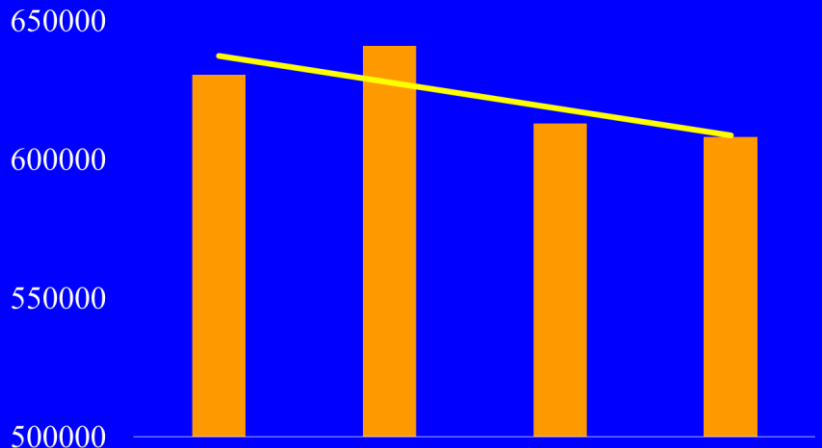
RESOURCE ALERT

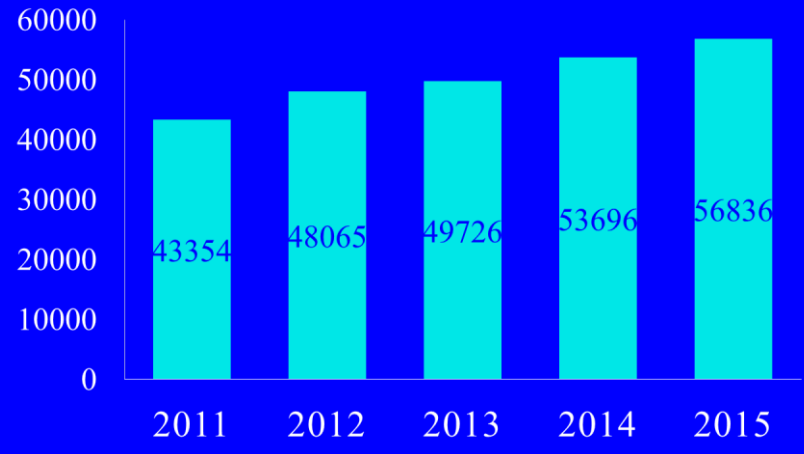
https://improvement.nhs.uk/resources/preventing-avoidable-admissions-full-term-babies/

Atain programme

Term live births in England (2011-2014) (↓3.6%)



Care days for term admissions (↑31%)



Why is this important

- Effects of infant maternal separation at birth profound and can be lasting
- Significant but avoidable cost to NHS, families
- Signal of sub optimal care during antenatal, intrapartum or post natal period
- Signal of inappropriate policies or failure to apply suitable policies

5

RESUSCITATION AFTER FETAL HYPOXIA-ISCHAEMIA

- Staff present with appropriate competence
- ABCD
- Start with air
- When to stop
- Communication
- Documentation
- Simulation training

ROLE OF THERAPEUTIC HYPOTHERMIA

- Acute profound hypoxia-ischaemia
- Standard of care since 2010
- Early passive
- Active in specialist centre
- 30% reduction in adverse outcome

PERINATAL STROKE

- Associated with complications of labour and delivery but causal link unknown
- Rare blood disorder
- May be silent
- Clinical signs not specific

NEONATAL INFECTION

- NICE guidance 2012
- GBS, Gram negative, herpes simplex
- Antenatal, intrapartum, postnatal acquisition
- Early signs very subtle
- Associated pathology
- Narrow therapeutic window
- Low threshold to screen and treat

NEONATAL JAUNDICE

- NICE guidance 2010
- Gestation specific thresholds
- Clinical signs may be subtle
- Often narrow therapeutic window
- But placing by a window not effective
- Underlying pathology esp meningitis
- Kernicterus – hearing, basal ganglia

NEONATAL METABOLIC ADAPTATION

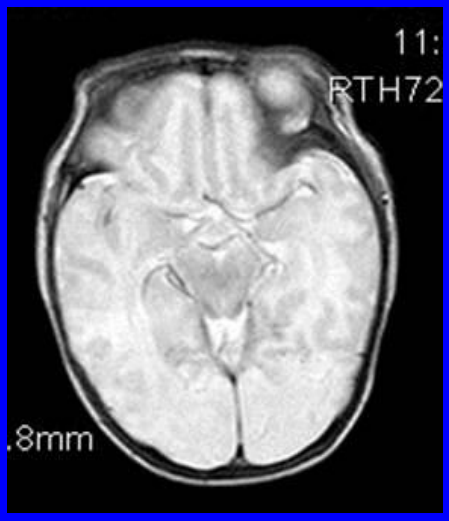
1. Blood glucose control

2. Alternative fuels -
   lactate, ketone bodies

Hypoglycaemia and brain injury.

