Bicarbonate Dialysis Using a Single Concentrate

J.	Josy	Martens
D.	Didier	Hauglustaine
R.	René	Verberckmoes
P.	Paul	Michielsen

Josy Martens, MD, Didier Hauglustaine, MD, René Verberckmoes, MD, Paul Michielsen, MD, Division of Nephrology, Universitair Ziekenhuis Gasthuisberg, Herestraat, 49, B-3000 Leuven (Belgium)

Dear Sir,

Haemodialysis with bicarbonate-containing dialysate may offer many advantages over acetate dialysis as improved vascular stability, prevention of dialysis-induced hypoxaemia, more adequate base repletion and improved patient well-being [1–4]. Bicarbonate dialysis is now more frequently used since automated techniques have been developed to prevent precipitation of calcium and magnesium carbonates. However, the present systems require a two-stream proportioning and monitoring device and two separate concentrates. These systems are more complicated and expensive than those used in standard acetate dialysis [4, 5]. We propose an alternative method for bicarbonate dialysis that circumvents the aforementioned problems. Our method of bicarbonate dialysis uses a single concentrate, composed of sodium chloride and sodium bicarbonate. Calcium, magnesium and potassium chloride are omitted from the dialysate but administered by a continuous intravenous infusion.

The concentrate was prepared long in advance by dissolving sodium chloride and sodium bicarbonate in deionized water to achieve, after dilution 1/12, a final dialysate composition of Na⁺ 137 mmol/l, Cl⁻ 102 mmol/l and HCO₃⁻ 35 mmol/l. The concentrate and reverse osmosis water were mixed and monitored by a conventional single patient dialysis machine (< Monitral >, Hospal).

A sterile solution containing CaCl₂ · 2 aqua 51.35 g/l, KC15.53 g/l and MgCl₂ · 6 aqua 21.18 g/l, was infused by a calibrated pump at a constant rate of 0.5 ml/min into the blood being returned to the patient (i.e. 7 mg elemental calcium/min [6] and 25 mmol potassium and magnesium/4 h). In the event of a shutdown of the blood pump the infusion was stopped.

Table I. Laboratory measurements (pre- and postdialysis) in 7 patients during six bicarbonate dialysis (mmol/l)

Mean ± SD

Range

Serum potassium

pre

5.04 ± 0.56

6.50-

3.90

post

3.30 ± 0.36

3.76-

2.55

Serum calcium

pre

2.43 ± 0.13

2.87-

2.02

post

2.67 ± 0.17

3.19-

2.10

Serum magnesium

pre

1.03 ± 0.16

1.53-

0.84

post

0.97 ± 0.14

1.39-

0.65

Serum total CO₂

pre

23.71 ± 2.83

29.40-

16.00

post

27.35 ± 1.64

31.40-

21.00

The feasibility of this method was tested during 2 weeks in 7 stable patients treated 4 h three times a week using a variety of capillary dialyzers. The blood flow was ± 200 ml/min, the dialysate flow 500 ml/min. Results are given in table I. A limited series of intradialytic hourly measurements of serum potassium, calcium and magnesium, showed no special problems. No adverse effects were noted.

The major advantage of this technique over conventional bicarbonate dialysis methods is that sophisticated dialysate supply machinery is no longer needed. Precipitation of carbonates in the machine is entirely precluded. This technique can be performed in any existing facility using single-pass dialysis with either an adjustable centralized fluid supply equipment or integrated single patient proportioning systems.

Preliminary calculations suggest that the cost of this method is competitive with and may even be lower than conventional single patient bicarbonate haemodialysis. As no initial investment is required, this approach may be especially suitable for centres which are only equipped for acetate dialysis but still want to perform bicarbonate dialysis occasionally (e.g. in critical care situations).

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An additional advantage is its flexibility. Individual 2 patient needs for calcium and magnesium may be met by adjusting the infusion rate or composition of the intravenous infusion. Since the dialysate is free of calcium, this technique can be combined with regional citrate anti- 4 coagulation for patients at high risk for bleeding [6].

The potassium can be omitted from the intravenous 5 solution and added to the concentrate. This should fur-

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ther simplify the method and avoid a potential hazard. Our results and implications have to be validated by a longer study.

References

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