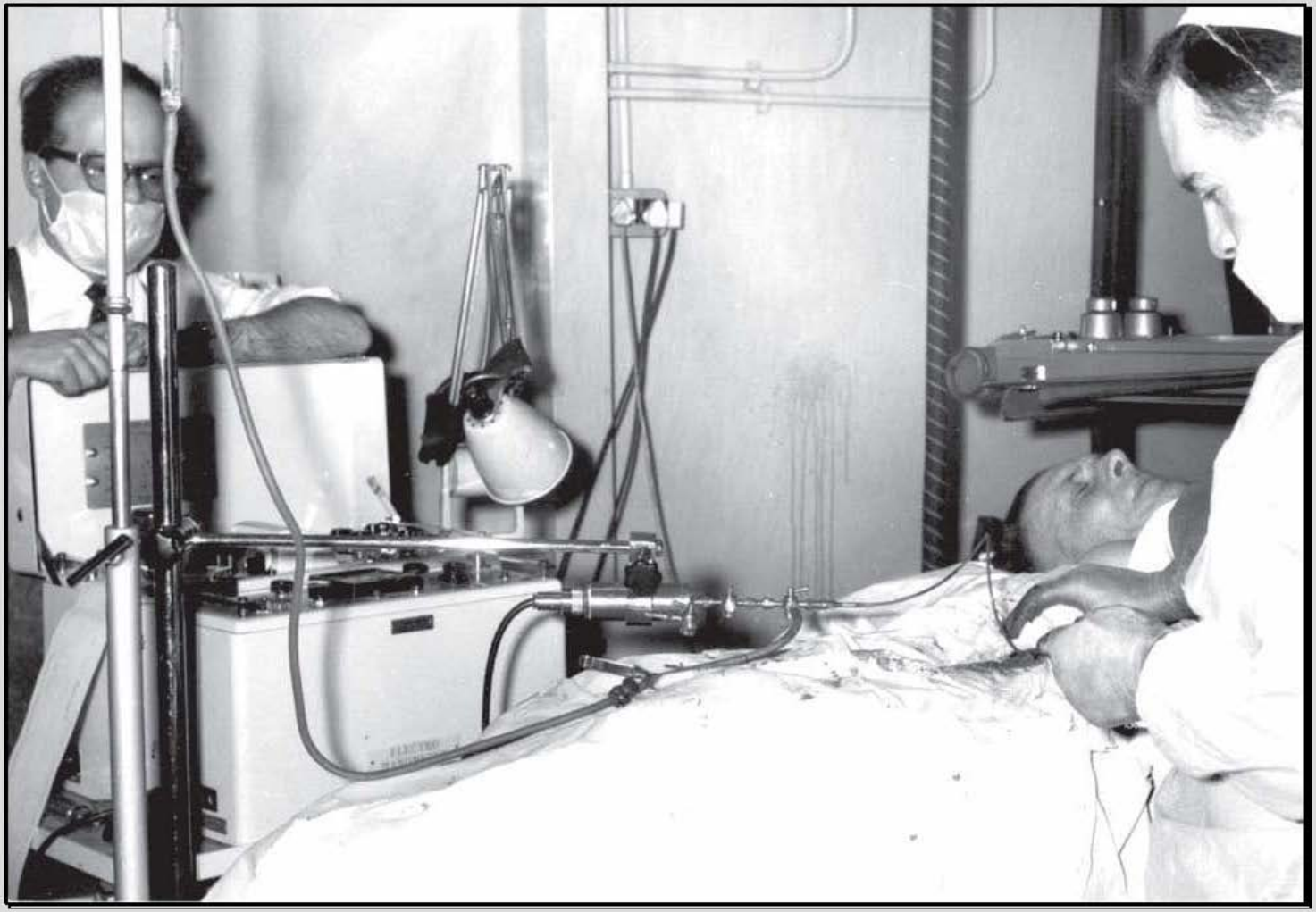
Personal History of Vascular Access for Haemodialysis

Stanley Shaldon MA., MD.(Cantab), FRCP. (Lond)

50th Anniversary of Dialysis in Munich

Hepatic Vein Catheterisation. Royal Free Hospital 1959



Femoral Catheterisation (Lancet, 1961)

Preliminary Communication

reprinted from THE LANCET, *October* 14, 1961, *pp.* 857-859

HÆMODIALYSIS BY PERCUTANEOUS CATHETERISATION OF THE FEMORAL ARTERY AND VEIN WITH REGIONAL HEPARINISATION

THE prognosis of acute uræmia seems to be better if patients are dialysed frequently,[1 2] and intermittent dialyses in patients with chronic renal failure are also giving promising results. Some revision of the standard "cut down" procedure for the introduction of hæmodialysis catheters is therefore necessary if enough vessels are to be available for repeated use. Scribner et al.[3] introduced a prosthetic arteriovenous fistula, which was left in the patient between dialyses and which could easily be connected to an artificial kidney when dialysis was required. We have devised an alternative procedure which does not necessitate a prosthetic attachment to the patient between dialyses. It can also be used for a single dialysis. Catheters are introduced into the femoral artery and vein by the percutaneous Seldinger technique,[4] and the same vessels may be used repeatedly. Regional heparinisation in hæmodialysis has been reported from the United States [5–7] but not in this country. We now use it routinely for all cases which require dialysis.

