

INSTRUMENTS AND TECHNIQUES\*

# Prolonged access to the venous system using the Hickman right atrial catheter

G SAGOR FRCS

Senior Surgical Registrar†

P MITCHEMERE FRCS

Senior Surgical Registrar

J LAYFIELD MB BS

House Surgeon

H G PRENTICE MRCP MCRPath

Senior Lecturer and Honorary Consultant, Academic Department of Haematology

R M KIRK MS FRCS

Consultant Surgeon, Royal Free Hospital, London

**Key words:** VENOUS SYSTEM, CATHETERISATION; HICKMAN RIGHT ATRIAL CATHETER; PARENTERAL NUTRITION; CHEMOTHERAPY

## Summary

Seventy-one Hickman catheters were inserted into 63 patients for prolonged access to the venous system. The mean catheter life was 98 days, but despite the long life in situ provided by these catheters only 5 (7%) had to be removed for septic complications. The technique of insertion is described and the subsequent management of these catheters discussed. The management of patients receiving parental nutrition, those undergoing bone marrow transplantation for acute leukaemia, and those having cytotoxic chemotherapy was greatly facilitated by the use of the catheter.

## Introduction

Patients undergoing bone marrow transplantation for leukaemia or having prolonged cytotoxic therapy for solid tumours often develop impairment of veins due to local toxicity of drugs. This makes both the administration of drugs and taking blood for monitoring purposes difficult and thus distressing for both patient and doctor. Patients requiring prolonged hyperalimentation may run into similar problems as the conventional 'long-line' catheters require changing weekly to avoid problems of infection. The administration of feeding solutions in a simultaneous fashion through 'Y' or 'W' giving sets is difficult with these catheters owing to the viscosity of some of the solutions and the small diameter of the lumen. The Hickman right atrial catheter and its mode of insertion has overcome these problems.

This paper reviews the long-term use of the catheter in 63 patients.

## The catheter

The Hickman right atrial catheter (Evergreen Medical Products Inc.) is a Silastic catheter with a Luer-Lock cap sealing the hub (Fig. 1). Thirty centimetres from the hub there is a small Dacron cuff the purpose of which is to incite a fibrous response, thus stabilising the catheter. The diameter of the lumen is 1.6 mm. The catheter resists kinking.

Correspondence to: P Mitchemere FRCS, Department of Surgery, Royal Free Hospital, London NW3 2QG.

† Present appointment Consultant Surgeon, St Albans City Hospital, St Albans, Herts.

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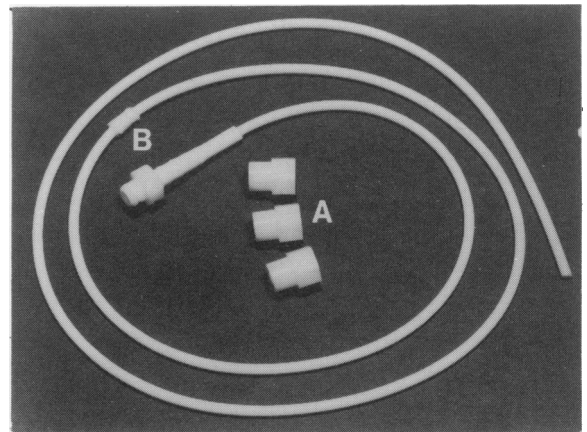


FIG. 1 The Hickman right atrial catheter with Luer-Lock caps (A). The Dacron cuff (B) is seen 30 cm from the hub.

## Technique of insertion

The internal jugular vein on either side provides access to the venous system. General anaesthesia is preferred, but local anaesthesia may be used for very ill patients. To expose the vein to the maximum a sandbag is placed under the shoulders, the neck extended, and the head rotated to the opposite side.

A 2.5-cm incision is made over the lower part of sternomastoid and the two heads of this muscle separated, thus exposing the internal jugular vein (Fig. 2). The investing fascial sheath is cleared and the vein isolated over a short distance with nylon tapes.