1920s	Insulin overdose in adults
1933	Insulin treatment of psychiatric disorder 30 mins hypoglycaemic coma
1950s	Neuronal necrosis demonstrated
Present	Insulin, OHAs - treatment error or self harm Insulin producing tumours and IEMs Failure of metabolic adaptation

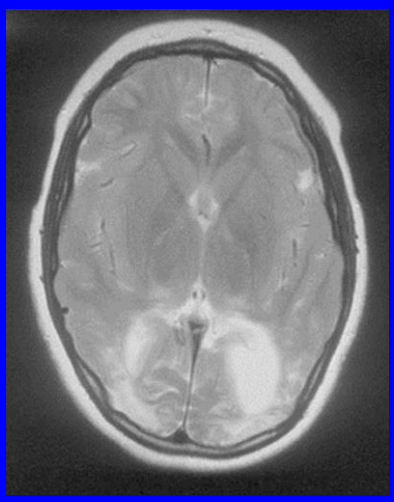
Imaging – acute (courtesy of Dr N Stoodley)



Term baby, 5 days, admitted at 3 days poor feeding, fitting, unrecordable blood glucose.

Increased parenchymal signal and loss grey-white matter differentiation in posterior parietal and occipital regions

Imaging – long term (courtesy of Dr N Stoodley)



Imaging on childhood following neonatal hypoglycaemia

Atrophy, gliosis and ulegyria in posterior parietal and occipital regions

Adverse neurodevelopmental outcome of moderate neonatal hypoglycaemia

661 infants 6808 samples

Bwt 1337g (315) Gest 30.5 (2.7)

Age 48hrs - 8 weeks

Causal relationship with signs in 5

Lucas et al, 1998

Occurrence of hypoglycaemia

	Plasma glucose (mmol/l)		
	<0.6	<1.6	<2.6
Overall	10%	28%	66%*
On 1 day	8%	20%	32%
On 2 days	1%	4%	18%
On ≥3 days	1%	4%	16%**

Variation between centres: * 53-79%

** 4-31%

Lucas et al, 1998

Factors associated with hypoglycaemia

- Neonatal unit
- Apgar 5 < 5
- Bwt <1000g
- SGA

Lucas et al, 1998

Regression analysis

Dependent variables:	Bayley motor and developmental scales
Independent variables:	Days hypoglycaemia*
	Sex
	Birthweight
	<10th centile
	Gestation <30/40
	Clinical complications*
	SBR >170
	Apgar 5 <5
	Social and educational*

Lucas et al, 1998

Relative risk of neurodevelopmental impairment (Bayley score ≤70 or CP)

Days hypoglycaemia	Adjusted RR
0	1
1-2	1.1
3-4	2.2
> 5	3.5 (1.3-9.4)

Lucas et al, 1998

Hyperinsulinaemic newborn monkeys

Pre and post delivery sub cut insulin by pump
Not fed after birth

Tested 8 months:
Pre-training - emotionality and adaptability
Matching to sample tasks
Delayed matching to sample - memory

Schrier et al, 1990

Hyperinsulinaemic newborn monkeys

Results:

10 hr hypo -
- more training difficulties
- more procedural alterations (adaptability)
- additional help from tutors (motivation)

No differences in -
- completion of tasks (with extra attention)
- personality characteristics
- neurology

Schrier et al, 1990

Operational thresholds

- The concentration of plasma or whole blood glucose at which intervention should be considered to increase the glucose level.

Operational thresholds

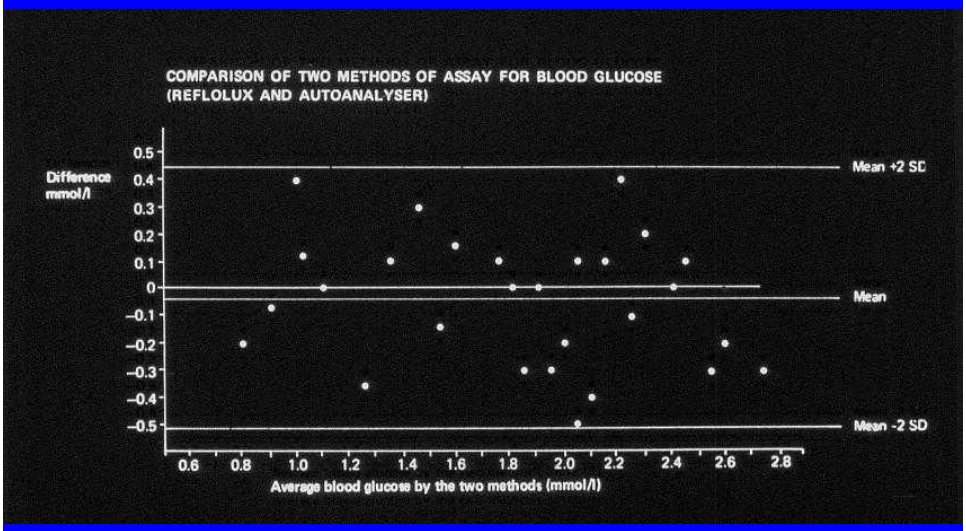
Infants with clinical signs:

2.5 mmol/l

Infants at risk:

Persistently <2.0 mmol/l

<1.0 mmol/l at any time



Neonatal hypoglycaemia?

