

Proximal Arteriovenous Fistulae for Haemodialysis when Radial Arteries are Unavailable

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Patients with chronic renal failure are maintained for long periods with regular haemodialysis. The success of this treatment depends on repeated access to blood vessels. Quinton and associates in 1962 described the use of an indwelling Silastic-Teflon cannula, and provided a good solution to this problem. However, the complications due to thrombosis and infection of the shunts, with septic pulmonary emboli in some cases, led to the development of other techniques. As a substitute for the Silastic-Teflon cannula, Brescia and associates in 1966 reported the use of a surgically created subcutaneous arteriovenous fistula at the wrist.

Since then this procedure has been gaining popularity in the dialysis units and at home (Menno et al, 1967; Shaldon, 1968; Schupak et al, 1969; Tellis et al, 1969). A limitation to this procedure has been calcification, severe arteriosclerosis, or thrombosis of the radial artery because of previous shunts (Table I). To help patients with these adverse problems various operations using a saphenous vein graft have been designed (Chavez & Bower, 1969; May et al, 1969; Mozes, 1970; Perez et al, 1970). Our report concerns an operation that is easy to perform and does not involve the use of a vein graft. It has been successfully used in ten patients, to date.

Table I. Indications for Proximal Arteriovenous Fistulae

Radial arteries unavailable because of occlusion by:

- 1) Calcification
- 2) Arteriosclerosis
- 3) Previous arteriovenous shunts

SURGICAL TECHNIQUE

Arteriography was performed in the patients who had undergone previous indwelling shunt procedures, so as to determine the exact site of occlusion of the radial artery and thereby to determine a suitable site for the arteriovenous

anastomosis. In all patients, the radial artery was occluded at a point within 1 cm from its origin.

The brachial artery and its bifurcation as well as the cephalic vein are exposed through a transverse incision in the antecubital fossa. Incisions can be extended, if necessary, proximally on the medial part and distally on the lateral end of the transverse incision (Figure 1).

In each of the first four patients, an end-to-end anastomosis was done between the radial artery, close to its origin and the cephalic vein (Figure 2). In five patients, the transected cephalic vein was anastomosed end-to-side to the brachial artery (Figure 3). This type of anastomosis is easier to perform than on the previous group: the amount of dissection is less and the size of the anastomosis is larger. In one patient, the basilic vein was used to construct a side-to-side anastomosis with the brachial artery. In that patient, problems were encountered because the basilic vein and the brachial artery run adjacent and parallel to each other, which made it sometimes difficult to be certain whether the vein was being cannulated instead of the brachial artery. Because of that problem, we have avoided the use of the basilic vein in the construction of proximal arteriovenous fistulae.

In all patients, the size of the anastomosis was as large as it could be constructed with the available vessels, in order to obtain the greatest flow of blood. No attempt was made to limit the size of the anastomosis, since high-output cardiac failure was not encountered in these patients during the follow-up period.

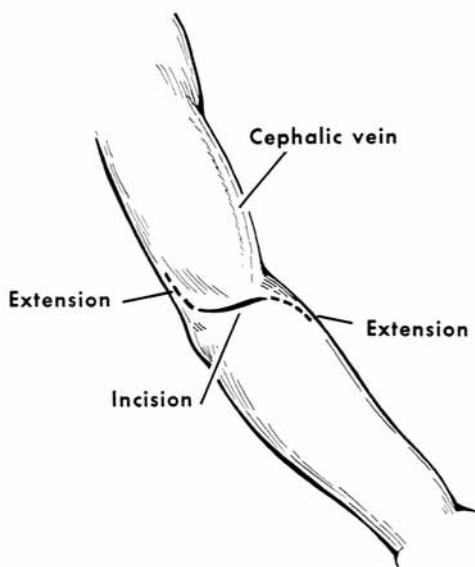


Figure 1. Transverse incision on the antecubital fossa with extensions medial and distal