A stab incision is made in the skin over the anterior chest wall above and medial to the nipple. A subcutaneous tunnel is fashioned with artery forceps from this site to join the neck incision. The catheter is threaded through this tunnel so that the Dacron cuff sits in the subcutaneous tissues.

The length required to reach the right atrium or lower superior vena cava is estimated and the catheter is then trimmed to this length, connected to a syringe, and filled with saline. A purse-string suture is placed in the vein, using

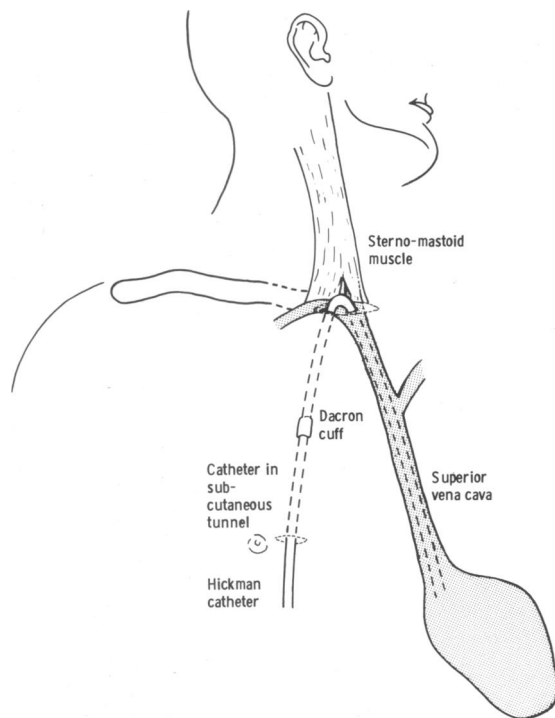


FIG. 2 Diagrammatic representation of the operative procedure.

a fine vascular stitch. A venotomy is made within the confines of the suture. The catheter is threaded through this into the right atrium and the suture tied. The catheter hub is connected to an infusion set and the wound is closed. A chest X-ray should be taken on the table to check the position of the catheter.

#### Subsequent management of the catheter

Swabs are taken for culture from the exit site every week. If clinically indicated, blood cultures are taken from the catheter.

When the patient leaves hospital the hub is sealed with the Luer-Lock cap. Every 48 h the patient instils 2 ml of preservative-free heparin (2000 U) into the lumen of the catheter to prevent clot formation. To prevent air from being sucked in the tube is clamped before the cap is unscrewed.

When it is no longer required the catheter is removed under local anaesthesia. The tissue around the Dacron cuff is loosened with an artery forceps and the catheter is withdrawn, pressure being applied to the internal jugular vein for 5 min. The tips of all removed catheters are cultured.

#### Patients and indications

Seventy-one Hickman catheters were inserted into 63 patients (39 male and 24 female). Six patients had a second catheter inserted on the opposite side, while 1 had 3 catheters inserted. The indication for catheterisation was chemotherapy of a solid tumour in 23 cases, treatment of leukaemia in 27, and prolonged intravenous feeding in 13.

#### Results

The mean catheter life in the series was 98 days (range 4–480 days, median 52 days).

Complications were encountered in 15 patients (see table). However, only in 6 cases did this necessitate removal of the catheter. The fate of all the inserted catheters was as follows: 36 catheters were removed at completion of the treatment; 7 catheters were in situ at the time of review; 22 patients died of their disease or complications of the disease with the catheter in situ; and 6 catheters were removed for complications directly attributable to the catheter.

