeeding rates
Timing of Delivery

Risk and Risk Perception in Management of the Timing of Delivery in Women with Diabetes

- Stillbirth
  - Perception: Stillbirth rates are "1% to 3%" of diabetic pregnancies...A four-fold increase compared to non-diabetic pregnancies..."
  - Reality: Stillbirth is preferable to mortality
  - Reality: Stillbirth rates are 5-7/1000, a rate comparable to the non-diabetic population
- Shoulder dystocia
  - Perception
  - Reality
- Cesarean section
  - Perception
  - Reality

Stillbirth: Perception and Reality

- Perception:
  - Stillbirth rates are "1% to 3%" of diabetic pregnancies...A four-fold increase compared to non-diabetic pregnancies..."
- Reality
  - Stillbirth rates are nearly equivalent to uncomplicated pregnancy rates in pregnancies managed with home glucose monitoring and antepartum testing
    - Class A1 DM not tested: 6/1000
    - Class A2 with testing: 5/1000
    - Non-diabetic population: 4/1000*
    - HAPO Study: 3.8/1000**

Prevention Of Stillbirth

- Antepartum testing
  - Non Stress Test
  - Biophysical Profile
  - Contraction Stress Test
- Induction of Labor
  - Prevention of stillbirth
  - Prevention of "iatrogenic prematurity"

Antepartum Monitoring Strategies

- Class A1, otherwise uncomplicated pregnancies
  - Begin twice weekly testing at 40 weeks gestation
  - Compared to uncomplicated pregnancy, stillbirth rate after term in diabetic patient is doubled.
- All other diabetic pregnancies
  - Stillbirth rates reported as high as 1-3%
  - Begin twice weekly testing at 32-34 weeks gestation
  - Modified BPP versus alternating CST/mod BPP

Primary Evaluation Of Fetal Health

- Non-Stress Test/Amniotic Fluid Index
- "Modified Biophysical Profile"
  - Combines acute indicator and chronic indicator of fetal health
  - Rapidly done, low false positive rate
  - Done twice weekly, will decrease stillbirth rates to 0.4 to 0.8 per 1000
Historical Factors And Prediction Of Shoulder Dystocia

- Presence of Diabetes
  - Increases Risk for Shoulder Dystocia 2-6 fold
  - Rate of Shoulder Dystocia Increases to 3-4%
- Presence of Macrosomia (Actual Birthweight)
  - 4000-4500 gm  1-10%
  - >4500 gm  4-20%
- Even in Diabetic Patients with Birthweights>4500 gm, Only 55% of Shoulder Dystocia Cases were Identified

The Risk of Brachial Plexus Palsy

- Prediction of cephalopelvic disproportion is very imprecise
- Incidence of brachial plexus injury is the real concern
  - 15 cases of Erb’s palsy in 14,358 births (0.1%)
  - 14 in cases of vaginal delivery (0.12%), 1 with C/S (0.004%)
  - In 7 of those cases, there was no recognizable shoulder dystocia occurring at delivery*

Prediction Of Actual Birthweight

- By Leopold’s Maneuvers
  - Underestimate birthweight by 500 gm in 50% of cases actually larger than 4000 gm*
  - Underestimates birthweight by 500 gm in 80% of cases actually larger than 4500 gm
  - Less useful in patients with excessive weight gain or pre-pregnancy weight over 90 kilos
- Use of ultrasound to predict shoulder dystocia
- Even when limiting elective cesarean delivery to women with diabetes and EFW >4500, for each permanent brachial plexus injury prevented by the 4500-g policy, you must perform 3695 cesarean deliveries in order to prevent one case of brachial plexus palsy**


**Rouse et al JAMA 13-NOV-1996; 276(18): 1480-6
What is Early Elective Delivery?

- Delivery prior to 39 weeks gestation
- Delivery without maternal or fetal medical indication
- Induction of labor under these circumstances
  - Increases cesarean section rates
  - Increases rates of NICU admission
  - Increases rates of neonatal respiratory distress
- Is diabetes a medical indication for delivery?
  - Do the benefits of early elective delivery outweigh the risks of waiting for spontaneous labor?

