GUIDELINES FOR SELECTING UMBILICAL ARTERIAL LINE FLUID/INFUSATE

BACKGROUND

**Metabolic acidosis** is defined as a pH <7.35, normal PaCO$_2$ and a base deficit of >5-7.

Acidaemia is common in preterm neonates – evidence suggests that metabolic acidosis occurs in 11.7% of all deliveries, although in very preterm neonates (23-25 weeks) the incidence may be as high as 18%. It is important to establish whether acidaemia is respiratory (high PaCO$_2$), or metabolic (normal PaCO$_2$, negative base excess), or a combination of both. Respiratory acidosis is corrected by addressing ventilatory parameters.

Metabolic acidosis is associated with a build up of lactic acid secondary to many factors including tissue hypoxia, hypotension, poor tissue perfusion, or sepsis. It's exacerbated in preterm neonates by associated lower glomerular filtration rates that lead to impaired urinary acidification. Also preterm neonates have a lower renal threshold for bicarbonate that results in a significant renal tubular leak of bicarbonate.

In the short term, metabolic acidosis is associated with the following abnormalities:

- Inhibition of surfactant production
- Increases in pulmonary vascular resistance
- Reduction in cardiac output
- Abnormal EEGs (consequences unclear)

In the longer term, a pH <7.2 is associated with an abnormal neurodevelopmental outcome in preterm neonates <1000g.

Metabolic acidosis is predominantly corrected by identifying its cause. Whether correction of metabolic acidosis improves outcome has not been studied in a randomised trial. However, if bicarbonate treatment is given, it is best administered slowly. Twenty-four hour intravenous infusions are associated with decreased mortality, whereas rapid infusions are associated with an increased incidence of IVH.

Extremely preterm neonates (<28/40 weeks) can be anticipated to develop a metabolic acidosis. Hence, prophylactic arterial infusion of low dose bicarbonate in this high risk population is established clinical management in many UK neonatal units.
All neonates <28 weeks gestation should receive prophylactic bicarbonate infusion. Consider using in older gestation neonates at high-risk of metabolic acidosis.

INFUSATE PROTOCOL

Route: Bicarbonate should be infused through a UA or peripheral arterial line.

Dose: 0.54mmols of NaHCO₃ administered per 24-hours (or about 1mmol/kg/day for a 500g neonate).

Preparation Dilute 8.4% Sodium Bicarbonate with an equal volume of sterile water (creates a bicarbonate concentration of 4.2% which is 0.5mmol/ml).

Draw up 10iu of 1000iu/ml heparin ie 0.01ml (final concentration of heparin in infusate is 0.5iu/ml).

- 3mls of 4.2% NaHCO₃ (=1.5mmol)
- 17mls of sterile water Run solution at 0.3ml/hr
- 10iu of heparin

Total volume 20.01mls

Heparinisation of fluid infused through PAL’s or UA’s appears to decrease the incidence of catheter occlusion. Studies suggest a relative risk reduction 0.2 (95% confidence interval 0.11 - 0.35). Concentrations above 0.25iu/ml have been shown to be effective.

REFERENCES


Dr Sybil Barr May 2004
To be re-evaluated September 2010