TECHNIQUE

Preparation of the Dialysis Catheters (fig. 1)

Odman-Ledin [8] plastic yellow tubing * (external diameter 3·0 mm., internal diameter 1·6 mm.) is gently heated over the

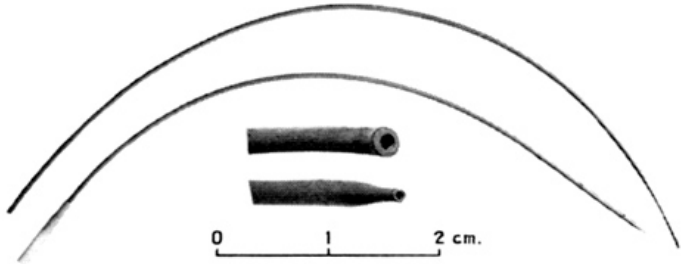


Fig. 1—Odman-Ledin plastic tubing before and after making a dialysis catheter, with close-up of tip before and after drawing out on Seldinger wire.

artery and vein in less than 5 minutes without discomfort to the patient. Removal is achieved by rapidly withdrawing both catheters simultaneously from the artery and vein, and immediately applying manual pressure in the groin for at least 20 minutes. Adequate manual pressure is essential to prevent the development of hæmatomata.

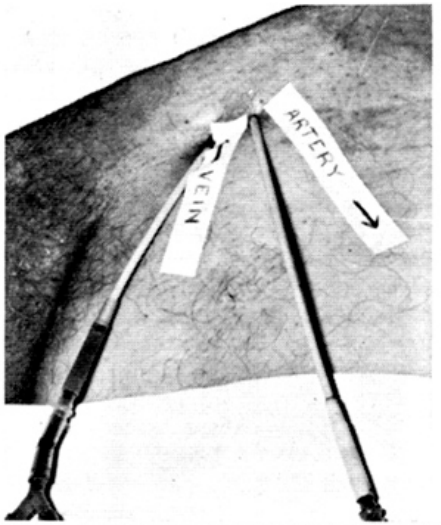


Fig. 2—Dialysis catheters inserted by the percutaneous technique into the femoral vein and artery.

Regional Heparinisation (fig. 3)

The principle of regional heparinisation is to supply anticoagulated blood to the artificial kidney, whilst not interfering with the normal coagulation of blood in the patient. This has previously been done by using infusions of heparin and protamine sulphate. Hexadimethrine bromide ('Polybrene', Abbott), a synthetic polymer of a quaternary ammonium salt, which has been shown to neutralise the anticoagulant effect of heparin,[9] has been used in place of protamine because fewer side-effects have been reported. Preliminary tests in vitro, using a modified thrombin clotting-time,[7] suggested that 1·8 mg. of hexadimethrine would neutralise 1·5 mg. (150 units) of heparin.

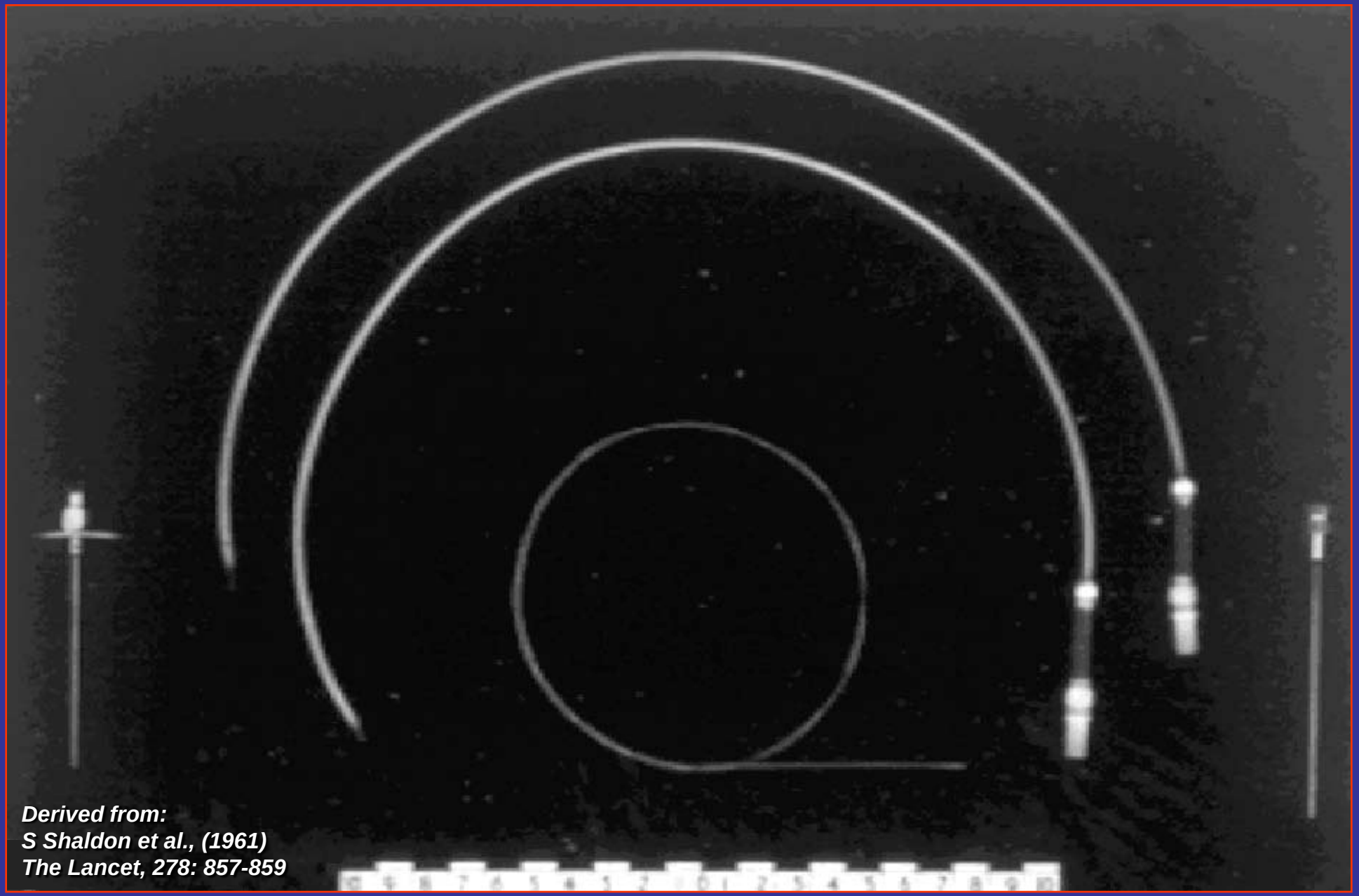
STANLEY SHALDON
M.A., M.D. Cantab., M.R.C.P.
Lecturer