Why is Early Elective Delivery to Be Avoided?

- Increased risk for cesarean delivery associated with Induction
- Increased risk for neonatal metabolic complications
- Increased risk for NICU admission

Adverse Neonatal Outcomes According to Completed Week of Gestation at Delivery: Odds Ratios

Adapted from Tita AT, et al. NEJM 2009;360:111
Complications of Induction of Labor

Timing of Fetal Brain Development

- Cortex volume increases by 50% between 34 and 40 weeks gestation. (Adams Chapman, 2008)
- Brain volume increases at rate of 15 mL/week between 29 and 41 weeks gestation.
- A 5-fold increase in myelinated white matter occurs between 35-41 wks gestation.
- Frontal lobes are the last to develop, therefore the most vulnerable. (Huttenloher, 1984; Yakasuev, Lacours, 1967; Schade, 1961; Volpe, 2001).

Risks of Elective Induction of Labor

- Increased risk for Cesarean Section
  - Risk doubles with elective induction
  - Exponential increases in risk for nulliparous patients or unfavorable Bishop score
- Increased risk for neonatal admission to the NICU
  - Retained lung fluid
  - Respiratory Distress Syndrome
  - Jaundice
  - Iatrogenic Prematurity

Stillbirths Before and After Implementation of Guidelines at Intermountain Healthcare

<table>
<thead>
<tr>
<th>Weeks of Gestation</th>
<th>Stillbirths Pre-Implementation</th>
<th>Deliveries Pre-Implementation</th>
<th>%</th>
<th>Stillbirths Post-Implementation</th>
<th>Deliveries Post-Implementation</th>
<th>%</th>
<th>OR (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>37</td>
<td>17</td>
<td>627</td>
<td>2.71</td>
<td>22</td>
<td>1,037</td>
<td>2.11</td>
<td>0.41 (0.22, 0.77)</td>
</tr>
<tr>
<td>38</td>
<td>10</td>
<td>13,077</td>
<td>0.07</td>
<td>21</td>
<td>28,029</td>
<td>0.07</td>
<td>0.406 (0.22, 0.72)</td>
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<tr>
<td>39</td>
<td>10</td>
<td>13,752</td>
<td>0.07</td>
<td>20</td>
<td>51,721</td>
<td>0.04</td>
<td>0.390 (0.21, 0.72)</td>
</tr>
<tr>
<td>40</td>
<td>10</td>
<td>24,129</td>
<td>0.07</td>
<td>21</td>
<td>51,721</td>
<td>0.04</td>
<td>0.390 (0.21, 0.72)</td>
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<tr>
<td>41</td>
<td>2</td>
<td>1,938</td>
<td>0.10</td>
<td>3</td>
<td>5,571</td>
<td>0.05</td>
<td>0.522 (0.09, 3.12)</td>
</tr>
<tr>
<td>All</td>
<td>58</td>
<td>37,686</td>
<td>0.15</td>
<td>88</td>
<td>122,718</td>
<td>0.07</td>
<td>0.466 (0.33, 0.65)</td>
</tr>
</tbody>
</table>

TJC Specifications Manual for Joint Commission National Quality Core Measures (20101a); Perinatal Care Core Measure Set. 2009.

