AN AUTOMATIC PERITONEAL DIALYSIS SYSTEM

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The three components of this system (dialysis fluid, fluid path and cycling machine) are described. Most of the sterile equipment used is disposable, and sterile pyrogen free dialysis fluid is prepared cheaply. A trained nurse takes one hour to make up the dialysis fluid and prepare the system for use. Sixteen patients have been treated on a total of 50 occasions. All the components have proved reliable and clinically safe.

Dialysis fluid

Twenty-litre ‘Pyrex’ containers are autoclav ed and filled aseptically with 500 ml of electrolyte concentrate, 750 ml of 40% dextrose solution and 18,750 ml of distilled water. All

Fig. 1. Preparation of dialysis fluid.
these solutions are sterile and pyrogen free. The final composition of the dialysis fluid is sodium 130, potassium 1.37, chloride 100.6, acetate 35, magnesium 1.0, calcium 2.5 mEq/litre and dextrose 1.5 g%. The dextrose concentration is increased if hypertonic dialysis fluid is required. Tests have shown no bacterial growth in the fluid reservoir after 24 hours.

Fluid path

A single, disposable unit made of clear plastic tubing with silicone rubber pump segments and sterilized by gamma irradiation. The unit is colour coded for positioning in the valve system of the cycling machine. A length of the tubing is immersed in a water bath kept at 40°C. and acts as a heat exchanger. The fluid path is connected to a sealed 'Pyrex' container in which the outflow collects.

Cycling machine

Dialysis fluid is pumped into and out of the abdomen by a single peristaltic pump, the direction of flow through the fluid path being controlled by solenoid valves. The rate of

![Diagram of fluid path and valve system of cycling machine.](image)

**Fig. 2.** Diagram of fluid path and valve system of cycling machine.
inflow and of outflow of the dialysis fluid can be adjusted separately in the range 1-12 litres/hour. Inflow volume can be adjusted from 0.002-14.5 litres so that the machine can be used for dialysis of small children and the fluid volume used for dialysis in adults can be altered to suit individual tolerance. The volume of fluid pumped out can be separately adjusted in the same range, and dialysis continues automatically once the desired volumes have been set. Pump revolutions are monitored electromagnetically and visually recorded by mechanical counters. Total (accumulated) pump revolutions are also recorded both for inflow and for outflow. There is a timing device so that the interval between the inflow and outflow of dialysis fluid can be adjusted in the range 1-60 minutes. An anaerobic gauge with adjustable positive and negative pressure limits is connected to the bubble trap and records pressure in the fluid path between the peristaltic pump and the patient; visible and audible alarms operate if the pressure limits are reached or the peritoneal cannula becomes blocked. These alarms also operate if the supply reservoir is empty or the water bath temperature varies.

**TABLE I**

Cost of 40-litre dialysis

<table>
<thead>
<tr>
<th>Material</th>
<th>Quantity</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electrolyte concentrate</td>
<td>1 litre</td>
<td>16/-</td>
</tr>
<tr>
<td>40% Dextrose solution</td>
<td>1.5 litres</td>
<td>15/-</td>
</tr>
<tr>
<td>Distilled water</td>
<td>37.5 litres</td>
<td>37/6</td>
</tr>
<tr>
<td>Sterile fluid path</td>
<td></td>
<td>18/-</td>
</tr>
<tr>
<td></td>
<td></td>
<td>86/6d</td>
</tr>
</tbody>
</table>

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Fig. 4. The complete system.