Abstract
The long-term survival and quality of life of patients on haemodialysis is dependent on the adequacy of dialysis via an appropriately placed vascular access. The native arteriovenous fistula at the wrist is generally accepted as the vascular access of choice in haemodialysis patients due to its low complication and high patency rates. It has been shown beyond doubt that an optimally functioning arteriovenous fistula is a good prognostic factor of patient morbidity and mortality in the dialysis phase. Recent clinical practice guidelines recommend the creation of a vascular access (native fistula or synthetic graft) before the start of chronic haemodialysis therapy to prevent the need for complication-prone dialysis catheters. A multidisciplinary approach, including nephrologists, surgeons, interventional radiologists and nurses, should improve the haemodialysis outcome by promoting the use of native arteriovenous fistulae. An important additional component of this program is the Doppler ultrasound for preoperative vascular mapping. This approach may be realized without unsuccessful surgical explorations, with a minimal early failure rate and a high maturation, even in risk groups such as elderly and diabetic patients. Vascular access care is responsible for a significant proportion of health care costs in the first year of haemodialysis. These results also support clinical practice guidelines which recommend the preferential placement of a native fistula.

Keywords: arteriovenous fistula, predialysis nephrologic care, referral, haemodialysis, duplex sonography, Doppler, blood flow, resistance index

Introduction
It is generally accepted that a well-functioning distal radiocephalic arteriovenous fistula (AVF) in the non-dominant arm is the ideal permanent access for haemodialysis (HD). This usually gives an adequate blood flow for HD and a long length of superficial vein for needleling. It also leaves proximal sites for further procedures in the event of failure. A distal radiocephalic AVF is possible in the vast majority of new patients but in many the cephalic veins and those at the antecubital fossa are unusable because of thrombophlebitis from previous intravenous cannulae. For this reason, it is essential that the cephalic veins and antecubital veins should be avoided for intravenous cannulae. Whilst more proximal AVFs have better than more distal ones, the most distal site with adequate vessels should be selected. The standard radiocephalic AVF is usually performed at the wrist. Occasionally, three or four radiocephalic AVFs can be performed at progressively more proximal sites in the forearm. If a radiocephalic AVF cannot be constructed, an ulnobasilic AVF may be possible. A brachiocephalic AVF at the elbow is the next option but with a much greater risk of steal than a more distal access. AV grafts or basilica vein transpositions are required for primary access if AVF is not possible [1].

When should the first access be created?
A too high proportion of patients begin HD with central venous catheter (CVC) (23-69%) because an AVF was not previously created or was not matured on time [2]. Besides all complications connected with CVC it has been shown that access patency is compromised in patients starting dialysis through a central line. It is, therefore, important that definitive access should be created as soon as possible and preferably well in advance of the first dialysis to allow for maturation and for redo surgery in the event of failure or non-maturation. An aggressive policy of venous preservation early before the beginning of any replacement therapy is needed. We advocate AVF creation at least 12 months before the anticipated date for dialysis and when creatinine clearance falls to 25 ml/min or the serum creatinine reaches 450-500 µmol/l [3]. Early enough AVF creation also appears to retard the rate of decline of glomerular filtration rate and defer the time at which HD needs to be initiated [4]. On the other side, recently published study confirm that most patients who underwent predialysis fistula creation eventually initiated dialysis but many patients had fistula creations earlier or later than recommended. The consequence of this is the risk of nonuse or the high use of central venous catheters. A more nuanced approach to selecting patients and timing fistula creation may reduce the risk of unnecessary surgery while also reducing incident catheter use [5].

How can we select the best level for AVF?
Among others, the quality of vessels is thought to play an important role for primary failure of AVFs. It is important
to perform a careful clinical examination of the venous and arterial vessels. It was suggested that duplex imaging should be used after that to evaluate all patients prior to the creation of an AVF. Use of duplex ultrasound influences the choice of access placement. Different parameters could be measured by this way: internal diameter, wall thickness, blood flow, resistive index, distensibility of the vessels etc. [6] Minimum arterial diameters of at 1.6-2.5 and a venous diameter of 2-2.5 mm have been advised as smaller vessels [7]. Early failure of AVF was closely associated with pre-existing intima media thickness [3]. The distensibility of the artery affects access outcome. It could be evaluated by measurement of resistive index before and at reactive hyperaemia [3]. On the base of clinical evaluation, parameters of vessels quality found by duplex imaging and other patient characteristics, we have to choose the most appropriate location for AVF construction with lower primary failure rates, higher maturation rates and lower complications.

How can we improve the patency of AVF?

Whilst training of junior staff is essential to ensure the future, access surgery must be performed or closely supervised by an experienced surgeon or interventional nephrologist. It has been shown that those surgeons (nephrologists) who have performed more autogeneous fistulae in training are more likely to create an autogeneous access when fully trained [7,8].

If there is a palpable thrill at the end of the procedure the chance of long-term patency is good. If there is a strong pulse but no thrill in the vein it is likely that there is a downstream stenosis in the vein and revision is indicated. Besides the other reasons, spasm of the artery could influence blood flow through the newly constructed anastomosis. Increased blood flow as a consequence of increased cardiac output after plasma expander infusion may prevent too low flow at the first time. Hydroxy ethyl starch has also antithrombotic effect by impairing platelet hemostasis and clot formation [9]. Use of other different pharmacological factors could also increase the patency of AVFs but this requires confirmation with more direct randomized studies.

How can we prevent thrombosis?

There is increasing evidence that monitoring and surveillance can detect stenosis within autologous AVFs and grafts to permit timely intervention to prevent their progression to occlusion. The loss of palpable thrill, needleling difficulties, deteriation in dialysis efficiency, and a reduced urea reduction ratio at each dialysis, a rising predialysis serum potassium or evidence of recirculation may signal impending failure. Surveillance by access pressure measurements, serial access flow measurements or duplex ultrasound has been used. Surveillance by duplex ultrasound has the advantage of demonstrating the stenosis itself as well as providing an estimate of access flow [10]. Once a significant stenosis has been detected, access thrombosis can be prevented by angioplasty. Duplex monitoring reduces AVF and graft thrombosis, hospitalization and central venous catheter usage [11].

Conclusions

Vascular access provision is variable throughout the world. For those countries with long waiting times and a high proportion of patients starting dialysis using central venous catheter, improvements in the provision of adequate operating time would reap undoubted benefits for the patient. Venous preservation by the avoidance of intravenous cannulae in the cephalic or antecubital veins of either arm is essential. Careful clinical examination and the use of pre-operative duplex ultrasound will enable the best site for the creation of an autogenous AVF with greatest chance of long-term patency. Adherence to the standard principles of access planning of creating the most distal autogeneous AVF possible in the (preferably non-dominant) arm preserves access site for the future and minimizes the need for complex procedures. Surgery should be performed or supervised by experienced surgeon or dedicated nephrologist, depends from local situation. Surveillance by duplex scanning or sequential flow rate measurement with timely radiological intervention is likely to reduce the incidence of access thrombosis and the need for further surgery.

Conflict of interest statement. None declared.

References