EFFICIENT AND INEXPENSIVE, NO-PRIME, NO-BLOOD-LOSS
HAEMODIALYSIS SYSTEM

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The dialysis system is made of a plexiglass core around which a silicone rubber band is coiled. This silicone rubber band has a profile of parallel grooves and ridges running obliquely on either side. The ridges touch only at the crossing points. Winding a cellophane tube together with the profile band gives a regular pattern of compression at multiple points and a very regular pattern of blood distribution in the tubing (Fig. 1). No spacers are necessary and therefore the winding of the coil is easy. The completed coil is encircled by a rigid plexiglass girdle which prevents expansion of the coil due to blood pressure. The coil is attached to a lid covering a polyethylene dialysate tank with a capacity of 150 l. On top of the lid, in the centre, a noiseless split-phase motor is mounted driving a fan which pushes the wash solution downward from the centre of the core while at the same time dialysate moves upward through the grooves in the silicone rubber profile band crosswise to the blood-filled cellophane tubing with a high rate of recirculation (Fig. 2). One long blood path is used to reduce the necessary connections between blood tubing and cellophane to only two. Metal caps are pushed over the cellophane in a similar manner as described earlier (Hoeltzenbein, 1967, 1968). While the cellophane tubing is sterile inside, the silicone rubber blood tubing is sterilized in an autoclave or by heat and inserted sterile into the cellophane. The blood path is thus mounted in a sterile fashion and no other sterilization of the completed system is required.

Fig. 1. Blood path in the cellophane tubing due to the special type of membrane support.

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A blood pump must be used. We prefer an occlusive roller pump*, the speed of which can be regulated by a continuously variable gear. The split-phase motor of this compact blood pump is noiseless.

Before dialysis, the tank is filled with warm tap water, concentrate added and the dialysate is mixed by means of the evacuation pump. No thermostatic device is provided in the tank since dialysate temperature in the closed tank falls only very slowly. The transparent tank and plexiglass lid would allow immediate detection even of a minor blood leak in the tank. The blood path is flushed with only 1 l of saline. Into the last 200 ml, 3 ml of heparin are injected and when the saline bottle is empty the system is connected to the patient. When

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standard Visking tubing 36/32” is used, the filling volume is 200 ml. Therefore no blood priming is necessary. No clotting time determinations are done. The blood system has no bubble trap since the air is flushed out with the saline.

The chloride clearance in vitro at a ‘blood’ flow of 200 ml/min. is 120 ml/min. At this point, the clearance curve (Fig. 3) begins to level off and the maximal clearance is about 140 ml/min. Ultrafiltration, however, rises corresponding to increased blood flow and can be regulated by the speed of the blood pump. Cuprophane tubing gives better clearance values and can be used in this type of membrane support without danger of rupture. It has, however, a larger filling volume. Because clearance with Visking tubing is amply sufficient and filling volume lower, Visking tubing is preferred.

After dialysis, the blood is returned into the patient by means of a saline infusion into the apparatus. Practically all of the blood in the machine except for 1/2 (!) ml or less can be returned into the patient with approximately 400 ml of saline. Since the blood path is rinsed further with the rest of the saline in the bottle and finally with air, disassembly can be accomplished quickly and without any blood spilling. The cellophane is discarded, the silicone rubber blood tube flushed and sterilized in the autoclave together with the silicone rubber band which is quickly dried in this manner. The empty polyethylene tank is flushed with water by means of the evacuation pump and tilted upside down to drain dry.

Reassembly of the machine is accomplished by means of a winding board (Fig. 4) in less than 5 minutes and the system is then stored sterile and dry until use.

Essentially what is needed for a dialysis, apart from a little labour and time, are approximately 2 l of sterile saline solution, concentrate for preparation of 150 l of dialysate, 3 ml of heparin and 10 m of cellophane tubing; furthermore, very little time is required for sterilization of the re-usable blood path, assembly and disassembly.

Fig. 4. View of the dialysis apparatus and the winding board by which the machine can be assembled sterile and dry within less than 5 minutes. Blood loss in the machine is less than 1/2 (!) ml per dialysis.
REFERENCES
