Acidosis in pre-dialysis patients

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Author: David Voss

GUIDELINES

No recommendations possible based on Level I or II evidence

SUGGESTIONS FOR CLINICAL CARE

(Suggestions are based on Level III and IV evidence)

- **Oral sodium bicarbonate should be administered to maintain the serum bicarbonate above 22 mmol/L. (Level III evidence)**

Sodium bicarbonate is preferred to sodium citrate if the patient is also on aluminium phosphate binders (Mailloux and Levey 1998).

Oral sodium bicarbonate in a total daily dose of 0.5 –1.0 mmol per kg body weight per day, in divided doses two to three times a day (tailored to the individual patient's tolerance) should be administered to maintain the serum bicarbonate above 22 mmol/L.

Oral bicarbonate is available as the sodium salt. The amount of bicarbonate required to correct the acidosis often results in a sodium load that may exacerbate the patient's hypertension or oedematous state. A balance between the benefits of correction of the acidosis, and the risks of excessive sodium loading has to be made for each individual.

Each 4 g Ural sachet (Sigma, Clayton, Victoria) contains 28 mmol of sodium. Each sodium bicarbonate tablet contains 10 mmol of sodium/tablet.

1 teaspoon (approximately 5 g) of baking soda in 60 mL of water produces 1 mmol HCO_3/mL (see 'Sodium in pre-dialysis patients' guideline for sodium content).

Correction of metabolic acidosis in severe renal failure is desirable to minimise skeletal muscle breakdown and the associated negative nitrogen balance.

Background

Acidosis is most commonly a result of metabolism. Metabolic acidosis inhibits lipoprotein lipase activity. Bone is a buffer of the acidotic state, and acidosis can

worsen the bone disease of chronic kidney disease (CKD), and may have deleterious effects on vitamin D synthesis (Pitts et al 1988). Acidosis can increase skeletal muscle breakdown through increased protein catabolism (Garibotto et al 1992) and diminish albumin synthesis (Ballmer et al 1995). These result in the loss of lean body mass and muscle weakness and may exacerbate the protein malnourished state of CKD (Mitch 1991).

This guideline aims to outline the available recommendations and guidelines for administering dietary sodium bicarbonate and maintaining serum bicarbonate levels above 22 mmol/L. It also aims to investigate if a serum bicarbonate level lower than 22 mmol/L is associated with morbidity or mortality.

Search strategy

Databases searched: MeSH terms and text words for kidney disease were combined with MeSH terms and text words for acidosis and bicarbonate then combined with the Cochrane highly sensitive search strategy for randomised controlled trials. The search was carried out in Medline (1996 – November Week 2 2003). The Cochrane Renal Group Trials Register was also searched for trials not indexed in Medline.

Date of searches: 27 November 2003.

What is the evidence?

No randomised controlled trials (RCTs) are available which address this issue.

Prospective studies:
One prospective intervention study in patients with near-end–stage kidney disease (ESKD) (mean GFR = 0.21 mL/sec [approximately 13 mL/min]) and a mean plasma bicarbonate of 17 mmol/L showed they had increased skeletal muscle breakdown. The authors then proceeded to correct the plasma bicarbonate to a mean of 24.3 mmol/L with oral bicarbonate, resulting in reduced urinary nitrogen loss (Nosadini and Tonolo 2003).

Summary of the evidence

There are no RCTs on this topic.

What do the other guidelines say?

Kidney Disease Outcomes Quality Initiative:
Pre-dialysis or stabilised serum bicarbonate levels should be maintained at or above 22 mmol/L.

British Renal Association:
Control of serum bicarbonate within normal limits is advocated. A balance has to be met, and assessed for each individual, between the benefits of correcting the acidotic state, and worsening hypertension/fluid control from the sodium load in the bicarbonate therapy.

Canadian Society of Nephrology:
No recommendation.

European Dialysis & Transplant Nurses Association/ European Renal Care Association:
No recommendation.

Implementation and audit

Regular (at least 3-monthly) blood testing of plasma bicarbonate to assess therapy success and compliance is recommended.

Suggestions for future research

Investigate partial compared with complete normalisation of acidosis in CKD (i.e. serum bicarbonate 22 mmol/L vs 26 mmol/L).

References

Ballmer PE, McNurlan MA, Hulter HN et al. Chronic metabolic acidosis decreases albumin synthesis and induces negative nitrogen balance in humans. J Clin Invest 1995; 95: 39–45.

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