#### Complications due to catheter

Complication	Number	Details	Fate of catheter
Sepsis	5	3 septicaemia	Removed
		1 suspected septicaemia	Removed
		1 exit site infection	Removed
Aspiration problems	6	Fluid inflow normal; aspiration of blood difficult	All retained
Incorrect siting of catheter tip	2	{ 1 in axillary vein	Both retained
		{ 1 in azygos vein	
Axillary vein thrombosis	2	Both catheters corrected sited at operation	1 removed, 1 retained

#### Discussion

The use of Silastic catheters for parenteral nutrition was first reported in 1973 (1). Recent reports indicate that intravenous catheters may remain in situ for prolonged periods (2, 3). The long-term life of the Hickman catheter reported in this series (mean 98 days) is attributed to its wide diameter, the low incidence of infection, and the ability of the patient to manage his own 'long-line'.

The wide diameter of the catheter allows a wide variety of fluids and blood components to be administered despite the high viscosity of some of these substances. It is ideal for use in patients with acute leukaemia undergoing bone marrow transplantation (4). The catheter obviates repeated venipunctures and is therefore of great value in children and in chronically ill immunosuppressed patients, who often have a paucity of peripheral veins and who are prone to septicaemia.

In this series only 5 catheters had to be removed for septic complications despite the fact that many of the patients were immunosuppressed and all had major illnesses or had undergone gastro-oesophageal surgery. The patients were often pyrexial and frequently causes other than catheter sepsis were found to account for this. A persistent pyrexia per se did not necessarily constitute an indication to remove the catheter. The low incidence of catheter-related sepsis has been achieved by a strict aseptic technique of insertion in the operating theatre. In addition the increased distance between the skin entry site and the internal jugular vein decreases the risk of infection gaining access to the blood stream (5).

The Hickman catheter affords advantages to patients undergoing intermittent chemotherapy. Outpatient treatment is possible after instruction of the patient in catheter asepsis and the instillation of heparin to prevent thrombotic complications. The position of the catheter allows freedom of neck and arm movement, the Dacron cuff providing stability by inciting a fibrous tissue response around it.

Mechanical problems with the catheter are reported in only 9 (13%) cases, but in only 1 patient with an axillary vein thrombosis was it necessary to remove the catheter. When difficulties were encountered with either aspiration of blood or incorrectly sited catheters it was often possible to manoeuvre the catheter under X-ray control to a satisfactory position. It is stressed that where possible the Hickman catheter should be inserted under X-ray control.

The Hickman is more expensive than conventional long-line catheters, its cost at the time of writing being £22. Viewed in relation to the cost of all inpatient treatment this is not considered excessive. It is suggested that as the method provides such reliable access to the central venous system consideration should be given to its use as a preliminary for patients who are in a poor nutritional state when first seen and cannot be restored to a biochemical balance by oral

feeding or for patients undergoing a major surgical procedure that will prevent oral feeding for 5–7 days.

Grateful acknowledgements are extended to Drs M Shannon and R Corringham, Registrars in Haematology and Oncology at the Royal Free Hospital. We should also like to thank the Department of Medical Illustration at the Royal Free and Mrs G R Wynne for typing this manuscript.

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## Notes on books

**Pharmacoangiography in the Diagnosis of Tumours** by Gy Vargha. 253 pages, illustrated. Akademiai Kiado, Budapest. \$32.

The author is Professor of Radiology in Debrecen, Hungary. The book deals with the angiographic diagnosis of tumours of kidneys, bone, joints, soft tissues, and also gastric and bronchial neoplasms. It reports experimental angiographic studies using vasoactive drugs to detect hyper- and hypovascularised tumours.

**Physicians' Handbook** by M A Krupp, L M Tierney Jr, E Jawetz, R L Roe, and C A Camargo. 20th edn. 774 pages, illustrated. Soft covers. Lange Medical, Los Altos. \$12.

The appearance of the twentieth edition of any book is a guarantee of its worth and its general appeal. This is a true *vade mecum*—compact and packed with valuable, up-to-date information.

**International Advances in Surgical Oncology. Volume 5** edited by G P Murphy. 404 pages, illustrated. Alan R Liss, New York, and Heyden and Son, London NW4. £43.70.