38 weeks

Labetalol in pregnancy and postnatal
Fetal distress in labour, NVD
Placenta small and gritty
Good condition, no resuscitation
Birthweight 2192g (2nd centile)
Head circumference 33cm (25th-50th centile)

Neonatal hypoglycaemia?

1hr: paed informed of weight, “watch feeding and temperature”

11 hours: paed examination normal

14 hours: discharged

28 hours: MW visit, baby floppy and unresponsive, cardioresp depression

28.5 hours: NNU, BM unrecordable, cardiac arrest, fits, renal impairment

Neonatal hypoglycaemia?

Follow up:

MRI: parieto-occipital cortical and white matter injury

Global developmental delay

Autistic features

Neonatal hypoglycaemia?

37 weeks

Emergency CS for breech

Meconium stained liquor

Good condition, no resuscitation

Birthweight 2900g (50th-75th centile)

Head circumference 34cm (75th-91st centile)

Neonatal hypoglycaemia?

Meconium obs normal, discontinued

Support to attach at breast

12 hours: unsettled not feeding, EBM by syringe

16 hours: lethargic, placed skin to skin, would not suck, gasping, paed informed

16.5 hours: BM unrecordable, paed attended, NNU

17 hours: cardiorespiratory arrest x 3, fits, renal impairment

Neonatal hypoglycaemia?

Follow up:

MRI: injury to basal ganglia, cortex, white matter

Very long chain acyl coA dehydrogenase deficiency

Microcephaly, epilepsy and severe disability

Neonatal hypoglycaemia?

37 weeks

Diet controlled gestational diabetes
Emergency CS for CTG abnormalities
Good condition, no resuscitation
Birthweight 2566g (25th centile)
Head circumference 33cm (25th centile)

Neonatal hypoglycaemia?

Planned to breast fed
18 hours - not fed, sleepy
BG 0.4mmol/l
Took bottle slowly, remained sleepy
BG 1.4mmol/l
Admitted NNU
IV glucose, infection screen

Neonatal hypoglycaemia?

Age (hrs)	BG (mmol/l)
18	0.4
19	1.4
20	1.6
21	3.7
25	5.8

Neonatal hypoglycaemia?

BG	1.8 mmol/l
Ammonia	112 umol/l
Cortisol	87 nmol/l
TSH	3.27 mU/l
Thyroxine	30.3 pmol/l
Insulin	<1.0 mU/l
BOH	533 umol/l
Acac	234 umol/l

Organic acids, amino acids, carnitine profile - normal

Infection screen negative

Neonatal hypoglycaemia?

Maximum glucose requirement 6mg/kg/min

Remained sleepy until day 4

No further low BG

Day 2 - EBM tube feeds commenced

Day 3 - Successfully weaned from iv glucose

Day 4 - Fully breast/cup fed (pulled tube out)

Follow up - no neurodevelopmental concerns

Infants at risk of abnormal neonatal metabolic adaptation

- **Altered maternal metabolism**
  -intrapartum administration of glucose
  -maternal drug treatment
  -diabetes
- **Secondary to neonatal complications**
  -infection
  -polycythaemia
  -perinatal hypoxia-ischaemia
  -hypothermia
  -prematurity
- **IUGR**
- **Neonatal hyperinsulinism – transient or prolonged.**
- **Endocrine disorders**
- **Inborn errors of metabolism**

Blood glucose and brain injury
The evidence

Healthy full term	None
Preterm	Prolonged hypoglycaemia Confounding factors
IUGR	None direct ? ADD
Prolonged with signs	Cortical loss, global delay

Clinical recommendations
Healthy, term, AGA babies

- Support breast feeding
- No routine blood glucose monitoring

Clinical recommendations
Very preterm or sick babies

- Regular glucose monitoring
- Milk or IV glucose to maintain BG >2.5mmol/l
- Expressed breast milk as tolerated

Clinical recommendations
Small or vulnerable babies

- Support breast feeding
- Maintain rigorous clinical monitoring
- Expressed breast milk or formula supplements according to clinical signs and BG

And above all: Identify and **document**

- Risk factors
- Coexisting conditions
- Clinical signs/ normality
- Accurate blood glucose measurements
- Response to treatment
- Investigations for underlying pathology