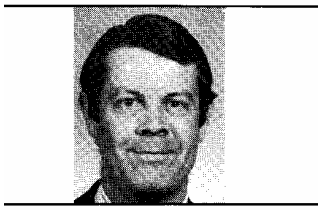

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THE SUBCLAVIAN CANNULA: TEMPORARY VASCULAR ACCESS FOR HEMODIAL YSIS WHEN LONG TERM PERITONEAL DIAL YSIS HAS TO BE INTERRUPTED

Robert Uldall
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SUMMARY

On occasions, it may be necessary to interrupt long-term peritoneal dialysis -now most commonly CAPD, because of peritonitis, mechanical and catheter problems, or to permit abdominal surgery, The most convenient way to provide vascular access for hemodialysis during these interruptions is by means of the subclavian cannula, This paper describes our experience with 41 peritoneal di , alysis patients who required hemodialysis over the last three years, Usually the complications of subclavian cannulation are not serious and can be kept to a minimum by obeying a few simple rules, This technique offers great advantages to both patient and staff, but the most important are conservation of the patient's blood vessels and the avoidence of repeated femoral punctures.

Long-term peritoneal dialysis has been a definitive mode of therapy for endstage renal failure at the Toronto Western Hospital since 1970, first as intermittent peritoneal dialysis (IPD) (1), and since 1977 as continuous ambulatory peritoneal dialysis (CAPD) (2). From the beginning the patients have enjoyed free access to temporary hemodialysis when, for any reason, peritoneal dialysis had to be interrupted. Interruptions, usually lasting for 2-3 weeks, have been necessary because of episodes of peritonitis, mechanical problems, or the need for abdominal surgery. In these circumstances we could have provided vascular access for temporary hemodialysis by prior construction of an arteriovenous fistula in every patient. We decided against this because many of these patients have poor blood vessels, because the use of prosthetic arteriovenous grafts may precipitate high-output cardiac failure in some patients, and because most of the patients would never need the fistula anyway. In the absence of an A V fistula, we were left with two alternatives -to insert a silastic Teflon shunt or to do repeated femoral punctures until PD could be started again.

Shunts destroy blood vessels, and are often undesirable or are impossible to use in elderly patients with peripheral arterial disease. For these reasons, it seems wrong to use this method of access for the sake of two or three weeks of hemodialysis. In this situation many centers use repeated femoral cannulation but this method makes the patient uncomfortable and a doctor must be present to start each dialysis.

It was for these reasons that, in the summer of 1977, we started to develop the concept of an indwelling subclavian cannula, which could be left in place after its initial insertion and not removed until two or three weeks later when hemodialysis was no longer needed.

METHOD

The subclavian hemodialysis cannula and its method of insertion and use have been described in detail elsewhere (3, 4,5). It is introduced under local anesthetic by the Seldinger technique through a subclavicular approach and a subcutaneous tunnel on the anterior chest wall. The cannula is held in place by sterile, transparent, adhesive dressings (OP-SITE) and, when not in use, it is closed off by means of Luer-Iock injection caps. It is as easy for the nurses to start hemodialysis with a subclavian cannula as with a shunt except that, because the cannula has only one pathway, it is necessary to use a singleneedle machine to provide an alternating blood flow. The other option is to employ an arm vein for the venous return if the patient has a convenient vein. Between one dialysis and the next patency is maintained by injecting heparin (5000 units in I ml) into the injection cap of the cannula when the dialysis is discontinued. This measure will prevent clotting in the cannula until dialysis is repeated one to three days later; most of the heparin will stay within the cannula because it has a deadspace volume of just under I ml. There is no need for systemic anticoagulation and we have abandoned the twice-daily heparinisation previously advocated. When the cannula is no longer needed (usually we wait until peritoneal dialysis has been resumed) the nurse removes it, applies pressure to the exit site for a few minutes and then applies a dry dressing or a BAND-AID. The scars left by the procedure are barely noticeable, and the same site can be used again if peritoneal dialysis has to be interrupted again.

RESULTS

From J anuary 1, 1978 to December 31 , 1980, 41 patients required transfer from peritoneal dialysis to hemodialysis 25 temporarily and 16 permanently. Table 1, which summarises this experience, shows the number of patients in each category. This table presents the number of patients requiring transfer in relation to the total peritoneal dialysis activity for each of the three years. It seems that although we continue to have temporary transfers, from both IPD and CAPD programs, the need is less for permanent tranfer from

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TABLE I – *The Toronto Western Hospital total experience in patient years with each type of peritoneal dialysis and number of transfers to hemodialysis in each category during the three year period.*

	IPD			CAPD		
YEAR	PATIENT YRS OF PD EXPERIENCE	TEMPORARY TRANSFERS	PERMANENT TRANSFERS	PATIENT YRS OF PD EXPERIENCE	TEMPORARY TRANSFERS	PERMANENT TRANSFERS
1978	25.9	3	2	39.8	2	3
1979	23.0	1	2	49.8	8	7
1980	18.7	3	2	60.2	8	0

