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EDUCATIONAL ARTICLE

Dialysis Access—Guidelines for Current Practice

H.J.T.A.M. Huijbregts[1,2] and P.J. Blankestijn[1*]

Departments of [1]Nephrology, and [2]Vascular Surgery, University Medical Centre Utrecht, Utrecht, The Netherlands

Current guidelines promote the use of the native arteriovenous fistula (AVF) as the first choice for access over grafts and central venous catheters. However, the prevalence of AVF use shows enormous differences among national, regional and local practice surveys, even after adjusting for demographics. In this review, we will briefly discuss these differences and present actions potentially improving outcome of vascular access care.

Keywords: Vascular access; Practice pattern; Haemodialysis; Arteriovenous fistula; Guidelines.

Introduction

The ideal vascular access for haemodialysis enables the dialysis staff to deliver adequate dialysis, has excellent patency with low complication rates, and is easy to create. In every day clinical practice 300–400 mL blood/min is required for the extracorporeal circuit in order to provide 'adequate' dialysis. This is only possible when the access blood flow is at least 400–500 mL/min. It is well accepted that the native arteriovenous fistula (AVF) meets best with these expectations.

In 1997, the K/DOQI Work Group issued evidence and opinion based guidelines as well as strategies for implementation to improve quality of life and overall outcome for haemodialysis patients.[1] The primary objectives of these guidelines are increasing the placement of native AV fistulae and detecting access dysfunction prior to access thrombosis. The Vascular Access Society (www.vascularaccesssociety.com) recently published clinical algorithms on access care. They show many similarities with earlier guidelines, but they emphasize the value of the preoperative duplex and the role of the interventional radiologist for fistula salvage.[2]

Several studies have demonstrated striking regional differences in vascular access care practice.[3–6] The DOPPS study,[6] which compared vascular access use at 145 dialysis units in the United States and 101 units in five European countries, reported that an AVF was used by 80% of European and 24% of the American prevalent haemodialysis patients. After adjusting for age, gender, body mass index, diabetic status, peripheral vascular disease, and angina, AVF *versus* graft use was still much higher in Europe than the United States.[6] Furthermore, the percentage of AVF use in these different dialysis units displayed a great range, varying from 39 to 100% in Europe (median 83%), and rates as low as 0% AVF use in some American dialysis units but as high as 87% in other facilities (median 21%),[6] (Fig. 1). These findings strongly suggest that a facility's practice is predominantly determined by local preferences and approaches.

In this review, we will discuss factors affecting outcome of vascular access care and actions potentially improving outcome.

The Need for Change

Factors affecting quality and outcome of access care can be divided into non-modifiable and modifiable

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*Corresponding author. Dr Peter J. Blankestijn, MD, PhD, University Medical Centre Utrecht, Room F03.223, P.O. Box 85500, 3508 GA Utrecht, The Netherlands.
E-mail address: p.j.blankestijn@umcutrecht.nl

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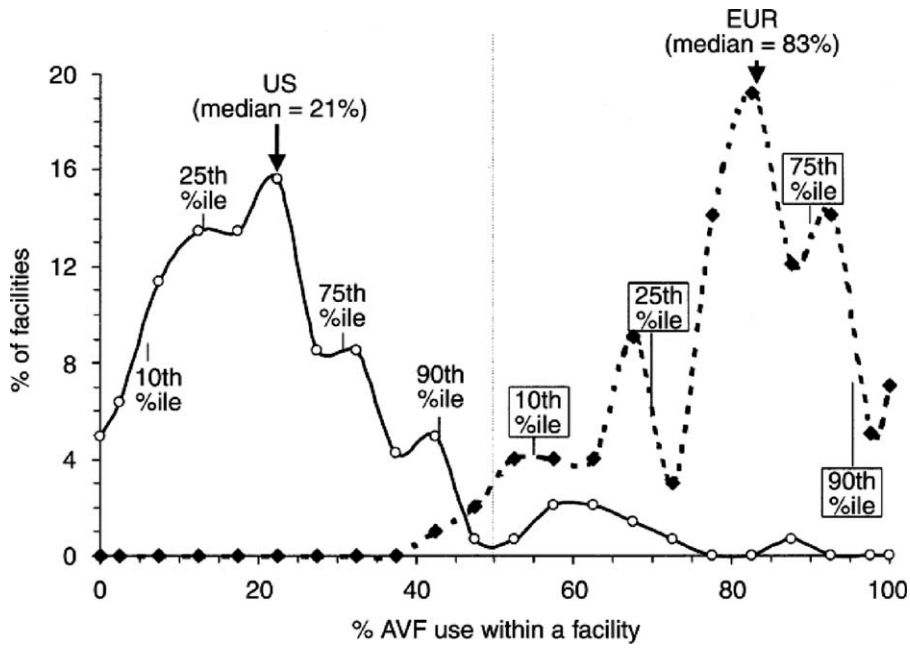

