Patients with end-stage-renal-disease (ESRD) usually have a number of co-morbid conditions in addition to their renal disease. The nephrologists, should refer the patients for arteriovenous fistula (AVF) early enough to provide time for the fistula to mature.

Choice of Vascular Access

For a long time the policy in our unit is to construct autogenous AVF whenever possible, either radiocephalic, brachioccephalic or transposed brachial-basilic vein fistula. This practice has been supported recently by “Clinical Practice Guideline 3” for Vascular Access (National Kidney Foundation Kidney Disease Outcomes Quality Initiative DOQI) (1): The first choice vascular access is radial-cephalic primary AVF, followed by brachial-cephalic primary AVF. If either of these options is not possible, alternative accesses are arteriovenous prosthetic graft (AVG) and transposed brachial-basilic vein fistula. We prefer the transposed brachial-basilic vein fistula over AVG. More recently, data from Dialysis Outcomes and Practice Patterns Study (DOPPS) has been published. This study has compared the vascular access at 145 dialysis units in United State and 101 units in five European countries (France, Germany, Italy, Spain and the United Kingdom) and included more than 6400 patients. The study had shown that AVF patency was superior to grafts (AVG) (P = 0.0002) (2).

In Europe, an overall 80% of hemodialysis patients have AVFs, while only 24% of patients in the United State had a functional AVF (2). In a prospective study done in our unit over about 18 months, 122 patients had 134 access procedures and only 6 (4.5%) of them had AVGs.

Venous Mapping

The hemodialysis patients usually have multiple hospital admissions during which intravenous infusions are required. Thus, superficial vein thrombophlebitis with segmental occlusion or stenosis inspite of recanalization is common. Upper limb vein mapping does not only outline the course of the major superficial veins (Figs. 1, 2) but also gives a rough estimate of the diameter of the vein (Fig. 1) and evaluates the venous outflow in the subclavian/axillary vein (Fig. 3). The latter is very important in cases of previous use of indwelling central catheters. The creation of AVF in an upper limb with proximal venous outflow occlusion will lead to immediate fistula failure or rapid massive arm swelling. In cases with no suitable veins in the upper limbs (Fig. 4), lower limb venous access should be performed.

Preoperative venous mapping has become routine practice in most of the dialysis units since DOQI guidelines (1) recommend that a minimum of 50% of all hemodialysis access procedures should be AVF. Routine mapping results in a marked increase in placement of AVF in many series (3, 4) including ours. It also results
in an improvement of the adequacy of fistulas for dialysis (4, 5) and increased maturation rate (6). In contrast, Patel et al. (7) observed the functional maturation rate decreased from 73% to 57% after implementation of a preoperative imaging protocol. This could be explained by an increase in performing complex procedures which were often secondary ones.

Although preoperative ultrasound (3) and MR venography (8) have been used with high success rate, conventional venography is still the gold standard and we did not record any related complications. In addition, the accuracy of duplex ultrasound depends on the operator’s skills and up to 32% of cases need venography in addition to the duplex (7).
The policy in our unit is to perform upper limb venography for all patients except those requiring primary access and presenting visible veins. Based on the preoperative examination and venography, the final planned vascular access is decided. In our series in which 134 vascular access procedures were performed, preoperative venography was required in 95 cases. It has resulted in a change of the initially planned surgical procedure in 13 (14%) cases. A graft rather than a planned fistula was placed in six (5%) cases. Unsuccessful surgical exploration was not encountered in our experience, which is similar to other series (3).

Factors associated with early failure

Early failure of AVF may result from non-maturation or thrombosis. Early failure was reported to be 40% (9) - 55% (10) in the American series and about 7% (11) to 10% (12) in the European series. In our series it was 9%. However, once the fistula is established and functioning well, it rarely fails (13).

Few recent studies have been published about predictors of failure of AVF. Some have shown that advanced age, female sex, diabetes and forearm fistula were significantly correlated with failure (10, 14). Our series like others (9) showed no relationship with these factors. Hypotension and overweight were other significant risk factors for failure in some studies including ours (10, 15). The use of large sized arteries and veins was associated with high success rate in our series as well as of others (9, 15).

The role of access blood flow measurement for predicting the vascular access failure has been recently studied. There are several methods to measure the vascular blood flow including Doppler ultrasound, indicator dilution technique or more recently using transit time ultrasonography. Its advantage over the Doppler ultrasonography is that it is not dependent on the angle of insonation, and diameter independent (16, 17). We measure intra-operative blood flow (in mL/min), after completion of the AVF, using a hand-held flow probes (Transonic system Inc. HT207, USA). The flow probe is placed around the venous outflow tract and repeated measurements are made until a consistent result is obtained.

Access blood flow measurement has been shown to be a good predictor of early failure of AVF in our series and those of others (18, 19). In our series the intra-operative blood flow was significantly lower in the failure group than in the patent group (at the wrist 109 ± 38 ml/min vs. 180 ± 35 ml/min, at the elbow 240 ± 45 ml/min vs. 350 ± 47 ml/min and overall 160 ± 35 ml/min vs. 260 ± 29 ml/min p < 0.01).

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**Fig. 4**

Upper limb venography of a patient on chronic haemodialysis with past history of multiple AV access surgeries. (A) Right side showing non opacification of the right basilic, cephalic, axillary and subcalvian veins. (B) Left side the same findings like figure A. A AV-fistula at the level of the tigh was the alternative.
Conclusion

Multiple disciplines should be involved in management of vascular hemodialysis access. Preoperative venography reduces the incidence of negative exploration. The current data show that intra-operative blood flow is a reliable parameter that determines early patency of A-V fistula. Careful selection of the vein and the artery may improve the outcome.

References


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