LIVIO CHIANDUSSI
M.D. Padua
British Empire Cancer Campaign Research Fellow

BRENDA HIGGS
M.B., B.SC. Lond.
Senior House-Officer

The Department of Medicine, Royal Free Hospital, London, W.C.1

Femoral Catheters in 1961



Derived from:
S Shaldon et al., (1961)
The Lancet, 278: 857-859

British Medical Journal Editorial (1963)

BRITISH MEDICAL JOURNAL

LONDON SATURDAY JUNE 29 1963

Pointers

Phenylketonuria : Recommendations of an M.R.C. Conference on the detection and dietary treatment of phenylketonuria (p. 1691). Pamphlet reprints available. Leader on p. 1686.

Kidney Homotransplantation : Mr. W. J. Dempster defines four types of anuria after transplantation and discusses their prevention (p. 1697).

Immunotherapy of Cancer : Professor R. C. Nairn and colleagues report immunization of a patient against her own advanced renal cancer. They discuss therapeutic implications (p. 1702).

Hodgkin's Disease : Nearly 40% of patients with localized Hodgkin's disease, lymphosarcoma, or reticulosarcoma survive as long as the general population (p. 1704).

Pyelonephritis in Children : Report from Czechoslovakia on treatment (p. 1707).

Iron-deficiency Anaemia : Buccopharyngeal lesions and koilonychia are conspicuously

New Developments with Artificial Kidney

A "self-service" approach to the artificial kidney is reported by Dr. Stanley Shaldon and his colleagues in a preliminary communication at page 1716 of the *Journal* this week. They describe the case of a patient who enters hospital twice a week in the afternoon, connects himself to an artificial kidney, and after undergoing haemodialysis leaves the following morning. Two catheters have been introduced percutaneously through the same femoral vein into the inferior vena cava. They remain there and are easily accessible to the patient. The authors have trained him to connect himself to the artificial kidney. The dialyses can be performed with the help of a trained nurse, no medical attention being required. The cost of maintaining such a patient is said to be as low as £500 per year.

Cold Coil Dialysis (1963)

On admission

5 weeks later

Refrigerated Femoral Venous-Venous Hemodialysis with Coil Preservation for Rehabilitation of Terminal Uraemic Patients

Case history:

A 30 year old male draughtsman, PP, developed malignant hypertension and progressive renal failure. He was referred to the Royal Free Hospital Unit, three months after the onset of symptoms, in a terminal uraemic state; vomiting, drowsy and virtually blind from advanced papilloedema and with gross fundal haemorraghes and exudates with bilateral macular involvement. His blood pressure was 260 / 160 mm Hg.

He was treated initially by short daily hemodialysis with progressive ultrafiltration. Between dialysis he received a diet containing 10 meq Na. Within one week his blood pressure stabilised at 120 / 80 and his vision began to improve. He received no hypotensive therapy (the original antihypertensive medication had been stopped). He left hospital 5 weeks later with eyesight fully restored and is currently on long term dialysis program 2 x weekly 12 hours overnight and a 22 meq salt restricted diet. Three months later he restarted work with a blood pressure of 120 / 70.

S Shaldon, AI Rae, SM Rosen, H Silva, J Oakley,
Br Med J; 1:1716-1717 (1963)

British Medical Journal (1963)

"... The possibility of electronic monitoring replacing nursing monitoring must be considered. If this could be achieved the ultimate aim of home dialysis could result in the treatment of larger numbers of patients at present dying with terminal renal failure. ..."

Shaldon, S. et al., British Medical Journal, 29th June, 1963. Vol. 1. p 1717-1718.

Unattended Overnight Home Dialysis

Patient OH,
age 45.

First *unattended overnight Home Haemodialysis*
October 1964

First Report of Overnight Home HD

Reprinted from Excerpta Medica International Congress Series No. 103
Proceedings of the Second Conference of the
EUROPEAN DIALYSIS AND TRANSPLANT ASSOCIATION
Newcastle-upon-Tyne, September, 1965

OVERNIGHT HAEMODIALYSIS IN THE HOME

ROSEMARIE A. BAILLOD, CHRISTINE COMTY, M. ILAHI,
F. I. D. KONOTEY-AHULU, L. SEVITT and S. SHALDON

Renal Unit, Royal Free Hospital. London N.W.3, England

Although haemodialysis is an effective form of treatment for chronic renal failure, the economic burden has limited its expansion. In addition, the total dependence of the patient on the hospital unit has produced many psychological problems. For this reason, we have undertaken a programme of home haemodialysis for patients with the assistance of their spouses. To date, we have 32 months of home dialysis experience with 256 overnight home haemodialyses derived from six patients.

