HYPERNATRAEMIA DURING PERITONEAL DIALYSIS

M. V. MORIARTY and F. M. PARSONS
Renal Research Unit, General Infirmary, Leeds 1, Great Britain

It is now well established that control of thirst, fluid intake and hypertension can be achieved by keeping patients on intermittent haemodialysis hyponatraemic. We have observed, however, the development of severe hypernatraemia (up to 168 meq./L.) when using hypertonic (6.36% or 3.86% dextrose) peritoneal dialysis solutions containing 141 meq./L. Na⁺. Accordingly net Na and water loss during dehydrating exchanges were assessed. A series of two litre exchanges of hypertonic solutions were collected, the exchange time usually being 1–1½ hours. In all cases the [Na⁺] was lower than the initial observed level though higher than could be accounted for by mere dilution. Clearly therefore both water and sodium were being removed by dialysis – but relatively more water than Na⁺. The concentration of Na⁺ in the excess fluid removed,

\[ E = \frac{(\text{Vol. out} \times \text{Conc. out}) - (\text{Vol. in} \times \text{Conc. in})}{(\text{Vol. out} - \text{Vol. in})} \]

ranged from 80–115 meq./L. (Figure 1). To induce hyponatraemia this figure should be well in excess of 140 meq./L.

The variation in [Na⁺] and fluid volume with time was then assessed. Dialyses were performed in rats and samples taken during an exchange. The sodium concentration and the
volumes at given times were measured. The latter estimation was performed with a high molecular weight dye-dextran blue (molecular weight 2 millions) and its accuracy (in the absence of bleeding) was confirmed by comparing the colorimetric results with those obtained by evisceration. Curves were obtained for both factors and the [Na\textsuperscript{+}] in the excess fluid calculated from these. The graph obtained was similar to the one illustrated when later the same experiment was performed on the human subject (Figure 2). Clearly there is an initial rapid inflow of water into the peritoneal cavity and it is only when, as a result of this, a concentration gradient of Na\textsuperscript{+} is set up that Na\textsuperscript{+} crosses the membrane at figures approaching those in Extracellular fluid or plasma.
HYPERNATRAEMIA DURING PERITONEAL DIALYSIS

In intermittent peritoneal dialysis a short dialysis time is clearly an advantage. Boen has shown that the optimum economical urea clearance (20–30 ml/min.) occurs when a 2 litre exchange lasts only 45–60 minutes. The graph shows that equilibration of the [Na⁺] in the excess fluid with that of the E.C.F. only takes place after two hours.

It is therefore apparent that in order to achieve a plasma concentration of about 130 meq./L, it will be necessary to use a dehydrating solution with a [Na⁺] of considerably less than this.

The exponential relationship between varying Na concentrations in the initial dialysate fluid (when osmolality is kept constant at 565.5 m.osm/kg) and the [Na⁺] in the excess fluid is shown in the third figure (Figure 3). The low figures of the [Na⁺] in the excess fluid are due to the fact that they were taken at 15 minutes, i.e. at the bottom of the curve shown in the second figure. In addition, this effect is more marked in rats than in humans. We have found that by reducing the [Na⁺] in the dialysate fluid to between 115 and 120 meq./L, a mild degree of hyponatraemia (132–135 meq.) occurs over a series of 5–10 dehydrating exchanges and the [Na⁺] in the excess fluid comes off at between 145–165 meq./L. To substitute a litre of 5% dextrose for one of the two litre packs of Dialysate solution at every fourth exchange has the same effect.