DIARRHOEAL DISEASE: METABOLIC MANAGEMENT

Metabolic acidosis

Five causes: shock (hypoperfusion), hypoxia, dead tissue, exogenous anions (e.g. salicylates), bicarbonate losses

Children with metabolic acidosis have rapid deep respiration, which you may confuse as a sign of an acute respiratory infection.

Mild acidosis needs neither measurement nor treatment. Restoration of intravascular fluid volume will allow the acidosis to be corrected by the kidneys. (Indications for lab tests are given in "Diarrhoeal Disease: Overview")

If pH < 7.1 despite adequate fluid resuscitation, half correct the acidosis as a slow bolus:

\[
\text{ml 8.5 % NaHCO}_3 = \frac{1}{2} \times \text{base excess (BE)} \times 0.3 \times \text{body weight in kg}
\]

NB. Exercise caution in patients with K\(^+\) < 3.4 mmol/l or Na\(^+\) > 145 mmol/l AND when the patient is hypoventilating

Hypokalaemia (K\(^-\)<3.5)

Clinically, hypokalaemia manifests as weakness, floppiness and ileus.

1) If K\(^-\) < 3.4:
   Give oral Rx: MIST POT CHLOR 0.5ml/kg 8H for 2 days

2) If K\(^-\) < 2.0 mmol/l or < 3.0mm/l but NPO
   Give IV Rx: add 2 ml KCl (15% solution) to 200 ml ½DD (to give a concentration of 37 mmol/litre K\(^+\)). Monitor acid-base & electrolytes 6-hourly till K\(^+\) > 2.5mmol/l

Hyperkalaemia (K\(^+\) > 4.5)

Establish cause: e.g. renal failure; excess supplementation; tissue necrosis

1) If K\(^+\) > 6.0 mmol/l:
   - stop all K\(^+\) intake - check both prescription and fluid therapy charts
   - check acid-base status; correct acidosis by TREATING THE FLUID DEFICITS
   - monitor urine output
   - preferably monitor ECG (peaked tall T waves, broad QRS, ventricular fibrillation)
   - 6 hourly serum K\(^+\), acid-base, urea, creatinine

2) If K\(^+\) > 7.0 mmol/l:
   This is life threatening. Manage as above, and commence stepwise treatment:
   1) Nebulised SALBUTAMOL 1 ml in 2 ml saline; repeat 3 hourly PRN (fenoterol is also used for this purpose)
   2) IV 10% CALCIUM GLUCONATE 0.5 ml/kg over 10 minutes (use cardiac monitor and stop immediately if bradycardia occurs)
   3) KAYEXALATE 0.5-1 g/kg stat PO or as retention enema; repeat 6 hourly if necessary
   4) 8.4% NaBic 2ml/kg IV over 10 minutes
   5) NOTIFY CONSULTANT (glucose + insulin infusion and/or dialysis may be needed)
Hyponatraemia (Na⁺ < 130 mmol/l)

Clinically, hyponatraemia manifests as lethargy, altered level of consciousness, and seizures

- If on oral fluids, repeat serum Na⁺ in 4 hours
- If on IV fluids, and Na⁺ <125mmol/l, or the child is symptomatic, change ½ DD to a Normal Saline (NS) cocktail: add 2ml 15% KCl and 20 ml D₅₀W to 200ml NS.
- This cocktail contains Na⁺ 154 mmol/l, Cl⁻ 154 mmol/l, K⁺ 20mmol/l, and 5% dextrose

\[
\text{ml NS} = 4 \times \text{body weight in kg} \times (140 - \text{serum Na⁺})
\]

- Monitor serum Na⁺ 12 - 24 hourly - aim to correct over 24 hours.
- Change back to ½ DD once serum Na⁺ > 130 mmol/l

Hyponatraemia (Na⁺ > 150mmol/l)

- Potential complications – these are likely when Na⁺ > 160 mmol/l – include:
  - Cerebral oedema: due to serum Na⁺ falling too rapidly
  - Convulsions: due to serum Na⁺ falling too rapidly or secondary to a cerebral vein thrombosis due to hyperviscosity and sludging
  - Permanent brain damage

Failure of serum Na⁺ to drop is usually due to inadequate fluid replacement

- Aim to correct dehydration over 24-48 hours
- Use ½ DD for rehydration
- Monitor Na⁺ 6 hourly. Aim to decrease serum Na⁺ by 1 mmol/hour
- If Na⁺ is dropping by more than 1mmol/hour, decrease the rate of fluid administration
- If Na⁺ is falling too slowly, the child usually requires more fluid
- Check for shock/hypoperfusion. Ensure that normovolaemia is attained and maintained
- Check for an osmotic diuresis
- Check GIT losses, which may be more than initially estimated

Because dehydration will have been under-estimated clinically, do not change the initial fluid plan