Neonatal Hypoglycemia

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Postnatal Glucose Homeostasis in Late-Preterm and Term Infants

Committee on Fetus and Newborn

Pediatrics 2011;127;575; originally published online February 28, 2011;
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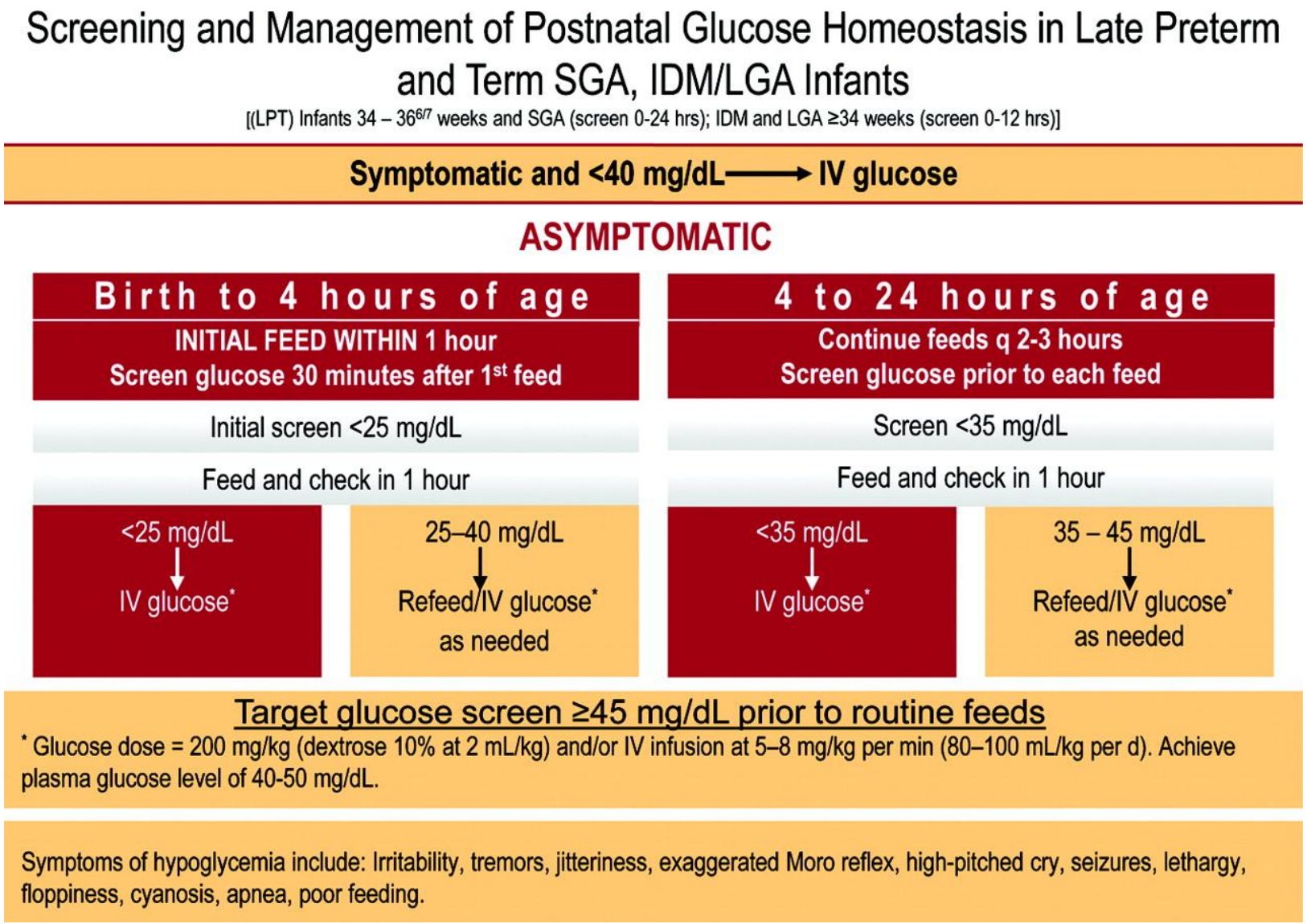
What the AAP tells us…

- A practical guide for the screening and management of neonatal hypoglycemia.
- No recommendations of a specific concentration of “normal” glucose.
- Does not state a level that can potentially result in acute or chronic irreversible neurologic damage.
- Early identification of the at-risk infant and institution of prophylactic measures to prevent neonatal hypoglycemia are recommended as a pragmatic approach despite the absence of a consistent definition of hypoglycemia in the literature.