Fetal Lung Maturity Testing Before 39 Weeks and Neonatal Outcomes

Fetal Lung Maturity Testing Before 39 Weeks and Neonatal Outcomes

<table>
<thead>
<tr>
<th>Procedure/Condition</th>
<th>Pre-Implementation Prevalence (%)</th>
<th>Pre-Implementation Adjusted OR (95% CI)</th>
<th>Post-Implementation Prevalence (%)</th>
<th>Post-Implementation Adjusted OR (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Concurrent admission</td>
<td>0.9</td>
<td>2.6 (1.3-5.1)</td>
<td>0.9</td>
<td>1.0 (0.4-2.5)</td>
</tr>
<tr>
<td>Concurrent admission*</td>
<td>0.3</td>
<td>2.0 (1.3-3.2)</td>
<td>0.2</td>
<td>1.0 (0.7-1.5)</td>
</tr>
<tr>
<td>Standardized p2 to p3</td>
<td>0.7</td>
<td>2.2 (1.2-4.0)</td>
<td>0.2</td>
<td>1.0 (0.7-1.5)</td>
</tr>
<tr>
<td>Hypertensive shock</td>
<td>0.9</td>
<td>1.0 (0.5-2.0)</td>
<td>0.2</td>
<td>1.0 (0.7-1.5)</td>
</tr>
<tr>
<td>Preterm</td>
<td>0.5</td>
<td>0.04 (0.01-1.14)</td>
<td>0.0</td>
<td>1.0 (0.7-1.5)</td>
</tr>
<tr>
<td>Hypertension</td>
<td>0.3</td>
<td>0.7 (0.4-1.5)</td>
<td>0.2</td>
<td>1.0 (0.7-1.5)</td>
</tr>
<tr>
<td>Hypertension of illeg</td>
<td>0.8</td>
<td>2.2 (1.1-4.6)</td>
<td>0.2</td>
<td>1.0 (0.7-1.5)</td>
</tr>
<tr>
<td>Hypertension of illeg*</td>
<td>0.6</td>
<td>2.0 (1.1-4.0)</td>
<td>0.2</td>
<td>1.0 (0.7-1.5)</td>
</tr>
</tbody>
</table>

*Includes maternal hypertension, pre-eclampsia, eclampsia, chronic hypertension, preeclampsia, chronic hypertension

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Strategy to Decrease Early Elective Delivery

- Good third trimester glycemic control
- Awareness of inability to predict shoulder dystocia
- Adhering to ACOG guidelines concerning
  - Estimated fetal weight and cesarean section
  - Timing of delivery
  - Use of labor induction protocols
- Use of antepartum testing

What about induction of labor at 39-40 weeks gestation?

- Five studies comparing elective induction at 39-40 weeks to standard labor management for women with gestational diabetes*
- No differences in rates of
  - Shoulder dystocia
  - Stillbirth
  - Cesarean delivery
  - Neonatal hypoglycemia
  - Intra-partum complications
- 11 studies, 3751 patients**:
  - Increased cesarean section rate among women with induction
  - No differences in shoulder dystocia, stillbirth rates

**Obstet Gynecol 2002 Nov;100(5 Pt 1):997-1002

Rates of Labor Induction and Cesarean Section in Women with Diabetes

![Graph showing rates of induction and cesarean section]

Factors Influencing Cesarean Section Rates in Women with Diabetes

- Ante-partum factors
  - Use of insulin
  - Induction of labor
    - Suspicion for macrosomia
    - Occurrence of pre-eclampsia
    - Occurrence of ante-partum testing abnormalities
- Intra-partum factors
  - Labor progress abnormalities
  - Fetal heart rate assessment

Management of Labor

- What is “normal” labor progress?
- How do you decrease risk for neonatal metabolic complications?
- How do you manage maternal metabolic needs in labor?
- What steps should you take to be ready for shoulder dystocia?

Normal Labor Progress

Second stage normals (<95th percentile) P0 with epidural 3.9 hours

*Zhang et al Obstet Gynecol 2010; 115:705-710
Strategies to Prevent Neonatal Metabolic Complications

- **Fetal glucose metabolism**
  - Facilitated diffusion, with almost all fetal glucose derived from maternal glucose pool
  - Fetal levels are always about 80% of maternal levels
  - At birth, fetus is severed from maternal glucose pool and protects its brain by:
    - Increasing cerebral blood flow
    - Increasing glucagon, epinephrine, nor-epinephrine, cortisol
    - Decreasing insulin production
  - Babies born to women with poorly controlled diabetes have difficulty decreasing insulin production
  - What are the roles of third trimester glucose control and intra-partum glucose control in development of neonatal hyperglycemia?

