

Clinical Challenges and Management of Arteriovenous Fistula in Elderly Hemodialysis Patients

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ABSTRACT

An arteriovenous fistula or graft is necessary for hemodialysis (HD). It is the technique of connecting a high resistance artery to a low resistance vein and therefore boosts cardiac output (CO). Early days of HD used to see patients with end-stage kidney disease (ESKD) frequently being younger and their access to HD being in the distal forearm. But in the present times, individuals with ESKD are largely the elderly and many of them are quite old (over 80 years). The quality of vessels of such old people is frequently low, and access to the distal forearm is improper. This research addresses the problems associated to vascular access choice, timing of vascular access, and vascular access management in the elderly population with end stage renal disease. The involvement of the healthcare professionals, and specifically nursing staff in getting the optimal vascular access results is underlined with special focus owing to regular monitoring, patient education, and evidence-based procedures.

Keywords: *Elderly Patients, End Stage Renal Disease, Cannulation, Dialysis Management.*

I. INTRODUCTION

There is a growing global population of adults aged 65 and up, with predictions of a tripling of this age group in the next three decades. In the 65–74 age group, about half of all adults have five or more chronic health issues; in the 85+ age group, that number might rise to 70%. There is a high frequency of comorbidities, including diabetes mellitus, peripheral vascular disease, hypertension, and congestive heart failure, and a growing number of older patients with chronic kidney disease (CKD) are presenting to nephrologists. The age group of 65 and over had the highest increase in incident haemodialysis (HD) patients from 1982 to 2000. Patients aged 65-74 years and >75 years constitute 22% and 20% of the overall prevalent renal replacement treatment population, respectively, according to the 2012 Annual Report of the European Renal Association-European Dialysis and Transplant Association (ERA-EDTA) registry. Renal replacement therapy in the elderly patients brings up numerous important questions about life expectancy, quality of life, and other

moral, ethical, financial, social, and legal matters; furthermore, the Kidney Disease Initiative Global Outcomes (KDIGO) recently released clinical practical guidelines for the assessment and management of chronic kidney disease (CKD) offer few suggestions pertaining to the elderly.

The vascular access (VA) of choice for HD patients is arteriovenous fistulas (AVFs), according to many national clinical guidelines. However, it is unclear if these guidelines also apply to the elderly, and some have proposed ways to change the recommendations for VA choice in this population. The Fistula First Initiative might not be the best choice for older patients due to their shorter life expectancy and inconsistent post-operative outcomes; in fact, VA planning for the elderly differs from that for younger patients. Even while AVF has the potential to outperform AVG and CVC in all age categories, including the elderly, the combination of numerous comorbidities and inadequate vasculature for fistula development makes the elderly less likely to have a successful AVF procedure. Additionally, many fistulas will never be utilised in patients over 65 years old owing to the increasing risk of mortality before dialysis beginning; the failure rate of fistulas is twice in this age group compared to younger patients.

A high rate of central venous catheter (CVC) insertion at the beginning of HD therapy is associated with unsuccessful fistula installation, which increases the likelihood of serious risks and consequences such bacteremia and thrombosis. But it's possible that elderly people have a far lower risk of bloodstream infections compared to younger patients. Statistics about AVG in the aged are contradictory. Several studies support the use of autogenous VA rather than autogenous vascular endografts (AVG), suggesting that the patency rate in older individuals may be comparable to younger people. However, there is evidence that suggests the inverse of the 'AVG first' approach is more appropriate in octogenarians, with a greater risk of mortality prior to dialysis initiation when using AVF compared to AVG. Nutritional condition, pre-dialysis nephrology treatment, cardiovascular disease, and the VA are crucial variables that greatly impact patient survival. If nephrologists really want to increase people's chances of having a good life, they should look for the best VA possible.

II. VASCULAR ACCESS PLACEMENT IN ELDERLY PATIENTS

In VA treatment, strong clinical practice includes a structured predialysis approach and prompt VA placement. There are several advantages to starting dialysis early and receiving proper education and preparation. These include fewer hospitalisations, a higher percentage of patients choosing home dialysis, and a lower percentage of central vein thrombosis (CVC) in patients beginning home dialysis. There is a correlation between age and a slower pace of renal function loss, a lower number of events leading to end-stage renal disease (ESRD), and a shorter survival time for older patients. High rates of central venous catheter (CVC) insertion at HD beginning are linked with an increased risk of mortality and morbidity in elderly patients, and these patients may not survive long enough to reap the benefits of an AVF. Primary fistula failure is also more common in this age group. Putting an AVF >6-9 months predialysis in the elderly does not improve the success rate, according to a study. Instead, it is associated with more interventional procedures, with the number of procedures increasing from 0.64 per patient for AVFs created 6-9 months predialysis to 0.72 per patient for AVFs created >12 months in advance.