Specific topics in diagnosis and treatment are discussed. These include laser surgery, mechanical stapling techniques, hyperthermia, non-ionising radiation, and combined treatments. The book is aimed at surgeons, medical oncologists, and radiotherapists.

**Female Incontinence** edited by N R Zinner and A M Sterling. 413 pages, illustrated. A R Liss, New York, and Heyden and Son, London NW4. £43.70

This is Volume 78 in the series of 'Progress in Clinical and Biological Research'. It reflects the impact of advances in urodynamics displayed at a joint meeting of the International Incontinence Society and the Urodynamics Society in Los Angeles in 1980. The first group of contributions discusses female incontinence in particular and urodynamics in general. In the second part are displayed specific aspects of research in both fields of relevance to each other.

**Techniques of Anaesthesia** by J A Thornton and C J Levy. 2nd edn. 574 pages. Chapman and Hall, London. £16.50.

The authors, from Sheffield, retain the aim in the second edition to provide practical advice. The subtitle of the book indicates that it deals with management of the patient and intensive care. Apart from the expected subjects it deals with obstetric anaesthesia, pain relief clinics, adjacent units, and resuscitation units.

**Munro Kerr's Operative Obstetrics** by P R Myers-conger. 10th edn. 508 pages, illustrated. Baillière Tindall, London. £25.

It is a tribute to the concept of any book that it appears in 10 editions. The account of caesarean section has been rewritten. Preterm labour, low birthweight, and handicaps are discussed for the first time. The reference lists have been revised and updated. Some of the excellent illustrations are in colour. This is a finely produced book.

**Critical Problems in Vascular Surgery** edited by F J Veith. 472 pages, illustrated. Prentice/Hall, Hemel Hempstead. £31.90.

This book is aimed at vascular surgeons facing difficult and controversial problems. Consequently, to reveal opposing views, two authorities have been given the opportunity to display these differences. The book stems from the 1980 Montefiore–Einstein Vascular Symposium.

**Lecture Notes on Urology** by John Blandy. 3rd edn. 384 pages, illustrated. Paperback. Blackwell, Oxford. £8.50.

Professor Blandy is to be congratulated. As he states, this is almost a new book rather than a new edition. The sheer practicality makes it a model of clarity and directness. It is excellent for undergraduates and interns and, except for operative detail, valuable for FRCS candidates—a winner.

**Surgical Pathology of the Nervous System and its Coverings** by P C Burger and F S Vogel. 2nd edn. 739 pages, illustrated. John Wiley, Chichester. £50.50.

The presentation is anatomical, proceeding from the skull to brain, sella turcica, epidural space, spinal cord meninges and nerve roots, and peripheral nerves. The book is well illustrated and full references are given to the literature. Updating has allowed the inclusion of entities not mentioned in the first edition and the display of appropriate electron micrographs.

**Disorders of the Knee** edited by A J Helfet. 2nd edn. 504 pages, illustrated. Harper and Row, London. £38.50.

This edition follows the first after only five years. The helicoid knee prosthesis and knee brace and the biomechanics of knee prostheses are described. There is a chapter on sports medicine and one on instability. The book is extensively illustrated, including colour plates where appropriate. Full references to the literature are given throughout.

**Orthopaedic Rehabilitation** by V L Nickel. 594 pages, illustrated. Churchill Livingstone, Edinburgh.

Rehabilitation is directed at minimising the consequences of a disability in contrast to standard medical care, which is directed towards curing the pathological cause. In this book the author discusses the work of various members of the rehabilitation team and then systematically deals with various disorders. The book is well written and produced.

**Medical Eponyms: Who Was Coudé?** by John Lourie. 207 pages. Paperback. Pitman, London. £4.95.

In spite of the gloomy attempts of egalitarians who wish to expunge all eponyms from medicine we still glory in them, especially if they consist of a list of names strung together with hyphens. Professor Lourie has produced an excellent little pocket book. Buy it for your favourite nephew or niece who is about to start a career in clinical medicine—buy it a few days early so you can read it yourself.