Screening for and management of postnatal glucose homeostasis in late-preterm (LPT 34–36 6/7 weeks) and term small-for-gestational age (SGA) infants and infants who were born to mothers with diabetes (IDM)/large-for-gestational age (LGA) infants.



Committee on Fetus and Newborn Pediatrics 2011;127:575-579

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Infants of Diabetic Mothers

Guidelines for Practice & Areas for Research

- What we know
  - Increased risk for hypoglycemia
  - May have hypoglycemia but be symptom free
    - Frequent determination of blood glucose level is necessary
- What we don't know
  - Which infants will actually develop hypoglycemia
  - Which infants will need IV therapy
  - Best place to admit these infants
    - Different protocols in different hospitals

Infants of Diabetic Mothers:
Admit Location

- *Previously at SMH (and Highland Hospital)…*

Maternal History

Diet Controlled Diabetes
(Class A1)

→ Infant → **NBN or Birth Center**

Maternal History

Medication Dependent Diabetes
(Class A2 +)

→ Infant → **NICU**

Infants of Diabetic Mothers
Implications of the Previous Protocol

- Infants are separated from their mothers and families
  - Impacts breastfeeding initiatives*
    - May interfere with initiation of breastfeeding within 1 hour of birth
    - Delays rooming-in 24 hours a day
    - Makes breastfeeding on demand a challenge
  - Impacts mother-infant bonding

* Steps 4,7,and 8 of Ten Steps To Successful Breastfeeding, *The Academy of Breastfeeding Medicine*, Protocol # 7. www.bfmed.org.

Infants of Diabetic Mothers

Research at Strong and Highland Hospitals

Background

- Research at Strong by **Haidar-Ahmad** (Jan 2003-June 2005)
  - Retrospective chart review
    - 127 asymptomatic infants of medication dependent diabetic mothers (GA≥35weeks)
  - 4 risk factors associated with increased likelihood of needing IV dextrose
  - Risk score was developed using all 4 risk factors
    - As risk score increased from a total score of 0 to score of 4, there was significantly increased risk of needing IV dextrose

Hypoglycemia Risk Score

Score Components	0 points	1 point	2 points
Maternal pre-delivery BG**	< 120 mg/dL	≥ 120 mg/dL	N/A
Maternal age	< 35 y	≥ 35 y	N/A
Neonatal weight for age	AGA	SGA, LGA	N/A
Neonatal BG	40-120 mg/dL	N/A	< 40 mg/dL or ≥ 120 mg/dL

N/A = not applicable

Infants of Diabetic Mothers

Research at Strong and Highland Hospitals

Background

- Research at Highland by **Scheurer** (Feb 2008-July 2008)
  - Hypothesis
    - The risk score developed by Haidar-Ahmad can be used in the delivery room to predict need for intravenous glucose in asymptomatic infants of **medication dependent diabetic mothers**.
  - Retrospective chart review
    - 78 asymptomatic infants of medication dependent diabetic mothers (≥35 weeks)
  - Results
    - Verified that the risk score performs similarly in a separate population of infants
    - Total risk score of 0-1 has a NPV = 0.98
      - » It is 98 percent likely that the infant with a score of 0 or 1 will not require IV dextrose for hypoglycemia

Score Performance

Total Risk Score	No IV Dextrose	IV Dextrose	Total
Score 0 or 1 (to NBN/BC)	67	1 (1.5%)	68
Score ≥ 2 (to NICU/SCN)	6	4 (40%)	10
Total *P* = 0.001 Fisher's exact	73	5	78