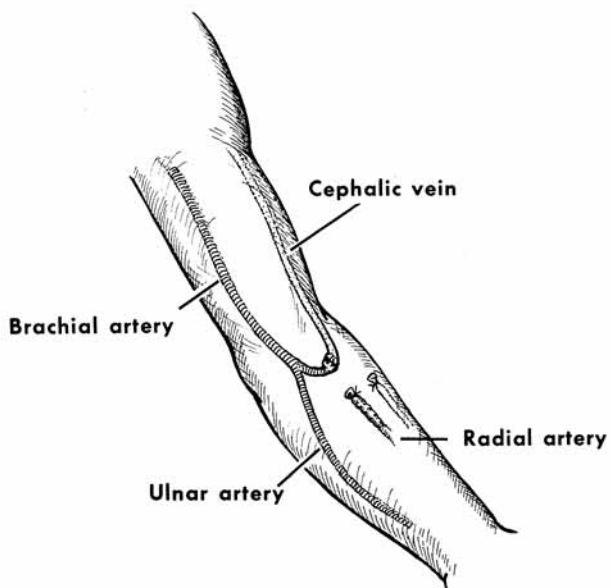


Figure 2. End-to-end anastomosis between the radial artery and the cephalic vein

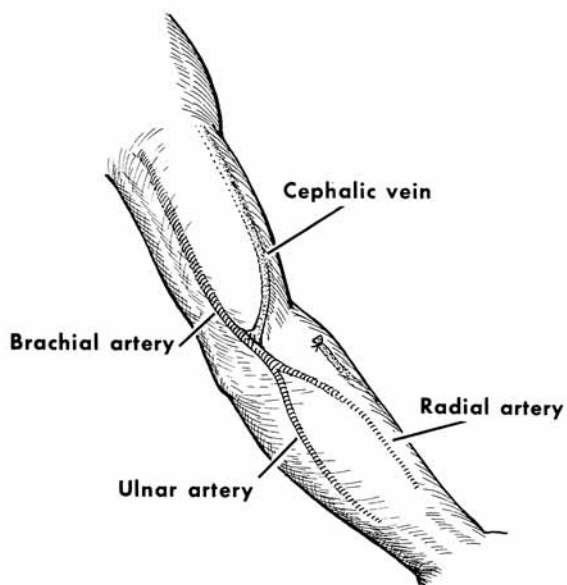


Figure 3. Cephalic vein anastomosed end-to-side to the brachial artery

RESULTS

Between December 1966 and January 1970, 10 proximal arteriovenous fistulae were created in 10 patients who were in the chronic hospital or home dialysis programmes. All the patients were on regular dialysis twice a week at the hospital haemodialysis unit and at home. The ages of the patients ranged between 18 and 46 years; there were three women and seven men. The fistulae were used for dialysis the day after operative creation in two patients, and within 15 days in the others, and were successfully used for periods of from 3 to 21 months. All the fistulae were used for haemodialysis until the patients received renal transplants, or died, except in one patient in whom an arteriovenous leg shunt was constructed after staphylococcal infection and phlebitis developed around the fistula five months after its construction.

Temporary oedema of the proximal limb occurred in two patients for a few days after the operation, but it receded spontaneously. No embolic or septicæmic complications developed in this series of patients. In none of these patients was there overloading of the circulation.

THE DIALYSIS TECHNIQUE

We followed the same technique for dialysis as that used for the fistula in the wrist. Procaine hydrochloride was injected intradermally through a 26-gauge needle at the site of venepuncture. Venepuncture was performed with the arteriovenous cannulation set (Travenol) with a 15-gauge by $1\frac{1}{2}$ inches thin-wall needle and female Luer connector.

A blood flow between 200 and 300 ml per minute (an average of 245 ml per minute) was achieved.

Although the segment of arterialised vein available for cannulation was shorter in these patients than in those in whom the site of the arteriovenous fistula was at the wrist, there was no difficulty in cannulation, except in one patient who had multiple thrombosed veins and in whom the flow was inadequate.

COMMENT

Several advantages of the arteriovenous fistula over the external Silastic-Teflon shunt described by others were confirmed by our experience. These advantages include decreased incidence of infection, clotting and haemorrhage, fewer operations for shunt revision, and less responsibility for the patient in regard to care of the shunt.

The proximal arteriovenous fistula proved to be satisfactory for dialysing patients in whom the radial artery at the wrist was not available. The blood flow volumes were comparable with those obtained with arteriovenous fistulae at the wrist or with external arteriovenous shunts. Proximal arteriovenous fistulae were successfully used in home dialysis patients.

SUMMARY

For patients who must be maintained on regular haemodialysis, and in whom no radial artery is available (because of prior shunts), arteriovenous fistulae have proved satisfactory. In 10 patients proximal arteriovenous fistulae were created between the brachial or radial artery and the cephalic vein and successfully used for from 3 to 21 months at the haemodialysis unit in the hospital and at home. The blood flow obtained ranged between 200 and 300 ml per minute.

The results indicate to us that the arteriovenous fistula at the elbow may be successfully used for regular dialysis on patients in whom the radial artery in the wrist is not available. The new site provides a good vein for venepuncture and has presented no major complications.

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