Fig. 1. Distribution of arteriovenous fistula (AVF) use among facilities within Europe (EUR) and the United States (US). The percent of patients using an AVF was determined for a cross-sectional sample of patients within each DOPPS dialysis unit in EUR and the US. The distribution of AVF use within facilities is shown separately for the US and EUR, and is shown in increments of 5%. The following percentiles of each distribution are provided for the 10th, 25th, 50th (median), 75th, and 90th percentiles. (with permission from ref. 6, Blackwell Publishing, UK).

influences. The non-modifiable factors are patient characteristics such as age, diabetes mellitus and peripheral vascular disease. The modifiable factors, on the contrary, appear to be dependent on the willingness and motivation of decision makers and include the implementation of protocols, communication and strategies to meet quality of care standards (Table 1). Recently, recommendations have been presented on how to increase the percentage of prevalent AVFs and optimise surveillance and patency.[7,8]

Vascular access care is a classical example of multidisciplinary teamwork between nephrologists, vascular surgeons, interventional radiologists, ultrasound technicians, and dialysis nurses. To achieve the best outcome the team must agree on a set of goals, collaborate closely and maintain good mutual communication. A key player in this multidisciplinary approach is a dedicated access coordinator who acts as a liaison officer between the disciplines and schedules the meetings.[9] This person, who may be a nurse, can prospectively monitor vascular access outcomes and complications, and evaluate on practice patterns. During meetings he or she can provide feedback to all decision-makers enabling them to adjust practice if necessary.

Timely referral may increase the percentage of patients starting haemodialysis treatment with AVFs instead of grafts or central venous catheters (CVC).[10] Referral for access surgery should be within 6–12 months of the anticipated start of dialysis, i.e. when glomerular filtration rate (GFR) drops below 25–20 mL/min. This allows ample time for access maturation or for additional procedures in case of primary failure.

Table 1. Factors involved in vascular access care

Non-modifiable	Modifiable
Sex	Local protocol different from DOQI/European guidelines
Peripheral vascular disease	Absence of a multidisciplinary team
Diabetes mellitus	CRF-patients starting dialysis over CVC or graft
Age	Absence of standard preoperative duplex examination
Body mass index	AVF number and patency different from quality of care standards
	Absence of AVF quality control program
	No radiological interventions to assist patency in case of failure
	No secondary AVF creation in graft or catheter patients
	No feedback on outcome

Finding the best location for fistula placement starts with the selection of the appropriate vessels. Physical examination by an experienced vascular surgeon is indispensable but the addition of preoperative duplex examination has been proven to influence the choice of access placement and provides the vascular surgeon with valuable information.[11] A standardised examination of arteries should record internal diameters, Doppler waveform analysis and the sites of stenosis and occlusion. Veins are assessed for compressibility and internal diameters are measured. Cut-off thresholds for internal diameters are still debated so that internal diameter alone cannot fully predict adequate remodelling but internal diameters of $\geq$2.0 mm for artery and vein for radiocephalic AVFs, and 3–4 mm for the vein for brachiocephalic or brachiobasilic AVFs are associated with adequate maturation, whereas smaller diameters may predict non-maturation.[2]

Fistula surgery can be technically challenging. It has been demonstrated that the type of access placement varies with individual surgeon practice patterns.[12] The DOPPS study showed that AVF use was significantly less likely if surgery trainees assisted or performed vascular access placements.[6] Moreover, the odds ratio of AVF placement is more than three times greater in high volume centres (>30 access procedures per year) than in low volume centres (<10 access procedures per year).[12] Thus, only experienced vascular surgeons who are willing to primarily place AVFs should construct new accesses.

