POTENTIAL APPLICATION OF A PUMPLESS HAEMODIALYZER FOR HOME DIALYSIS*

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A new parallel-flow haemodialyzer (Fig. 1) may permit home dialysis with a minimum of equipment. The dialyzer consists of 40 layers of cellophane or cuprophane dialysis tubing, each supported by an interposed layer of plastic screen mesh. The tubing ends are manifoldded by embedding them in epoxy resin (Fig. 2). The resin also separates blood compartments from the dialysate compartment (Fig. 3). The resin is moulded to give a curved entry to each layer of tubing.

![Photograph of haemodialyzer. Dimensions are 23 x 7 x 6.5 cm.](image)

Resistance to flow is minimal so that a blood pump is not necessary. Priming volume is less than 100 ml and the small size of the dialyzer permits mounting of the dialyzer close to the patient with minimal blood loss in tubing. Dialysate consumption is approximately 500 ml/min. with a single pass system. If an insulated dialysate container and preheated water are used, the only mechanical equipment required is a dialysate pump. Insertion of a constant flow pump into the dialysate outflow line and restriction of the lumen of the inflow line permit regulation of transmembrane pressure.

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372
One possible dialysis system for this dialyzer is shown in Figure 4. The dialyzer is mounted vertically with blood entering the top. An anaeroid manometer monitors arterial input pressure. An adjustable micrometer pinch clamp constricts the lumen of the dialyzer blood outflow line. An air trap and blood filter are placed in the outflow line. The blood entry plenum chamber also serves as an air trap. A small roller pump draws dialysate through the dialysate compartment from an insulated dialysate reservoir. A calibrated pinch clamp adjusts lumen size of the dialysate inflow line. Dialysate outflow is being returned to the reservoir in the demonstration, but in actual use it would be discarded to waste.

The flow resistance of both the blood and dialysate is relatively constant from one dialyzer to another, so that a flow-pressure nomogram can be constructed for blood and dialysate. Thus, by occluding the blood outflow line temporarily, a measure of arterial blood pressure is obtained. Pressure then is measured when the outflow line is open. The difference in pressures is directly proportional to flow. The desired flow is obtained by adjusting the micrometer screw clamp to give the pressure drop for that flow. This value is read from a nomogram.
Similarly, since the dialysate flow and dialysate flow resistance are constant, the desired negative pressure for ultrafiltration can be obtained by setting the calibrated inflow pinch clamp to a predetermined value which is read from a nomogram.

When the system is operating, the arterial pressure gauge can be monitored periodically by the patient. Simple high and low limit switches can be added to the dial for automatic monitoring. The dialysate outflow line can be monitored visually or a simple photocell circuit can be used to detect haemoglobin. Colour coding of connecting tubes and keyed tubing connectors will simplify assembly by the operator.

If desired, more elaborate dialysate delivery systems and monitors can be used, but this system should be useful in its present form. It is hoped that it will permit dialysis therapy of larger numbers of patients than has heretofore been possible.