Beta cell responsiveness to IV glucose challenge in the neonate

<table>
<thead>
<tr>
<th>Time</th>
<th>C peptide level</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>10</td>
<td>1.5</td>
</tr>
<tr>
<td>20</td>
<td>1.2</td>
</tr>
<tr>
<td>30</td>
<td>1</td>
</tr>
<tr>
<td>40</td>
<td>0.5</td>
</tr>
<tr>
<td>50</td>
<td>0</td>
</tr>
<tr>
<td>60</td>
<td>0</td>
</tr>
</tbody>
</table>

Fetal and Neonatal Hyperinsulinemia

- **Contribution of third trimester maternal glycemic control**
  - Maternal third trimester HgA1c of >6.5% is associated with a significant increase in risk for neonatal hypoglycemia (69% vs 44%)*
- **Contribution of maternal glycemic control in labor**
  - In the presence of poor maternal glycemic control, tight glucose control in labor (<100 mg/dl) decreases the risk of neonatal hypoglycemia**
- **Fetal hyperinsulinemia is episodic, usually resolving 1-2 hours after cessation of maternal hyperglycemia**
- **Maternal insulin requirements usually decrease in labor**

The Case for Watchful Waiting

- Analysis of rates of neonatal hypoglycemia with policy of non-intervention with maternal glucose levels of 72-126 mg/dl (4-7 mmols)
  - 93% of diet controlled gestational diabetics
  - 89% of insulin requiring gestational diabetics
  - 73% of pre-gestational diabetics
- 87% of the neonatal hypoglycemia occurred within this glucose range (72-126 mg/dl)
- 37.5% of maternal hyperglycemia occurred in setting of emergent delivery without labor

* Aust NZ Obstet Gynaecol 2009;49(2):162-167

Glucose Management Protocol in Labor

- IV 125 cc/hr, piggyback insulin into mainline
- Check sugars every 2 hours (goal 80-110 mg/dl)
- Check urine ketones q void
- Blood sugar parameters
  - <100 mg/dl: 0.5 units/hour in D5LR
  - 101-140 mg/dl: 1 unit/hour
  - 141-180 mg/dl: 1.5 units/hour
  - 181-220 mg/dl: 2.0 units/hour
  - >200 mg/dl: 2.5 units/hour

In Labor……...

- Avoid extremes of maternal glycemia
- Avoid dehydration
- Avoid maternal ketosis
- Avoid misdiagnosis of labor progress anomalies
- BE PREPARED FOR SHOULDER DYSTOCIA
  - Drill, drill, drill...................
- Once delivery is accomplished, on to the next goal…establishment of breastfeeding
Benefits of breastfeeding

- Bonding
- Improved immune response
- Possible impact on risk for chronic disease in later life
- Benefits same for infants of diabetic mother

Breastfeeding and the incidence of IDDM in Pima Indians

<table>
<thead>
<tr>
<th></th>
<th>Adjusted Mean Weight</th>
<th>Rates of NIDDM (age 20-29)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exclusive breastfeeding</td>
<td>140% IBW</td>
<td>8.6%</td>
</tr>
<tr>
<td>Some breastfeeding</td>
<td>139% IBW</td>
<td></td>
</tr>
<tr>
<td>Exclusive bottle-feeding</td>
<td>146% IBW (p=0.019)</td>
<td>14.7% Odds Ratio 0.41 C.I. (0.18-0.93)</td>
</tr>
</tbody>
</table>

Pettitt DJ, Forman MR, Hanson RL, Knowler WC, Bennett PH
Lancet 1997 Jul 19; 350(9072):157-8

Impact Of Breastfeeding On Body Weight And Glucose Tolerance In Children Of Diabetic Mothers

- 112 pairs (83 with Type I DM, 29 with GDM)
- Effect of either diabetic breastmilk or donor breastmilk at day 1-7, stepwise regression analysis
- Positive correlation between volume of diabetic breastmilk ingested and risk of overweight at age 2 (OR 2.47 (1.25-4.87))
- Risk of childhood IGT increased in those with early exposure to diabetic breastmilk (OR 0.19 (0.05-0.70))