TABLE 2 – *Reasons for temporary and permanent interruption of peritoneal dialysis in each modality.*

		IPD	CAPD	TOTAL
TEMPORARY (N=25) TRANSFER	Bacterial peritonitis	2	7	9
	Fungal peritonitis	0	2	2
	Post-Op: nephrectomy	1	3	4
	hernia repair	0	3	3
	cholecystectomy	0	2	2
	bowel resection	1	0	1
	Exit-site infection	1	0	1
	Poor drainage	0	1	1
	Decreased clearance	1	0	1
	During TPN	1	0	1
PERMANENT (N=16) TRANSFER	Bacterial peritonitis	3	5	8
	Fungal peritonitis	2	2	4
	Post-Op: aortic aneurysm	0	1	1
	Exit-site leak	0	1	1
	Poor drainage	0	1	1
	Decreased clearance	1	0	1
		13	28	41

CAPD to hemodialysis. The reasons for transfer to hemodialysis are shown in Table 2. The mean duration of the temporary transfers to hemodialysis was 19.5 days.

The only significant complication of subclavian cannulation was blood stream infection in nine patients; it was necessary to remove the subclavian cannula and insert it again two days later on the opposite side. The diagnosis was based on at least two blood cultures obtained from distant venous sites. All temperature elevations associated with these infections returned to normal within 48 hours after antibiotic therapy and did not recur. During 1980 we had one infection per 20 patient weeks, or to put it another way, 17% of all insertions became infected. Thus, less than one in five patients will develop this fever attributable to the cannula. The organism was *Staph epidermidis* in 50% of these episodes. Only one patient, in whom peritoneal dialysis had to be interrupted because of peritonitis, developed a subclavian cannula-related blood-stream infection and in this case the organism responsible for the septicemia was different from that which caused the peritonitis. **It** would appear that peritonitis does not predispose to septicemia in patients with a subclavian cannula. The morbidity from subclavian-cannula infections has been slight and the mortality nil. Our studies show that weekly changing of the cannula (a Seldinger guide wire is used to pass a new cannula down the same track as the one being replaced) does not reduce the infection rate.6 Therefore, we have abandoned the

practice of a weekly change and do not replace the cannula except in the rare instance when the flow becomes inadequate because of thrombosis. We did not treat patients in whom we obtained positive cultures from the subclaviancannula exit site because most of the time positive skin cultures were not accompanied by blood-stream infection.

The only other complication of this technique, trauma (4), is minimal if medical personnel inserting the cannula are trained properly and supervised. **In** our hospital the procedure is done only by members of the nephrology staff and by trainee nephrologists who spend at least six months on the renal service. We do not allow residents rotating through the department to do the procedure. A chest X-ray is done to check the position of the cannula after each new insertion. If the cannula slips part way out it must never be pushed back in again without the insertion of a guide wire to lead it back to its former position. Pushing a cannula back blind**l**y may cause perforation of the vein wall and dangerous intrathoracic bleeding. Hemodialysis nurses should be warned about this possibility. Such a perforation caused hemothorax in one of our patients (not on peritoneal dialysis and not included in this report); this patient required a blood transfusion and a thoracotomy to evacuate the clot. Fortunately this man survived without permanent disability. This is the only patient with end-stage renal failure at Toronto Western Hospital during the last three years in whom we had to use a silastic Teflon shunt.

DISCUSSION

The development of the indwelling subclavian cannula has revolutionized temporary vascular access for hemodialysis in our institution. No longer in these patients can we justify the use of a silastic-teflon shunt which involves an incision, destruction of blood vessels, and unsightly residual scars, just for two to three weeks of hemodialysis. Similarly, femoral cannulation at each dialysis, with the associated patient discomfort and medical and nursing staff inconvenience which it involves, is now a much less attractive alternative.

Subclavian cannula insertion takes 20 to 30 minutes and, when performed by a skilled operator, causes no discomfort and has a low incidence of complications. Once in place, it can be used for as long as necessary without further venous punctures; in one patient in this hospital it has been left in place for over five months. This method has the following advantages: Ease of insertion (it is no longer necessary to depend on surgeons to put in a shunt); little or no discomfort to the patient; convenience when performing dialysis; no limitation of the patient's mobility, and no disfiguring scars. Since the technique does not destroy blood vessels, it can be used repeatedly at different times in the same patient. We believe it to be the best method for temporary vascular access for hemodialysis when peritoneal dialysis must be interrupted temporarily.

ACKNOWLEDGEMENTS

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The subclavian cannula is manufactured and supplied by:

Sorenson Reseach Company Hemodialysis Division
P.O. Box 15159
Salt Lake City, Utah 84115
U.S.A.

Telephone Number: (801) 262-3875

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