If we use score = 0 or 1 to triage to the NBN/BC

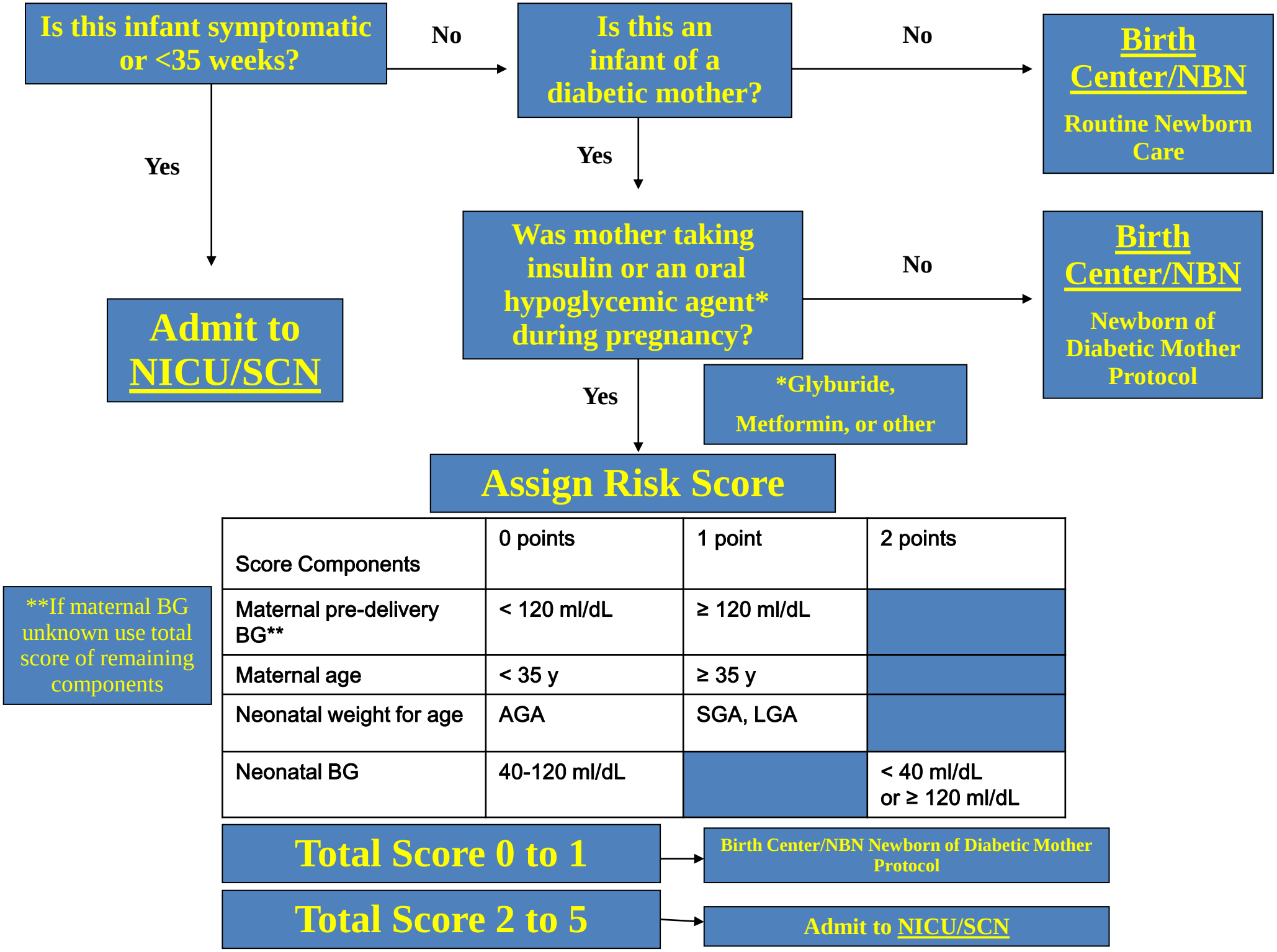
PPV = 0.40 Sensitivity = 0.80

NPV = 0.98 Specificity = 0.92

(NPV: likelihood that a negative test (score 0 or 1) indicates infant will not develop hypoglycemia that requires IV dextrose.)

