Introduction
Continuous venovenous haemofiltration (CVVH) is an established treatment for patients with acute kidney injury. During CVVH, serum electrolyte concentrations tend to equilibrate with their concentrations in the replacement fluid. The rate at which this happens depends on the difference in their concentrations between serum and replacement fluid, and on the rate of treatment.

Patients presenting with acute kidney injury may have concomitant severe hyponatraemia or hypernatraemia. Over-rapid correction of the serum Na⁺ concentration is associated with pontine myelinosis and/or cerebral oedema [1,2]. If CVVH is needed, the Na⁺ concentration in the replacement fluid (usually 140 mmol/l) needs to be adjusted in order to avoid rapid changes of the serum Na⁺ concentration. In the present paper we provide some guidance on how to make these adjustments for CVVH. The same principle could be applied for continuous haemodialysis or dialfiltration.

Acute kidney injury and hypernatraemia (Na⁺ >155 mmol/l)
Free water hydration is the first-line therapy if possible. If CVVH is necessary, the Na⁺ concentration of the replacement fluid should be increased by adding concentrated NaCl solution (Table 1).

Generally, it is not considered safe to lower the serum Na⁺ concentration by more than 8 to 10 mmol/l over 24 hours, especially in the setting of chronic hypernatraemia [1]. Usually, a stepwise correction of the patient’s serum Na⁺ concentration is planned using replacement fluid made up to successively lower Na⁺ concentrations.

If the serum Na⁺ decreases by >2 mmol/l in 6 hours, either the rate of filtration should be decreased or the fluid bags should be changed to bags with a higher Na⁺ concentration.

The volumes of 30% NaCl added are small and will not affect the concentration of other electrolytes in the solution significantly.

Acute kidney injury and hyponatraemia (Na⁺ <125 mmol/l)
If CVVH is needed, the Na⁺ concentration of the replacement fluid should be reduced by adding sterile water (Table 2). Generally, it is not considered safe to increase the serum Na⁺ concentration by more than 8 to 10 mmol/l over 24 hours, especially in chronic hyponatraemia [2]. Usually, a stepwise correction of the patient’s serum Na⁺ concentration is planned using replacement fluid made up to successively higher Na⁺ concentrations.

If the serum Na⁺ concentration has increased by >2 mmol/l in 6 hours, either the rate of filtration should

### Table 1. Effect of adding different volumes of 30% NaCl to replacement fluid

| Volume of 30% NaCl added | Nil  | 5 ml (=25 mmol Na⁺) | 10 ml (=50 mmol Na⁺) | 15 ml (=75 mmol Na⁺) | 20 ml (=100 mmol Na⁺) |
|--------------------------|-----|--------------------|----------------------|----------------------|----------------------|
| Final Na⁺ concentration in replacement fluid | 140 mmol/l | 145 mmol/l | 150 mmol/l | 155 mmol/l | 160 mmol/l |

Effect of adding different volumes of 30% NaCl (≈5 mmol/ml) to a 5 l bag of replacement fluid containing a Na⁺ concentration of 140 mmol/l.

*Correspondence: Marlies.Ostermann@gstt.nhs.uk
Guy’s & St Thomas’ Foundation Trust, Department of Critical Care, Westminster Bridge Road, London SE1 7EH, UK
be decreased or the fluid bags should be changed to bags with a lower Na⁺ concentration.

The concentration of bicarbonate and potassium in the final solution will also be reduced, and the patient may need additional supplementation.

Abbreviations
CVVH, continuous venovenous haemofiltration.

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References
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Table 2. Effect of adding different volumes of water to replacement fluid

| Volume of water added (ml) | Final volume of diluted replacement fluid (l) | [Na⁺] in diluted replacement fluid (mmol/l) | [HCO₃⁻] in diluted replacement fluid (mmol/l) | [K⁺] in diluted replacement fluid containing 4 mmol/l |
|---------------------------|-----------------------------------------------|-------------------------------------------|---------------------------------------------|-----------------------------------------------|
| Nil                       | 5                                             | 140                                      | 35                                          | 4.0                                           |
| 150                       | 5.15                                          | 136                                      | 34                                          | 3.9                                           |
| 250                       | 5.25                                          | 133                                      | 33                                          | 3.8                                           |
| 350                       | 5.35                                          | 131                                      | 33                                          | 3.7                                           |
| 500                       | 5.5                                           | 127                                      | 32                                          | 3.6                                           |
| 750                       | 5.75                                          | 122                                      | 30                                          | 3.5                                           |
| 1,000                     | 6.0                                           | 117                                      | 29                                          | 3.3                                           |
| 1,250                     | 6.25                                          | 112                                      | 28                                          | 3.2                                           |

Effect of adding different volumes of water to a 5 l bag of replacement fluid with a Na⁺ concentration of 140 mmol/l. [Na⁺], sodium concentration; [HCO₃⁻], bicarbonate concentration; [K⁺], potassium concentration.

Competing interests
The authors declare that they have no competing interests.

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