National Kidney Centre, London 1966

Milton Roy Model A 1965

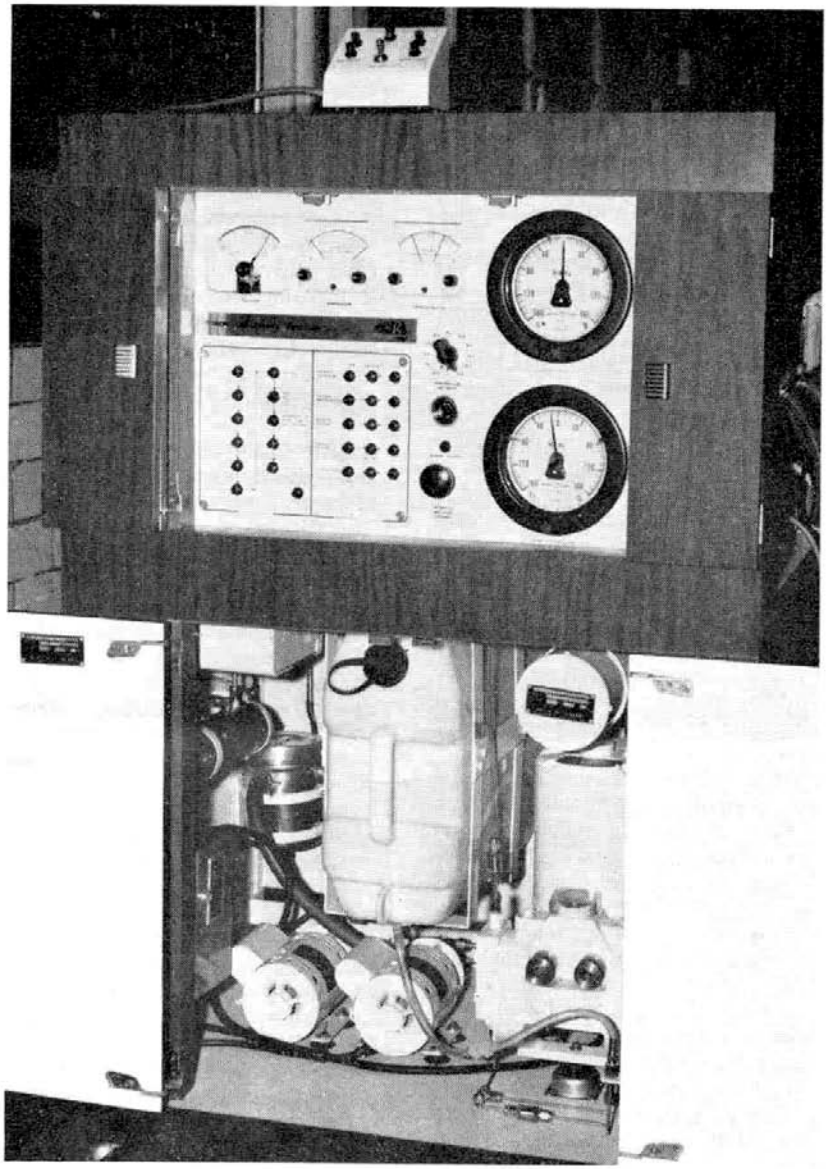


FIG. 2—Console containing proportioning pumps for dialysate preparation, full monitoring system for dialysis and automatic heat sterilisation sequence at the beginning and end of dialysis (*see text*).

HD Training at NKC, 1967

Learning ***in bed*** following leg cannulation

Semi ambulant learning to operate the system

Fully ambulant prior to returning for home HD

National Kidney Centre London, 1966-1974

First Out-of-Hospital Dialysis Centre

Proceedings of the Fourth Conference of the European Dialysis and Transplant Association
Paris, June 1967

AN INDEPENDENT SPECIALIST HOME HAEMODIALYSIS TRAINING AND SUPPORT UNIT

S. SHALDON and J. J. OAKLEY

The National Kidney Centre, 1 Fairholme Gardens, London, N.3, United Kingdom

Two years experience of home dialysis on a limited scale had suggested that this form of treatment is superior to hospital dialysis as its running costs are less, it produces fitter patients, less staff and space problems and less risk of infection and hepatitis (Baillod *et al.*, 1966). In addition, it has shown that:

1. Hospitalization back-up was virtually unnecessary.
2. Remoteness from the training and support centre was not critical.
3. Need for expert medical supervision was infrequent and usually related to recannulation.
4. Outpatient recannulation was a practical proposition.
5. Blood transfusions were not routinely necessary.

National Kidney Centre

UK Home Patients 1966-68

28 patients installed on home HD between 1966-1968

Greater London (11), Belfast (1), Middlesborough (1), Liverpool (2), Stoke/Trent (1), Birmingham (2), Coventry (1), Oxford (1), Cardiff (1), Luton (1), Harlow (1), Stevenage (1), Southend on Sea (1), Maidstone/Kent (1), Exeter (2)

National Kidney Centre, London, 1967

THESE PEOPLE ARE BUYING THEIR LIVES FOR THREE YEARS AT A COST OF £7,000 EACH. WHATEVER HAPPENED TO THE WELFARE STATE?