Risk Score Validation Summary

- Total risk score of 0 or 1 to triage to birth center/newborn nursery
  - 1.5% of babies that go to BC/NBN end up needing IV dextrose
  - 40% of babies that go to NICU end up needing IV dextrose
  - *p-value* = 0.001 (Fisher's exact)


Is this infant symptomatic or <35 weeks?
No
Is this an infant of a diabetic mother?
No
Birth Center/NBN
Routine Newborn Care
Yes
Yes
Admit to NICU/SCN
Was mother taking insulin or an oral hypoglycemic agent* during pregnancy?
No
Birth Center/NBN
Newborn of Diabetic Mother Protocol
Yes
*Glyburide, Metformin, or other
Assign Risk Score
**If maternal BG unknown use total score of remaining components
Score Components
0 points
1 point
2 points
Maternal pre-delivery BG**
< 120 ml/dL
≥ 120 ml/dL
Maternal age
< 35 y
≥ 35 y
Neonatal weight for age
AGA
SGA, LGA
Neonatal BG
40-120 ml/dL
< 40 ml/dL or ≥ 120 ml/dL
Total Score 0 to 1
Birth Center/NBN Newborn of Diabetic Mother Protocol
Total Score 2 to 5
Admit to NICU/SCN

Newborn of Diabetic Mother Protocol
(Low Risk, Score ≤ 1)

Well appearing babies with risk scores ≤ 1 will stay on BC/NBN and the following BG monitoring schedule must be followed.

- BG 30 minutes after NICU team's BG & establish feeding as soon as possible
- Then BG every 30 minutes until greater than 40mg/dl and stable (at least X 2)
- Then before feeds until greater than 40 mg/dl and stable (at least X 2)

Refer to hypoglycemia protocol if BG less than 40 mg/dL

- Feedings every 3 hours X 24 hours (BG after 4 hours if no po) then evaluate the need to continue with this frequency as per history and assessments.
- Maintain axillary temperature in normothermic range (36.5-37.4 C)
- VS and assessment per routine

Questions?

Thank you!

MANAGEMENT OF HYPOGLYCEMIA

1. Infants at high risk for hypoglycemia should be monitored. Risk factors for hypoglycemia include: IDM, SGA, LGA, polycythemia, asphyxia, sepsis, and maternal beta-sympathomimetics.

2. If BG Chem Strip is <40 mg, initiate feedings as soon as possible or begin IVF if infant not able to feed.

3. If BG Chem Strip falls between 25 mg/dl and 40 mg/dl before first feedings:

   (a) Treat with formula or 10-15 cc D5W p.o. or gavage.

   (b) Check BG Chem Strip 10-15 minutes later.

   (c) If BG Chem Strip >40 mg/dl, continue formula p.o. or gavage feedings.

   (d) If BG Chem Strip still between 25 mg/dl and 40mg/dl, or feedings not tolerated, start glucose by peripheral IV at 4 mg/kg/min at maintenance fluid rate (see chart).

   (e) Begin to taper IV glucose after 8-10 hours if BG Chem Strip is stable and feedings are well tolerated.

4. If patient is symptomatic (i.e. lethargy, limpness, tremors, apnea, cyanosis, seizures):

(a) Obtain blood to be drawn for whatever tests are indicated (e.g. serum glucose, insulin).

(b) D10W 2 ml/kg (200mg/kg) over 5-10 minutes.

(c) Glucose 6mg/kg/min at maintenance IVF rate (8-10 mg/kg/min of glucose may be required in some cases).

(d) Check BG Chem Strips at 30 min., increase IV glucose as necessary to maintain BG Chem Strip >40 mg/dl.

(e) May begin tapering IVF after 6-8 hours if patient tolerating feeding and BG Chem Strips are stable.

APPROX. GLUCOSE	**FLUID (cc/kg/day)**		
(mg/kg/min)	D5W	D10W	D15W
4	120	60	40
6	180	90	60
8	240	120	80
10		150	100
12		180	120

5. Other treatments may be indicated in certain circumstances (consult Fellow or Attending).

(a) Glucagon 300 ug/kg (0.3 mg/kg) IM may be given to infants with good glycogen stores to mobilize glucose (Max 1.0mg) Follow with IVF.

(b) Hydrocortisone is given at a dose of 5 mg/kg/day either by IV or orally every 12 hours or Prednisone may be given at a dose of 2mg/kg/day orally.

