POCKET: Feasibility Of The Use Of Point Of Care Technology To Measure Ketone And Lactate Levels In The Newborn At Risk From Hypoglycaemia

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Reducing Term admissions to Neonatal Units

The NHS has made it a priority to reduce the admission of full term babies (those at 37 weeks gestation and over) to neonatal units.
Term admissions to NICU: Top 5 Reasons

Term infants receiving at least 1 day of Neonatal Unit care by admission year
01 January 2011 to 31 December 2013

- Respiratory disease
- Infection
- Hypoglycaemia
- Jaundice
- Asphyxia

Hypoglycaemia

- The definition of hypoglycaemia is controversial
  - Definition: < 2.6mmol/L (45mg/dL)
  - Common during the first week of life
- Identification of infants “at risk” of hypoglycaemia may prevent the unnecessary separation of infants from their mothers, and subsequently reduce the associated costs of admissions to the neonatal unit.
Infants at risk

• “At risk” infants undergo routine glucose monitoring after birth
  
  • Infants with hyperinsulinism
  
  • Infants with infection or inborn errors of metabolism
  
  • Maternal drug treatment: terbutaline, beta-blockers, oral hypoglycaemic agents
  
  • IUGR
  
  • Preterm
Infants at risk

- Those at risk due to impaired counterregulation (gluconeogenesis, glycogenolysis, and ketogenesis) can be challenging to identify.

- Healthy term infants compensate by increasing cerebral blood flow and use of alternative fuels, ketone bodies, thus providing glucose-sparing fuel to the brain and protecting neurological function.
Aims & Hypothesis

• Point of care testing of ketones and lactate would help to provide further guidance on management of babies at risk from hypoglycaemia

• To validate the accuracy of the Nova Biomedical point of care ketone meter and lactate meter in new born babies considered at risk from hypoglycaemia.
Methods

• Prospective validation study at the Rosie Hospital, Cambridge

• Initial recruitment between (May 2014 - 31st March 2016)
  • Sample size of n = 50

• Further recruitment (July 2016)
  • Sample size of n = 10

• Informed consent obtained for all infants recruited
Method

- **Inclusions** - clinically well infants having routine blood glucose monitoring:
  - Any maternal diabetes
  - Maternal antihypertensives
  - Small or large for gestational age
  - <37 weeks completed gestation at birth
  - Sepsis

Image ref: https://stratog.rcog.org.uk/tutorial/fetal-growth-restriction
Method

- Nova StatStrip point of care (POC) meters used to obtain measures pre-feed:
  - Glucose, Ketone & Lactate (whole blood measures)
- Paired laboratory samples obtained (immediately centrifuged, separated and serum frozen at -20C until batch analysis by Gold Standard: Siemens Dimension analyser):
  - Ketone & Lactate
Method

- Additional measures/parameters recorded
  - Capillary blood gas
  - Birth weight and OFC
- Feeding
  - Method
  - Estimated volume/time fed
  - Time of last feed
Demographics: reason for recruitment

Other: Maternal labetalol, neonatal sepsis, prematurity, hypoglycaemia
Glucose Measures
Glucose Measures

- All infants clinically well and asymptomatic for hypoglycaemia
- 59 point of care measures:
  - Mean (SD) 2.91 (0.92) mmol/l
  - N = 20 ≤ 2.6mmol/l
- 44 point of care measures paired with laboratory samples
- 14 paired samples obtained when point of care measure ≤ 2.6mmol/l
Ketone Measures

Correlation value = -0.097

P = 0.548
Lactate Measures

Correlation value = 0.700

P = 0.000
Lactate Measures

Mean difference = 0.546

P = 0.002
Hypoglycaemia & Ketone Measures

![Graph showing POC Glucose Measure (mmol/L) vs Laboratory Ketone (mmol/L) with data points and a red dashed line indicating a threshold.]
Hypoglycaemia & Lactate Measures

![Scatter plot showing the relationship between POC Lactate (mmol/L) and POC Blood Glucose (mmol/L). The plot includes a vertical dashed line to indicate a threshold for blood glucose level.]
Summary

- Low levels of ketone were observed in this population regardless of blood glucose level
- The low levels of ketone make validation of the POC device difficult
- Measurement of ketones at this time is unlikely to help with defining those at risk
- The role of lactates in the setting of hypoglycaemia warrants further exploration
References


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