A fistula is generally ready to be used within 4–6 weeks after placement but primary failure, i.e. early thrombosis and lack of maturation, occurs in 20–50% of AVFs.[7] Reported patency rates can be misleading because some investigators have specifically excluded AVFs that never matured, whereas others have included these primary failures, leading to comparable 1-year cumulative patency rates for AVFs and grafts. Despite these figures the major advantage of fistulas over grafts is a better long-term patency with lower incidences of complications and interventions once fully matured. The role of the interventional radiologist in salvaging the failing AVF is very important. Accessory vein ligation and angioplasty (PTA) of primary failures can result in a 68–79% 1-year assisted primary patency.[13,14] Such additional interventions can convert a considerable proportion of primary non-functioning AVFs to functioning AVFs.

Patients with a functioning fistula (or graft) should have their access monitored regularly in order to predict complications. In grafts, access flow measurement seems to be the best method. A graft flow below 600 mL/min is associated with an increased risk of thrombosis.[15] Trend analysis by sequential access flow measurements has been proven to be even more effective.[16,17] In AVFs, access flow below 600 mL/min does not necessarily predict thrombosis. The inability to provide a flow of 300–400 mL/min to the extracorporeal circuit, or the finding of poor dialysis adequacy, for instance quantified as urea reduction rates, may help to identify the AVF with insufficient flow.

Every patient with an AV graft or central venous catheter should be evaluated for the secondary placement of an AVF, which is possiblein a considerable proportion of such patients allowing the removal of the catheter.[18]

The outcome of surgical and radiological interventions should be reported using standard definitions[19] in order to compare results with quality of care standards and modify clinical practice if necessary. Actions potentially improving vascular access care are summarised in Table 2.

Table 2. Actions potentially improving AVF care

Commitment to adherence to K/DOQI/Vascular Access Society guidelines
Multidisciplinary and motivated access team
Dedicated vascular access coordinator
Timely referral to nephrologist and vascular surgeon
Vessel mapping prior to surgery referral
Experienced vascular surgeon willing to meet 'AVF only' expectations
Monitoring and surveillance programs
Acceptance that primary failures may occur and need additional interventions
Interventional radiologist performing patency assistance procedures
Secondary AVF creation in AV graft or catheter patients
Outcomes feedback and willingness to adapt to meet care standards

Initiatives for Improvement

The assimilation of recommendations and guidelines into clinical practice is only possible if all parties involved are willing and motivated to cooperate. Single centre experiences have shown that major improvements in practice patterns can be achieved[20] but large scale implementation projects are scarce so that vascular access distribution has remained roughly the same since appearance of the K/DOQI guidelines. In 2003, the United States National Vascular Access Improvement Initiative (NVAII) launched Fistula First (http://www.fistulafirst.org). This is a large national initiative that offers a set of tools for physicians and dialysis facilities in order to accelerate increasing AVF use in haemodialysis patients. Eleven change concepts guide the target groups step-by-step to best practice. In The Netherlands, the CIMINO-project (Care

Improvement by Multidisciplinary approach for Increase of Native vascular access Obtainment) was initiated as an effort to increase AVF use.[21] In this program, vascular access teams are encouraged to adhere to current guidelines. A vascular access coordinator registers practice patterns in a newly developed database. In-centre outcome analysis may then show the need to improve access care in order to meet quality of care standards. Hopefully, initiatives like these result in greater awareness and improvement of patient care.

Summary

- Guidelines provide clear evidence based quality of care standards.
- Practice patterns show great variations.
- Modifiable factors affecting outcome of vascular access care are identified (Table 1).
- Actions potentially improving outcome of care are identified (Table 2).
- Success is only possible if not only dialysis staff, but also surgeons and radiologists regard access care as their concern.

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