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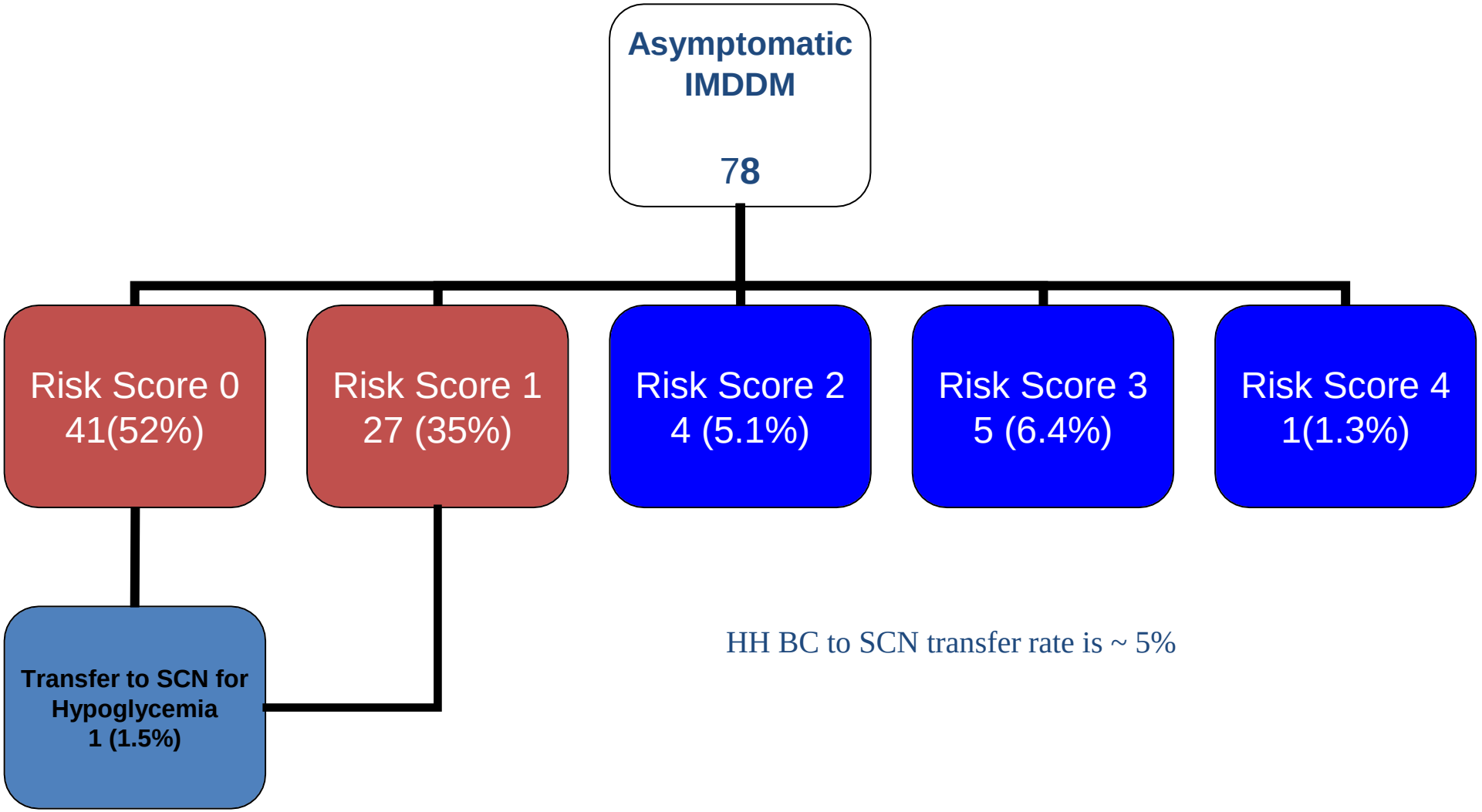
10		150	100
12		180	120

Infants of Diabetic Mothers
Implications of the Previous Protocol

- AAP News August 2008
  - "Many US maternity centers engage in practices that interfere with breastfeeding"
    - CDC in 2007
      - Maternity Practices in Infant Nutrition and Care Survey
      - 2,546 hospitals and 121 birth centers
      - All 50 states including District of Columbia & Puerto Rico
      - Score 0 to 100 for overall breastfeeding support
      - Average score = 63 (New York = 67)
      - Conclusion:
        - » "Facilities should consider changing maternity practices to provide more breastfeeding support"

Centers for Disease Control and Prevention. MMWR.2008;57: 621-625

Score Performance



HH BC to SCN transfer rate is ~ 5%

NBN/BIRTH CENTER vs. NICU/SCN