so that he could give free treatment to all the blinded soldiers who came his way, and it was transplanted two years later to the east side of Regent's Park to provide better and more convenient accommodation. For this new hospital Mr. Nash designed a splendid façade which characteristically bore little relation to the rather perfunctory premises that lay behind it.

The new Ophthalmic Hospital occupied the sites of 152-154 Albany Street, a street that had been the original farm track running northward to serve the tenant of Coneyburrow Farm (how happy to think of a burrow of conies where the tenement blocks now sprawl) but which Nash had developed as a market and service area for the occupants of his great Chester and Cumberland terraces, and which had already been embellished by the "Queen's Head and Artichoke" to provide for their refreshment.

This impressive building, cast in the Greek taste, with a fine central cupola, was leased to the Government by Mr. Nash at £600 a year for seven years. But the supply of

trachomatous soldiers was already on the wane, and after two years Mr. Nash's wards were closed and the building was taken over as a workshop. There Sir Goldsworthy Gurney constructed the steam carriage in which he managed to journey to Bath and back at 15 miles an hour. It was then used as a factory for Perkins and Bacon's "steam guns," prototypes of the modern machine-gun. Ultimately Nash let off the buildings in sections, and the very last piece of business he transacted was to make an assignment of the whole property to Sir Felix Booth, a wealthy distiller who had just earned a baronetcy for promoting Arctic exploration. After that the building was destroyed and replaced by a petrol filling-station—reflectively named "Nash's Sales and Service"—so that only the northern wing survived. But in 1967 even this remaining wing was immolated by developers and a faceless block of flats has taken its place, without even a plaque to recall the handsome Ophthalmic Hospital that Mr. Nash had built.

New Appliances

Disposable Membrane Insert for the Kiil Dialyser

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Summary

The use of a presterilized, disposable, mesh-supported membrane envelope in the Watson Marlow Kiil dialyser results in a 12% improvement in urea and creatinine clearance. Priming volume, uptake volume, and ultrafiltration rate are unchanged. Residual blood volume remains small. Blood flow resistance is increased. The envelope therefore offers considerable advantages over conventional assembly for dialysis with a blood pump.

Introduction

The Kiil dialyser is used for about 60% of all haemodialyses for chronic renal failure in Europe but is beginning to decline in popularity.¹ Its two main disadvantages are: (1) the need to build it by hand in the hospital or home, with the risk of inadequate sterilization and pyrogen reactions, and (2) urea and creatinine dialysance which are less than ideal, particularly for larger patients. Disposable presterilized membrane "envelopes" covered with a supporting mesh were described by Bier² and by Nosé *et al.*³; they were said to eliminate the need for formalin sterilization and to produce a modest improvement in the performance of the Kiil dialyser.

One such membrane envelope of the type described by Bier has recently been offered for sale in this country by Staynes Laboratories and has been evaluated at Newcastle upon Tyne.

Methods

Dialysance, priming and uptake volume, ultrafiltration, blood flow resistance, and residual blood volume were studied *in vivo* by standard techniques as described by von Hartitzsch and Hoenich.⁴ Dialysance studies were carried out in the third and fourth hours of dialysis when conditions had stabilized. We noted a fall-off in dialysance during the first two hours of dialysis (Fig. 1) for three Kiil dialysers. More dramatic drops were observed during this period with the Rhone Poulenc dialyser.⁵

FIG. 1—Change in urea dialysance with duration of dialysis in three Watson Marlow dialysers for pumped blood flows in the range 160-190 ml/min. Blood flow, dialysis fluid flow (500 ml/min.), and temperature (37°C) constant throughout dialysis for each dialyser. The experimental points for each dialyser are shown as constant symbols.

The Staynes envelopes were assembled dry but this trial batch had not been sterilized in the factory so they were disinfected with 2% formaldehyde before use. They were compared with conventional assembly on the same Kiil dialysers built with wet, cross-grained, 12-micron cuprophane and sterilized with 2% formaldehyde.

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Results

Dialysance.—The mean curve (with 95% confidence limits of the mean) calculated by computer from analysis of 105 observations on the conventional Kiil assembly and 75 observations on the Staynes envelopes are shown in Figs. 2 and 3 and Table I.

FIG. 2—Comparative urea dialysance at a dialysis fluid flow rate of 500 ml/min., and temperature 37°C. for Watson Marlow Kiil dialysers assembled with Bier Staynes disposable envelopes and conventional membranes.

Mean curves and the 95% confidence limits of the mean (broken lines) are based on 75 observations from 10 dialysers for the disposable envelopes and 105 observations from 12 dialysers for the conventional membranes.