(and whatever happens to those without £7,000?)

The house with the gilded chandeliers and the velvet drapes is in Finchley, North London. It is the headquarters of the National Kidney Centre, a non-profit-making charitable trust set up because one man feels that the National Health Service is going about the treatment of kidney disease in the wrong way. The man is . . .

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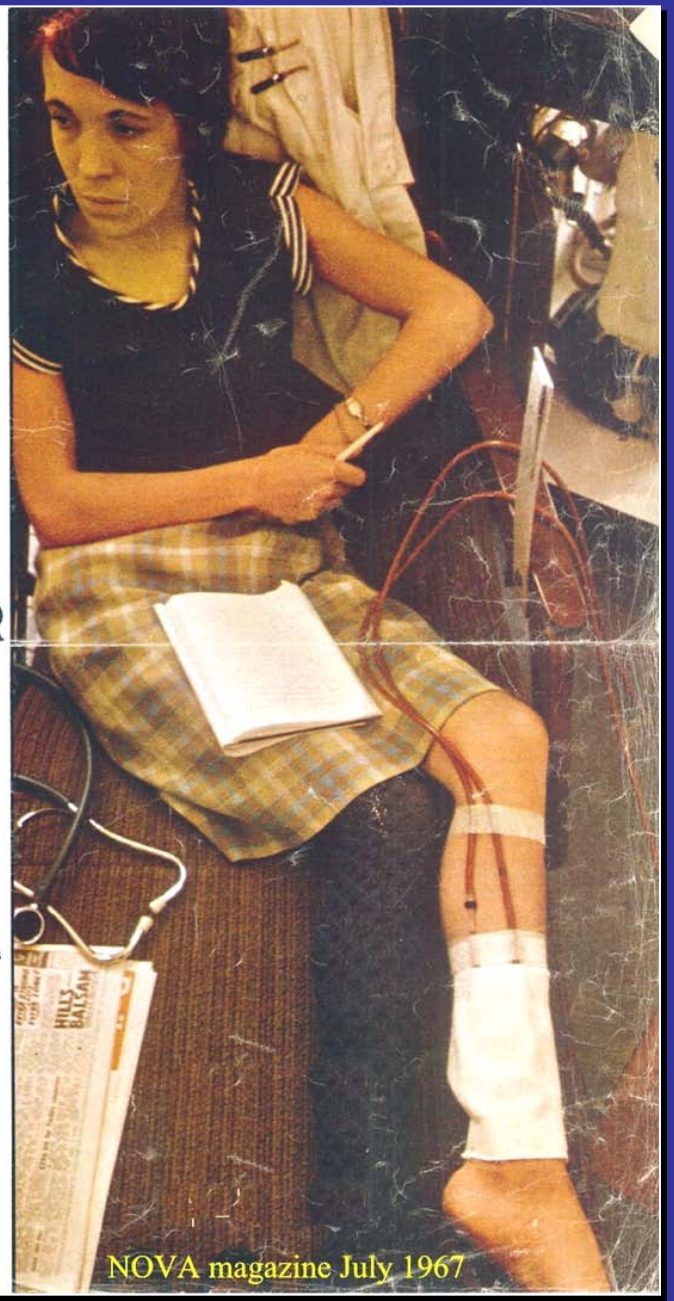
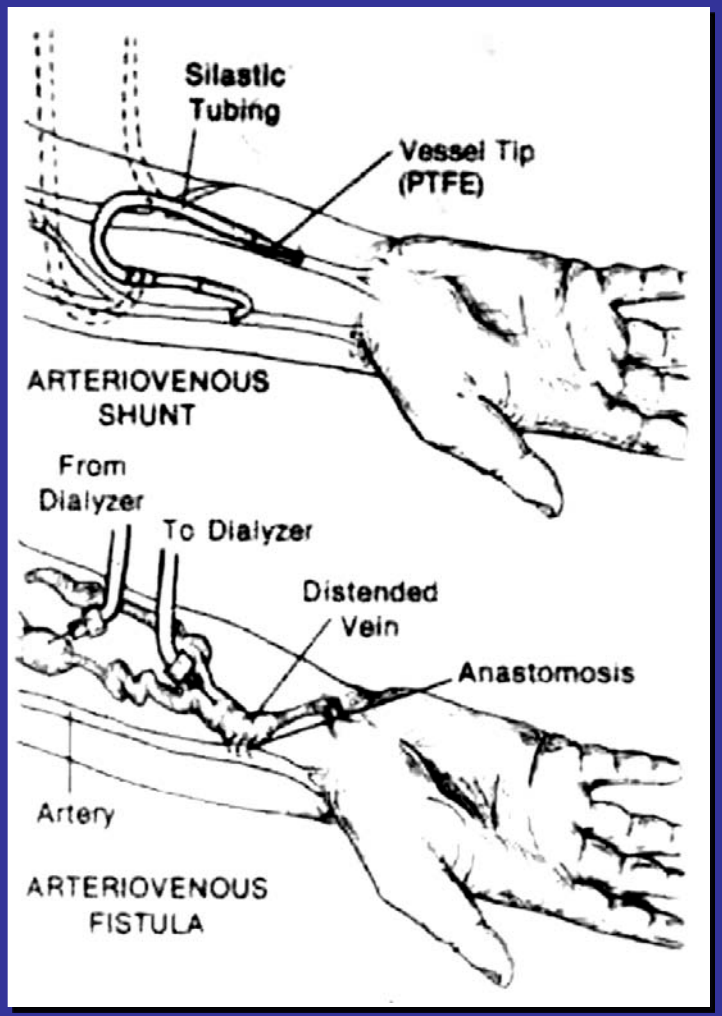