Breastfeeding issues for the diabetic woman

- Rationale for breastfeeding
- Barriers to initiation of breastfeeding
- Effect of diabetes on milk content
- Safety of use of oral hypoglycemic agents during breastfeeding
  - Drug levels
  - Clinical effects on the newborn

Risks of breastfeeding for the diabetic mother and infant

- Possible increased risk for jaundice in the neonate
- Altered carbohydrate and lipid metabolism for mother
- Increased risk for hypoglycemic episodes in the mother
- Lacturia and ketonuria

Effect of diabetes on milk content

- Diabetic animals are noted to have decreased lactose, fat, protein and volume of breastmilk
- In animals, these effects are reversed by use of insulin
- Concern that higher glucose content of diabetic milk may sustain a hyperinsulinemic state in the newborn

Effect of diabetes on milk content

- Lower long chain polyunsaturated fatty acids
- Higher concentrations of beta-glucuronidase (suggesting increased risk for jaundice in the breastfed newborn)
- Under conditions of tight glycemic control with insulin
  - No difference in glucose concentrations compared to non-diabetic controls (HgA1c <8.0%)*
  - No differences in triglycerides, protein, lactose, cholesterol, glucose or myoinositol levels (HgA1c <6.0%)**

*Exp Clin Endocrinol 1988 Sep; 92(1):32-6
**Am J Clin Nutr 1993 Jun;57(6):938-43

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Excretion of metformin in breast milk

<table>
<thead>
<tr>
<th></th>
<th>Serum Peak</th>
<th>Serum Trough</th>
<th>Milk Peak</th>
<th>Milk Trough</th>
<th>Infant glucose</th>
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</thead>
<tbody>
<tr>
<td>SV</td>
<td>0.67</td>
<td>0.27</td>
<td>0.13</td>
<td>Not detected</td>
<td>47 mg/dl</td>
</tr>
<tr>
<td>VC</td>
<td>1.9</td>
<td>0.51</td>
<td>0.46</td>
<td>0.39</td>
<td>52 mg/dl</td>
</tr>
<tr>
<td>SG</td>
<td>0.68</td>
<td>0.26</td>
<td>0.41</td>
<td>0.52</td>
<td>55 mg/dl</td>
</tr>
<tr>
<td>IG</td>
<td>0.78</td>
<td>0.47</td>
<td>0.42</td>
<td>0.34</td>
<td>59 mg/dl</td>
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Excretion of glipizide in breast milk

<table>
<thead>
<tr>
<th></th>
<th>Serum Peak</th>
<th>Serum Trough</th>
<th>Milk Peak</th>
<th>Milk Trough</th>
<th>Infant glucose</th>
</tr>
</thead>
<tbody>
<tr>
<td>CL</td>
<td>0.2</td>
<td>Not detected</td>
<td>Not detected</td>
<td>Not detected</td>
<td>61 mg/dl</td>
</tr>
<tr>
<td>ES</td>
<td>Not detected</td>
<td>Not detected</td>
<td>Not detected</td>
<td>Not detected</td>
<td>73 mg/dl</td>
</tr>
<tr>
<td>LL</td>
<td>Not detected</td>
<td>Not detected</td>
<td>Not detected</td>
<td>Not detected</td>
<td>62 mg/dl</td>
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Excretion of glyburide in breast milk

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<th>Serum Peak</th>
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<th>Milk Peak</th>
<th>Milk Trough</th>
<th>Infant glucose</th>
</tr>
</thead>
<tbody>
<tr>
<td>DG</td>
<td>Not detected</td>
<td>Not detected</td>
<td>Not detected</td>
<td>Not detected</td>
<td>Not done</td>
</tr>
</tbody>
</table>

INTERIM STUDY COMMENTS

- Significant barriers to establishment of breastfeeding
  - Overall rate of exclusive breastfeeding at LBMMC at discharge is over 75%
  - Among diabetic women wishing oral medication and exclusive breastfeeding rate was 60%
- No clinically significant events of neonatal hypoglycemia noted to date
- Metformin has highest observed milk to plasma ratio and, on average, lower infant blood glucose levels

