NEW APPLIANCES

Peritoneal Dialysis with In-line Sterilization of Dialysate
by Filtration

Dr. P. SHARPSTONE, lecturer in medicine, King's College Hospital Medical School, London S.E.5, and Dr. F. S. GOLDBY, medical registrar, King's College Hospital, London S.E.5, write: Peritoneal dialysis by means of commercially prepared solutions and disposable giving sets (Maxwell *et al.*, 1959) is a simple and effective technique, and is in general use in the management of renal failure and sometimes for the correction of overhydration. Disadvantages inherent in this system, however, include the high cost of the dialysate and the risk of introducing infection during the repeated interruption of the fluid pathway in order to change and to make additions to individual 1-litre containers of dialysate. McDonald (1965) has overcome these problems by preparation of dialysate in bulk at the time of use by diluting a concentrated solution with water and sterilizing the final solution by filtration through a 0.22-micron filter during its passage to the patient. He used an automatic peritoneal dialysis machine, but as manual methods of dialysis are more widely used at present we describe here a manually controlled system in which in-line filtration sterilization of the dialysate is used.

METHODS

Five hundred millilitres of a $\times 40$ peritoneal dialysis concentrate (Romford Laboratories Ltd.), 500 to 1,500 ml. of 50% dextrose solution, and potassium, heparin, etc., as required are placed in a 20-litre stainless steel pressure vessel (Millipore (U.K.) Ltd.), which is then filled to a 20-litre internal calibration mark with distilled water. The water is pyrogen-free but unsterilized, and is obtained from the hospital pharmacy in 25-litre polyethylene aspirator bottles. The dialysate is mixed by stirring and its concentration checked by osmometry. The vessel is pressurized by air at 15 lb./sq. in. (1.05 kg./sq. cm.) from a cylinder fitted with 0-30 lb./sq. in. (0-2.1 kg./sq. cm.) regulating valve (British Oxygen Co. Ltd.). Opening the outlet tap of the pressure vessel allows the required exchange volume of dialysate to flow through a 0.22-micron 142-mm. Millipore filter (Millipore (U.K.) Ltd.) into a modified 2-litre polypropylene measuring cylinder (Xlon Products Ltd.) suspended from a transfusion pole 5 ft. (1.5 m.) above the patient (see Diagram). Release of a tubing clamp then allows the dialysate to flow by gravity into the peritoneal cavity through a disposable warming coil (R66 blood warmer, Baxter Laboratories Ltd.) in a thermostatically controlled water bath (JB 1, Grant Instruments (Cambridge) Ltd.). With a bath temperature of 42° C. and a flow rate of 200 ml./min., the dialysate reaches the patient at a temperature of about 33° C.

Disposable vinyl tubing (Portland Plastics Ltd.) is used throughout. After use the pressure vessel and measuring cylinder are thoroughly cleaned and sterilized by autoclaving. The filter holder, after cleaning, is reassembled with a new filter membrane and pre-filter and sterilized in ethylene oxide. Before each dialysis the integrity of the filter

the hospital from a concentrate and distilled water. Sterilization of fluid in large containers is, however, difficult (Bosch *et al.*, 1966) and has led to the adoption of the present technique, which also eliminates the risk, inherent in the conventional method, of introducing infection during the conduct of the dialysis itself. The 0.22-micron filter

Diagram of apparatus for sterilization of dialysate by filtration, and the delivery of measured volumes to the patient via a heating coil.

is confirmed by demonstrating its inability, when wet, to pass air at 25 lb./sq. in. (1.76 kg./sq. cm.).

Animal tests for pyrogens were carried out on samples of dialysate taken from the patient's side of the filter at the end of every third dialysis. Each was given intravenously, in a dose of 3 ml./kg., to three rabbits whose temperatures were monitored for three hours by rectal thermocouples.

RESULTS

Thirty 20- to 40-litre dialyses have been performed with this system. After preparation of the dialysate and apparatus (by medical or specially trained nursing staff) the dialyses were conducted by nurses who required only brief instruction in the technique. Up to 40 litres of dialysate could be exchanged before blockage of the filter membrane necessitated its replacement.

The patients' oral temperatures were recorded two-hourly during dialyses and no pyrexial reactions occurred. All 10 samples of dialysate tested in rabbits were completely free of pyrogenicity.

DISCUSSION

A very considerable saving in dialysis fluid costs is achieved by its bulk preparation in

does not remove pyrogens, but with attention to the cleanliness of the apparatus and the use of pyrogen-free water the dialysate has proved free of pyrogenicity.

Additional advantages of the in-line sterilization system are that the dextrose content and exchange volume of dialysate can be adjusted to the requirements of individual patients; and that as no adjustment of potassium or dextrose content of the dialysate is made during the conduct of the dialysis this may safely be left in the hands of relatively untrained and unsupervised personnel.

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