NOVA magazine July 1967

Brescia-Cimino AV Fistula 1966



In my opinion, probably the *most important contribution* to long term survival of haemodialysis patients

Brescia MJ, Cimino JE, Appel K, Hurwich BJ. Chronic hemodialysis using venepuncture and a surgically created arterio-venous fistula. New Engl J Med. 1966;275;1089

First reported use of AV fistula in unattended overnight Home Haemodialysis in 1968

Reprinted from the BRITISH MEDICAL JOURNAL
14 *December* 1968, 4, 671–673

Use of Internal Arteriovenous Fistula in Home Haemodialysis

STANLEY SHALDON,* M.D., M.R.C.P.
SHEILA McKAY, R.G.N.

Summary: Five patients with previous experience of home haemodialysis (lasting one to two years) had internal arteriovenous fistulae created in a previously non-cannulated limb. After training of the spouses or patients to insert the needles, the arteriovenous cannulas were removed and the patients maintained on fistula dialysis in the home, unattended, overnight, for periods of 1 to 11 months (total patient experience of 30 months). All patients expressed a preference for the arteriovenous fistula, and no significant medical complications have been noted to date.

The safe use of a blood pump in the home, overnight, was achieved by the addition of an extra monitor on the outflow (arterial) blood line.

Self Puncture AV Fistula NKC London

Self Puncture AV Fistula NKC London

1969

The First German Home Dialysis Patient

Erwin K.:
First German home dialysis patient, training at National Kidney Centre London 1968

EK solved the problem of reimbursement by establishing a contract between himself and AOK, thus permitting the Krankenkasse to reimburse a hospital treatment at home, without involving the GP.
This *precedent permitted the KFH to be created one year later*, acting as a broker on behalf of the patient.