Issues to address prior to widespread use of oral hypoglycemic agents in breastfeeding women with diabetes

- Do the agents cross over or concentrate in breastmilk?
- Are there clinically evident adverse events noted in the newborn?
  - Short term: hypoglycemia, jaundice
  - Long term: risk for IGT or DM
- Do these agents alter breastmilk content?
Excretion of oral hypoglycemic agents in breast milk

- Drugs: Metformin, glipizide, glyburide
- Current metformin data
  - Appears to have clinically insignificant excretion into breastmilk
- Current glipizide data: None
  - Less placental transfer than tolbutamide (6.6% versus 21%)
- Current glyburide data: None

Initiation of breastfeeding in women with diabetes

<table>
<thead>
<tr>
<th></th>
<th>Diabetes (n=19)</th>
<th>Control (n=18)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Breastfeeding at discharge</td>
<td>78%</td>
<td>63%</td>
</tr>
<tr>
<td>Breastfeeding at 8 weeks</td>
<td>58%</td>
<td>56%</td>
</tr>
<tr>
<td>Breastfeeding at 3 months</td>
<td>47%</td>
<td>33%</td>
</tr>
</tbody>
</table>


Mixed Feedings Send Mixed Messages

Some moms either by choice, misconceptions regarding milk supply, or by suggestion of physicians, nurses or family members start to initiate 'mixed feedings' (breastfeeding and formula). In the vast majority of these cases formula is not medically necessary.

Item 4 in the AAP Recommendations on Breastfeeding for the Healthy Newborn state:
'Supplements (water, glucose water, formula, and other fluids) should not be given to breastfeeding newborn infants unless ordered by a physician when a medical indication exists.'
Mixed Feedings Send Mixed Messages
Why Not Offer Mixed Feedings?

- Decreases suckling time at the breast which decreases the stimulation at breast.
- Decreases the amount of breast milk that baby takes in.
- Decreased stimulation at the breast leads to decrease milk supply. There has to be a demand at the breast in order for the breast to make the supply.
- Mixed feeding suggests that the mom will not make enough milk for her baby.
- How we educate or make suggestions regarding milk supply greatly impacts mom’s perception of her ability to make milk.

Mixed Messages Send Mixed Messages

- Are all health care providers providing the same information to our patients?
  - Pediatrician
  - Obstetrician/Nurse Midwife
  - Nurse
  - Well meaning family
- Issues of Medications
  - Advice from ACOG, AAP, AAFP is minimal or non-existent
  - Special issues due to medical challenges

The Family and the Culture

- Variations on “La Cuarentena”
- Most traditional cultures support a period of “apartness”
  - Friends and family support mom, perform chores
  - Limited maternal and neonatal contact with outside world
  - Maximal maternal/baby contact facilitates breastfeeding

A Multi-cultural Perspective of Breastfeeding in Canada, Agnew, Gilmore and Sullivan
Asian/East Asian Practices

- First 28-30 days a woman is vulnerable to wind, cold and magic
- Stay at home, in bed, avoid baths, be pampered
- Avoid “cold” foods
  - Veggies, alcohol
  - Fatty or deep fried foods

Indian Cultural Practices

- First 40 days are spent with maternal grandmother, baby and mom are to be protected from “the evil eye”
- Tight swaddling
- Avoid spicy, heavy foods
  - Neonatal diarrhea
- Encourage maternal milk intake

Latina Cultural Practices

- Grandmothers know best; your doctor is not your grandmother
- 40 days of rest and protection
  - Avoid bathing and sexual intercourse
  - Cover the feet, avoid cold
- Avoid acid or cold foods
- Baby should not be too warm “enlechado"
- “Leche agitada”
Russian/East European Cultures

- 7-14 days in hospital postpartum
- Babies kept in nursery, brought “en masse” to postpartum moms
- Need to swab nipples with antiseptic before and after breastfeeding
- Tight swaddling, early introduction of solid food

