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Best Practice

Evidence based information sheets for health professionals

Management of asymptomatic hypoglycaemia in healthy term neonates for nurses and midwives

Recommendations

The recommendations from the 1997 World Health Organisation review are supported by the findings of the systematic review, in particular:

- Early and exclusive breastfeeding is safe to meet the nutritional needs of healthy term newborns worldwide. Healthy term newborns do not develop "symptomatic" hypoglycaemia as a result of simple underfeeding **(Grade A)**
- Healthy term newborns that are breast-fed on demand need not have their blood glucose routinely checked and need no supplementary foods or fluids **(Grade A)**
- Thermal protection (the maintenance of normal body temperature) in addition to breastfeeding is necessary to prevent hypoglycaemia **(Grade A)**

Additional recommendations

- If there are any concerns that the term newborn is becoming hypoglycaemic the infant should be given another breastfeed **(Grade A)**
- Given the importance of thermoregulation, skin to skin contact should be promoted and "kangaroo care" encouraged in the first 24 hours after birth **(Grade A)**
- Whilst it is important to maintain the newborn's body temperature, care should be taken to ensure that the infant does not become overheated **(Grade B)**

Information Source

This *Best Practice* information sheet has been derived from a systematic review[1] which extends a 1997 review by the World Health Organisation.[2] Information on the studies included in these reviews can be found in the source documents. The systematic review report is available from the Joanna Briggs Institute **www.joannabriggs.edu.au**

Background

Neonatal hypoglycaemia is not in itself a medical condition, but can be an indication of underlying illness or a failure to adapt physiologically to the outside world at birth. Hypoglycaemia can lead to death if it is not recognised, and long term neurodevelopmental outcomes are still not clear. It is almost 70 years since hypoglycaemia was first recognised in newborn and older infants but controversy still surrounds its significance, definition and management. The availability of point-of-care and micro-sampling techniques to detect "low" blood glucose levels and an increasingly litigious society have resulted in a definition for hypoglycaemia that is considerably higher than that proposed by Hartmann and Jaudon in 1937.[3] Concern that hypoglycaemia without any associated clinical signs (asymptomatic) might result in poor neurodevelopmental outcomes has resulted in a definition of hypoglycaemia as a blood glucose concentration more than two standard deviations below the mean for populations of both healthy term and low birth weight infants.

Grades of Recommendation

These Grades of Recommendation have been based upon the JBI developed *Grades of Effectiveness* [4]

Grade A	Effectiveness established to a degree that merits application
Grade B	Effectiveness established to a degree that suggests application
Grade C	Effectiveness established to a degree that warrants consideration of applying the findings
Grade D	Effectiveness established to a limited degree
Grade E	Effectiveness not established

Definitions

For the purposes of this information sheet the following definitions were used:

hypoglycaemia - the definition of 'normal' blood glucose levels remains controversial and may depend more on individual norms and maternal feeding practices than 'abnormal' values. Blood glucose levels cover a broad range in the first few days of life with levels in the first 24 hours being lower

kangaroo care - comprises three main components: skin to skin contact, exclusive breastfeeding and support to keep mother and infant physically together

Moro's reflex - startle reflex or response, parachute reflex

Whipple's Triad - satisfaction of three criteria considered key to diagnosing an infant with hypoglycaemia: 1. the presence of characteristic clinical signs; 2. coincident with low plasma glucose concentrations measured accurately with sensitive and precise methods; 3. resolution of clinical signs within minutes to hours once euglycaemia has been re-established

euglycaemia - normal blood glucose level

Concern has been expressed that setting an unnecessarily high blood glucose level may lead to the administration of intravenous glucose to otherwise healthy newborn infants in the neonatal intensive care unit (NICU), causing unnecessary pain to the neonate, emotional trauma to parents, increased cost to the hospital, and separation of the newborn infant at a crucial time in the breastfeeding and bonding process.

Signs of hypoglycaemia

The clinical signs of neonatal hypoglycaemia are non-specific and are associated with other disorders common in the neonate. These include abnormal or high-pitched cry, hypothermia, poor temperature control, sweating, poor suck or refusal to feed, tremors, exaggerated Moro's reflex, irritability, lethargy, hypotonia, seizures, cyanosis, pallor, tachypnoea, apnoea, abnormal eye movements, tachycardia, congestive heart failure and respiratory distress. Satisfaction of three criteria (Whipple's Triad) is still considered key to diagnosing an infant with hypoglycaemia. Application of Whipple's criteria to neonates is problematical in that they may remain asymptomatic even at extremely low blood glucose concentrations.

Objectives

The purpose of this *Best Practice* Information Sheet is to provide an overview on management of asymptomatic hypoglycaemia in the healthy term neonate, based on the findings of the two reviews.

Types of Intervention

The systematic review focused on studies that included healthy term (37-42 weeks gestation) appropriate size for gestational age (AGA) neonates in the first 72 hours following birth and provided information on three categories of intervention - type of feeds, timing of feeds and thermoregulation on prevention of hypoglycaemia, and re-establishment/ maintenance of blood or plasma glucose levels above the set threshold (as determined by the particular study). There was a lack of evidence on the effectiveness of monitoring or developmental outcomes, and insufficient evidence for breastfeeding success.

Quality of the research

The authors of the systematic review reported that improved study methodology and standardised reporting of results would assist in the interpretation of research data.[1] Three studies were excluded from this review because of inadequate data reporting or poor study methodology. In addition, the quality assessment of some of the studies was affected by a failure to report the randomisation method used.