National Kidney Centre 1969

Prof KM Koch and his sons

National Kidney Centre, August 1968

Drs Oppermann and Debusmann

NKC - KfH Joint Venture, 1969 - 1971

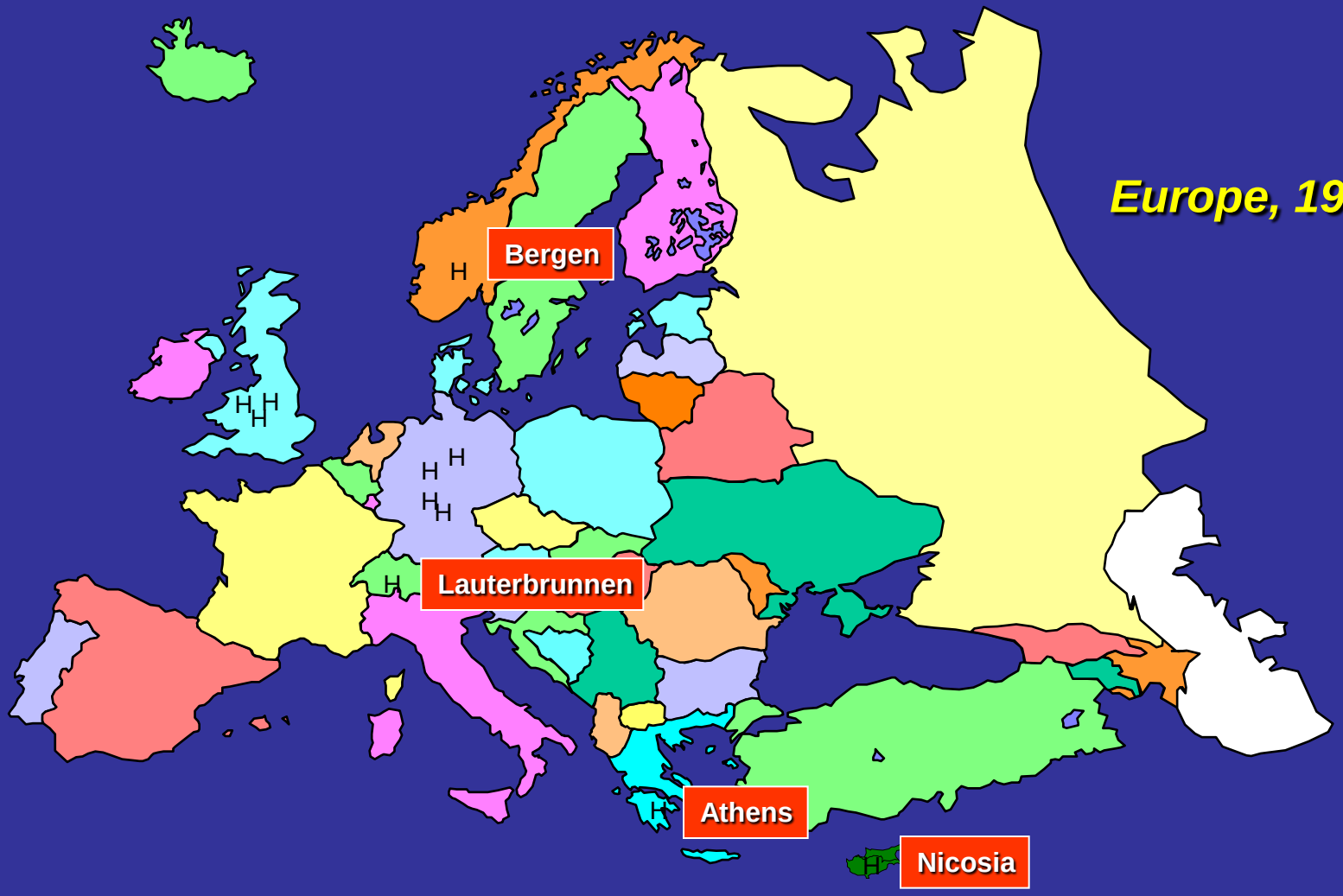
* Home Training Centre

35 patients **trained in London and 3 training centres established in Germany**

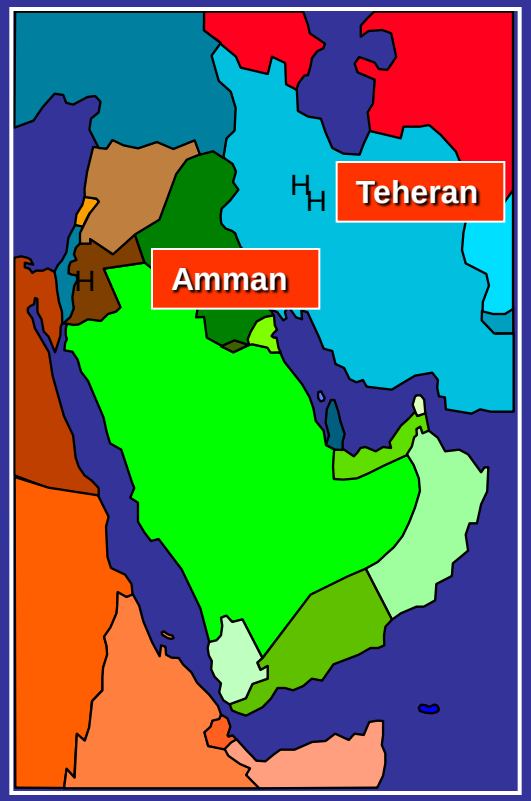
***Frankfurt Area (15), *Goettingen (5),* Hannover (4),**

Rendsburg (1), Kassel (2), Kreuztal - Ferndorf (1), Hanau (2), Darmstadt (1), Stuttgart (1), Munich (2)