Strategies to Improve Breastfeeding Rates

- Don’t separate the dyad!!!!!!!
- Use “Baby Friendly” and “Breastfeeding Friendly” techniques and integrate them into existing protocols for surveillance for neonatal hypoglycemia
- Train all providers to deliver the same message
- Be aware of the effect of cultural practices on breastfeeding performance

Strategies to Initiate Breastfeeding in the Infant of the Diabetic Mother

- Routine supplementation of healthy, term infants with water, glucose water, or formula is unnecessary and may interfere with establishing normal breastfeeding and normal metabolic compensatory mechanisms (Hawdon, Ward Platt, & Rynsdale-Green, 1990; Svenne et al., 1994; Gartner et al., 2005; National Childbirth Trust, 1997).
- Healthy term infants should initiate breastfeeding within 30 to 60 minutes of life and continue on demand, recognizing that crying is a very late sign of hunger (Gartner et al., 2005; WHO/UNICEF, 1989). Early breastfeeding is not precluded just because the infant meets the criteria for glucose monitoring.
- Initiation and establishment of breastfeeding is facilitated by skin-to-skin contact of mother and infant. Such practices will maintain normal infant body temperature and reduce energy expenditure (thus enabling maintenance of normal blood glucose) while stimulating suckling and milk production (Durand et al., 1997; Gartner et al., 2005).
- Feedings should be frequent, 10 to 12 times per 24 hours in the first few days after birth. (Gartner et al., 2005).

Strategies to Initiate Breastfeeding in the Infant of the Diabetic Mother

- At-risk infants should be screened for hypoglycemia with a frequency and duration related to the specific risk factors of the individual infant (Eidelman, 2001). It is suggested that monitoring begin within 30 to 60 minutes for infants with suspected hyperinsulinemia, and no later than 2 hours of age for infants in other risk categories.
- Monitoring should continue, until normal, preprandial levels are consistently obtained.
- Bedside glucose screening tests must be confirmed by formal laboratory testing.


Strategies to Initiate Breastfeeding in the Infant of the Diabetic Mother (BS>40 mg/dl)

- Continue breastfeeding (approximately every 1 to 2 hours) or feed 3 to 5 mL/kg (up to 10 mL/kg) (Williams, 1997) of expressed breast milk or substitute nutrition (pasteurized donor human milk, elemental formulas, partially hydrolyzed formulas, routine formulas).
- Recheck blood glucose concentration before subsequent feedings until the value is acceptable and stable.
- If the neonate is unable to suck or feedings are not tolerated, avoid forced feedings (e.g., nasogastric tube) and begin intravenous (IV) therapy (see the following). Such an infant is not normal and requires a careful examination and evaluation in addition to more intensive therapy.
- If glucose remains low despite feedings, begin IV glucose therapy and adjust intravenous rate by blood glucose concentration.
- Breastfeeding may continue during IV glucose therapy when the infant is interested and will suckle. Wean IV glucose as serum glucose normalizes and feedings increase.
- Carefully document signs, physical examination, screening values, laboratory confirmation, treatment and changes in clinical condition (i.e., response to treatment).

Strategies to Initiate Breastfeeding in the Infant of the Diabetic Mother (BS<25 mg/dl)

- Initiate intravenous 10% glucose solution.
- Do not rely on oral or intragastric feeding to correct extreme or symptomatic hypoglycemia. Such an infant is not normal, and requires an immediate and careful examination and evaluation in addition to IV glucose therapy.
- The glucose concentration in symptomatic infants should be maintained >45 mg/dL (>2.5 mmol/L).
- Adjust intravenous rate by blood glucose concentration.
- Encourage frequent breastfeeding after the relief of symptoms.
- Monitor glucose concentrations before feedings as the IV is weaned, until values are stabilized off intravenous fluids.
- Carefully document signs, physical examination, screening values, laboratory confirmation, treatment, and changes in clinical condition (i.e., response to treatment).
The goal……

- Term vaginal delivery of normally sized infant, bonding at bedside, with no evidence of jaundice, hypoglycemia, respiratory distress
- Breastfeeding established
- Planned simultaneous discharge home of mom/baby couplet
- ACHIEVED!!!!