Effectiveness of type of feeds in preventing hypoglycaemia

Three studies investigated exclusive breastfeeding, one investigated breastfeeding versus formula feeding and one study investigated the effect of breastfeeding versus breastfeeding supplemented with glucose water. Studies that investigated the effect of demand breastfeeding on blood glucose levels found that exclusively breast-fed infants have an adequate glucose supply in the first 24 hours of life, with the mothers producing sufficient colostrum, since this was the only external source of glucose supply.

Despite a mean increase in glucose levels in the formula-fed newborns compared with a mean decrease in glucose levels in the breast-fed newborns over the two-hour study period, both groups in the breastfeeding versus formula feeding study maintained mean blood glucose levels that were within the normal range.

The study that investigated the practice of administering glucose water in the first days after birth found significantly lower mean serum glucose levels in the exclusively breast-fed infants at 12 hours after birth than in the breast-fed infants who received 5% glucose water supplements *ad libitum*. At 24 and 48 hours these differences were insignificant. There was some evidence that in the longer term the practice of glucose water supplementation shortens the duration of breastfeeding, possibly as a result of insufficient milk production.

Table 1: Categories of infant who may be at risk of hypoglycaemia

Newborns > 4 kg or < 2 kg

Infants born before 37 completed weeks of gestation

Small for gestational age (SGA) < 10th percentile for weight

Large for gestational age (LGA) > 90% percentile for weight

Intrauterine Growth Restricted (IUGR) infants

Infants of mothers who are diabetic or who have gestational diabetes

Newborns suspected of sepsis

Newborns with symptoms suggestive of hypoglycaemia, such as tachypnoea, hypotonia, seizures, lethargy, temperature instability, apnoea, poor suck or refusal to feed, etc

Effectiveness of type of feeds on re-establishing and maintaining blood glucose levels

Three studies investigated breastfeeding on demand and one study investigated the effect of breastfeeding versus breastfeeding supplemented with glucose water. The infants in the three breastfeeding on demand studies were all able to re-establish and maintain normal blood glucose levels through breastfeeding alone. From six hours post delivery breast-fed infants with asymptomatic hypoglycaemia achieved normal blood glucose levels and were able to maintain these levels at 24 and 48 hours. All of the breast-fed infants with asymptomatic hypoglycaemia in one study attained normal blood glucose levels after an additional feed. Individual infants did not show significant differences in plasma glucose levels at different assessment time points.

In the first 24 hours after birth lower serum glucose levels were found in the exclusively breast-fed infants than in the infants that received glucose water supplementation, but these differences were not significant by 48 hours post partum.

Effectiveness of timing of feeds in preventing hypoglycaemia

Four studies investigated the effect of timing and initiation of feeding on the incidence of hypoglycaemia. One study found that that there was no correlation between the timing of the first feed and blood glucose levels at one hour after birth. Another study found that that the interval between feeds was not a major determinant of plasma glucose levels, and that plasma glucose levels in infants who were unfed for the first six hours of life maintained comparable plasma glucose levels to infants of multiparous mothers sampled within 30 minutes of breastfeeding.

The author of one of the two studies that investigated the effect of feeding initiation within the first hour after birth suggests that early initiation of breastfeeding might explain why a much lower incidence of hypoglycaemia was found in this study in comparison to the higher incidence found in previously published studies. The fact that sampling took place after a feed, rather than before a feed, may also explain this difference.

The authors of these studies conclude that prelacteal feeds are not necessary to supplement breastfeeding while lactation in primiparous mothers is being established. Breastfeeding, when initiated early and associated with frequent sucking provides adequate plasma glucose for the neonate in the first 48 hours of life, with no need for supplemental feeds or water in a healthy neonate.

Effectiveness of thermoregulation in preventing hypoglycaemia

Two studies found that newborn infants placed skin-to-skin in their mother's arms immediately after birth were able to maintain higher body temperatures. In addition one study found that these infants also had the slowest heart and respiratory rates, and the highest blood glucose levels, suggesting that skin-to-skin contact is optimal for adaptation after birth, helping to maintain body temperature and safe blood glucose levels in the healthy term newborn infant.

Implications for practice

The problem of defining "normal" values for plasma glucose is discussed in all of these studies. An author of one of the studies suggests that each infant has its own distinctive levels of plasma glucose, influenced by individual patterns of metabolic adaptation. In this study infants who had "low" plasma glucose levels at 3 hours of life were found to have "low" (defined as < 2.6 mmol/L) plasma glucose levels at 72 hours of life.

The overall incidence of hypoglycaemia in the newborn has been estimated at between 1 and 5 per 1,000 live births, but may be as high as 30% in "high risk" groups of infants. Current expert opinion takes the view that glucose screening should be reserved for infants who may be at risk (Table 1) since hypoglycaemia in the normal healthy neonate is normally a transient condition that resolves itself without need for intervention. Blood glucose should not be measured too soon after birth when all newborn infants are likely to have low blood glucose.

There is no evidence that low blood glucose levels among healthy breast-fed term infants who are feeding well are detrimental to outcome. Further assessment is warranted if the condition recurs or persists beyond 48 hours and is not resolved by additional feeds, as this suggests that a metabolic or endocrine disorder may be involved.

Healthy full-term infants born after a normal pregnancy and delivery and who do not display clinical signs of hypoglycaemia do not require screening and monitoring for hypoglycaemia. Routine screening/monitoring of blood glucose levels in normal term infants is only warranted if there are obvious clinical signs (symptomatic hypoglycaemia).

In one study 80% of the cases where infants were found to have serum glucose levels < 2.2 mmol/L in the first 24 hours were also associated with temperatures over 37.7ºC. Newborn infants cool down or heat up much quicker than adults because they are less able to regulate their body temperature, with small for gestational age (SGA) and preterm neonates at greatest risk. In general, newborns need a warmer environment than adults to maintain a body temperature above 36.5°C (97.7°F).

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