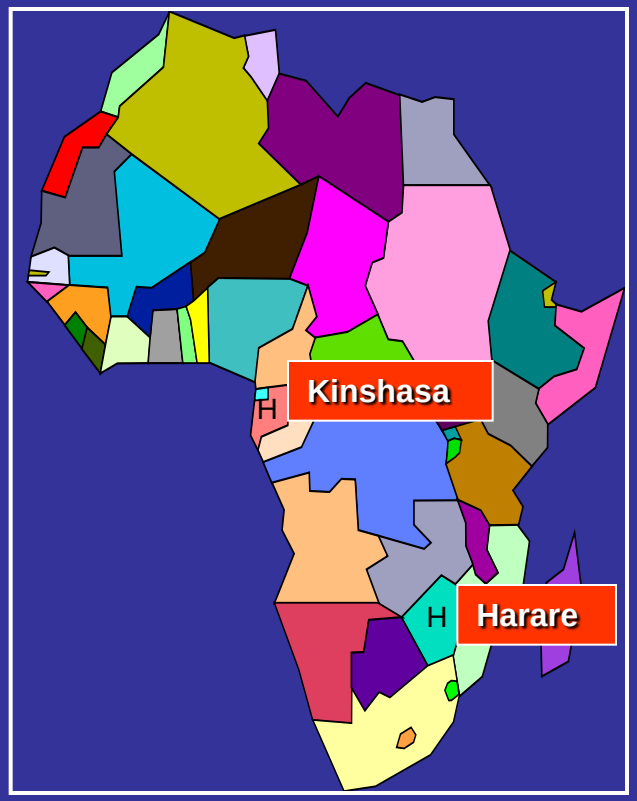
Home Dialysis Patients Trained by NKC



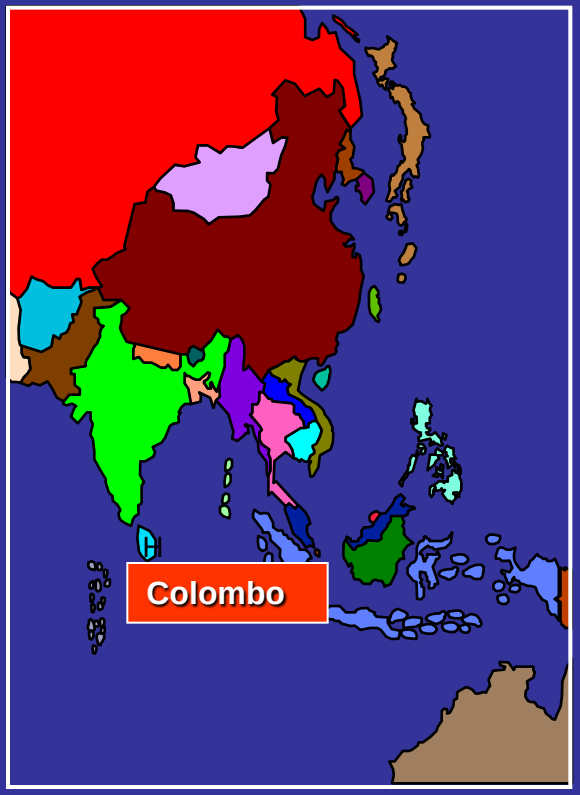
Home Dialysis Patients Trained by NKC



Middle East



Africa

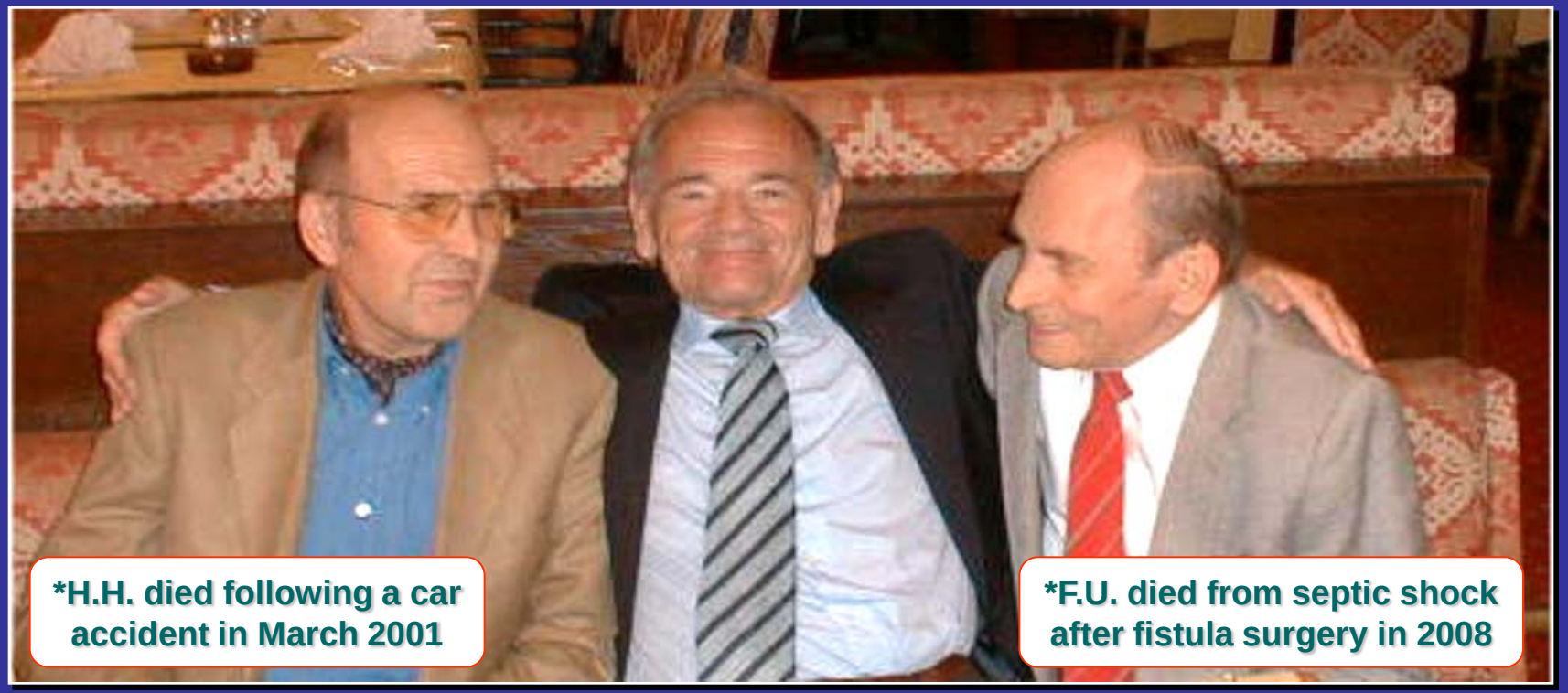


Asia Pacific

1966 - 1972

Longterm HD Survival

*H.H.:	1935 - 2001	*F.U.:	1938 - 2008
First HD:	19.01.1970	First HD:	19.01.1970
First AV fistula:	1970 - 1991	First AV fistula:	1970, used for more than 38 years
Second AV fistula:	1991 - 2001		



Self dialysis at home: Salt restricted diet: Both normotensive
Both received only IV iron 3 x week at home
Zero blood transfusions: since 1990 very occasional EPO

Longest Surviving AV Fistula: 38 Years +

Frith Uecker, D-24787 Fockbek

May 24th, 2006

Dear Doctor Shaldon!

In my 37th year of dialysis the haemo-diafiltration is effective during 4½ hours, three times a week in the afternoon. I feel well myself when dialysing, the blood pressure being constant 80 to 60 (90 to 60) then, my weight having reduced of about 2 kg each time and the potessium fallen from 5 or 5,5 to 3,8 or 3,6. The fistula ("side to side") You have made in 1970 is excellent.

6.123 dialyses with this AV fistula SELF PUNCTURING 24th May 2006

Constructed 20-01-1970 by S Shaldon

Conclusions

- The dominant theme of my personal history of vascular access was to facilitate **self-dialysis** and **patient independence**. The goal that haemodialysis would become the insulin of the chronic nephritic has yet to be achieved.
- The **National Kidney Centre London**, although never credited for its pioneering role in UK or in the history books, played a **significant part** in the development of home and limited care dialysis throughout Europe and the Middle East. It anticipated NMC (FMC today) by more than 1 year.
- It trained and installed at home 35 patients throughout Germany and was **instrumental** in the **founding** of **KfH**, the largest provider of dialysis today in Germany