FIG. 3—Comparative creatinine dialysance for Watson Marlow Kiil dialysers assembled with disposable envelopes (77 observations from 10 dialysers) and conventional membranes (98 observations from 12 dialysers). Figures 2 and 3 are reproduced from *Proceedings of the European Dialysis and Transplant Association*, Volume 7 (1971) by kind permission of the Editor and Pitman Medical.

TABLE I—Urea and Creatinine Dialysance in vivo in Watson Marlow Kiil Dialyser. Mean $\pm$ Confidence Limits of Mean

	Blood Flow (ml/min)			
	100	150	200	250
Urea:				
Disposable envelope	78 $\pm$ 1.4	93 $\pm$ 2.0	106 $\pm$ 2.5	116 $\pm$ 4.0
Conventional assembly	67 $\pm$ 1.5	83 $\pm$ 1.2	96 $\pm$ 2.0	107 $\pm$ 3.0
Creatinine:				
Disposable envelope	60 $\pm$ 1.0	73 $\pm$ 1.3	82 $\pm$ 2.0	88 $\pm$ 2.4
Conventional assembly	56 $\pm$ 1.4	65 $\pm$ 1.3	73 $\pm$ 1.8	80 $\pm$ 3.0

The envelopes produce an average improvement in urea and creatinine dialysance of 12% at clinically important blood flows. This is presumably due to the nylon mesh which supports the membrane.

Priming Volume, Uptake Volume, and Ultrafiltration.—The mean priming volume of the Watson Marlow Kiil dialysers was 105 ml, similar to the 112 ml previously reported.⁶ The mean priming volume of the envelopes was 92 ml, and the dialyser volume remained below that of the conventional assembly up to

a transmembrane pressure of 100 mm Hg. At higher filling pressures the envelopes had a slightly higher volume than the conventional Kiil. None of these differences is clinically important. Ultrafiltration rate was virtually identical with the two systems, averaging 5.5 ml/min at a transmembrane pressure of 150 mm Hg.

Blood Flow Resistance.—The pressure drop across the dialyser increased by 30% when the envelope replaced conventional assembly. This makes it less attractive for unpumped dialysis.

Residual Blood Volume.—The wash-in volume was estimated by the nurse at 800 ml but was rechecked by reweighing the bottle to give the figures in Table II. The residual blood volume

TABLE II—Residual Blood Volume

	Disposable Envelopes	Conventional Assembly
Observations	9	9
Mean actual wash-in volume (ml)	743	758
Residual blood volume (ml) { Mean	4.8	2.1
{ Range	1.3–10.0	0.4–3.8

was slightly higher with the envelopes than with conventional build but the difference is partly accounted for by the slightly greater wash-in volume which was, by chance, used with the conventional build and both volumes are clinically acceptable.

Ease of Handling.—The need to pressure-test and sterilize the envelopes at this clinical trial stage cancelled out most of the advantages in ease of handling. Nevertheless, production batches will be provided presterilized, and if clinical experience suggests that the pressure test can be eliminated (as in most disposable dialysers) handling time should be considerably reduced. The only disadvantage is that the surface of the Kiil must be dry. This alters the routine of reassembly and makes the rapid replacement of an envelope after a blood leak more difficult than might have been expected.

Discussion

The Kiil dialyser has been the mainstay of regular dialysis for a decade and several thousand are still in use. They will not be phased out from wear and tear for many years. The disposable envelope offers an opportunity of postponing their obsolescence by bringing them close to the performance of newer dialysers and reducing the burden of assembly. The higher cost of using a disposable insert will have to be weighed against the cost of re-equipping a unit with new dialysers.

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Requests for reprints should be sent to N.A.H.

References

- 1 Drukker, W., Haagsma-Schouten, W. A. G., Alberts, Chr., and Baarda, B., *Proceedings of the European Dialysis and Transplant Association*, 1970, 7, 3.
- 2 Bier, M., *Transactions. American Society for Artificial Internal Organs*, 1968, 14, 97.
- 3 Nosé, Y., et al., *Transactions. American Society for Artificial Internal Organs*, 1969, 15, 118.
- 4 von Hartitzsch, B., and Hoenich, N. A., *British Medical Journal*, 1972, 1, 237.
- 5 von Hartitzsch, B., and Hoenich, N. A., Report to the Department of Health and Social Security, 1971.
- 6 Hoenich, N. A., Strong, A., Strong, H., Frost, T., and Kerr, D. N. S., *Proceedings of the European Dialysis and Transplant Association*, 1970, 7, 484.