However, it is becoming more common to build AVFs prior to starting HD, even though there is data showing that patients older than 75 years had a 3.5 week delay between being referred to a nephrologist and starting dialysis, compared to 20.5 weeks for those younger than 75 years. There is some evidence that suggests postponing AVF implantation can be beneficial; for example, some writers recommend waiting to send older patients with CKD in order to lessen the likelihood of making an AVF that would go unused. While the mortality benefit of AVG over CVC may not apply in the oldest-old (>89 years) age-group, it becomes a valid alternative form of VA in cases where there is no suitable anatomy for AVF creation and slow renal progression. In such cases, the use of an early stick graft might be appropriate due to the high risk of non-maturing autologous AVF. Recent findings show that it is safe to wait commencing HD until the development of signs and symptoms of uremia, which is a significant consideration for most patients contemplating dialysis due to its potential impact on life expectancy and quality of life.

Since no maturation period is necessary for a tunnelled CVC, it might be the ideal option within the framework of an intent-to-defer HD treatment plan. Due to the decreased risk of catheter-related bloodstream infections in older patients, tunnelled CVC may be an appropriate dialysis access alternative in cases when the AVF has not matured or is not working well, and some authors have advocated for its widespread usage in this population. Proper catheter management and stringent nursing care guidelines must be put in place, nevertheless. One potential safe and effective method for locking catheters in haemodialysis is a citrate solution. A citrate lock that contains antimicrobials is more effective than a heparin lock in preventing catheter-related infections, according to a meta-analysis and systematic review of thirteen randomised controlled trials. When compared to heparin locks, citrate locks with low concentrations (1.04-5%) to intermediate concentrations (4.66-7%) were more effective in avoiding bloodstream infections due to catheters. A lock solution containing 4% sodium citrate is an appropriate option for geriatric individuals in order to reduce bleeding episodes and keep the tunnelled CVC open.

III. FACTORS FOR EFFECTIVE AVF AND AVG CANNULATION IN HEMODIALYSIS PATIENTS

Figure 1 shows the several clinical and interpersonal abilities that must be present in order for an AVF or AVG cannulation to be performed successfully, which is essential for the long-term effectiveness of HD therapy. A thorough understanding of the anatomy of the vascular access site, technical competence in cannulation techniques (such as rope-ladder or buttonhole methods), and the consistent implementation of aseptic protocols to reduce infection risk are critical components of successful cannulation. Important but less technical considerations include good patient communication, precise evaluation of vascular access before cannulation, and early detection of dysfunctional conditions such as stenosis, infiltration, or thrombosis. Success rates are further improved by interprofessional collaboration, availability to modern techniques like ultrasound guidance, and ongoing clinical training. To ensure the reliability and longevity of vascular access in HD patients, it is essential to have both technical skill and holistic nursing practice. Additionally, patient-centered care approaches, reflective practice, and self-awareness are proven to positively impact cannulation outcomes.



Figure 1: Determinants Influencing AVF and AVG Performance in Hemodialysis

A Life Plan should be established for individuals with end-stage renal disease (ESRD) that prioritises "the right access, for the right patient, at the right time, for the right reasons." The ultimate decision should be guided by each patient's preferences and features, however it is typically suggested to develop arteriovenous access distally in the nondominant arm with autogenous fistulas. Also, lowering the reliance on central venous catheters in HD patients depends on keeping arteriovenous access functional. The long-term advantages of the AVF make it the preferable option, however problems with maturation can reduce its effectiveness. Ensuring proper function is dependent upon sufficient cardiac output and the patency of the venous and arterial systems. In order for AVFs to develop and mature, it is essential to surgically preserve vascular structures. The potential consequences of trans-radial access on coronary procedures in the long run are another area of concern. Hence, it is equally important to inform patients and make sure that healthcare providers for end-stage renal disease (ESRD) are knowledgeable about ways to maintain healthy blood vessels.

IV. MOST IMPORTANT AV FISTULA COMPLICATIONS

Surgical Complications of AV Fistula

Choosing the right surgical approach for anastomosis is a crucial step in preventing potential problems during the procedure. The demanding surgical method is required, for instance, to perform end-to-end anastomosis. Ischaemia of the distal extremities, particularly in diabetic and elderly individuals, can result from improper surgical technique. It should be mentioned that side-to-side anastomosis can cause venous hypertension to develop, even if it is theoretically easier and can be performed when the blood arteries are close together.

At this time, end-to-side anastomosis is considered the best approach. Surgeons should refrain from doing procedures that include an acute angle, longitudinally rotating the veins, or modifying their anatomical location in order to minimise the risk of turbulence and endothelium damage, which in turn minimises the likelihood for stenosis.

It is possible to get haematoma, poor venous flow, or bleeding right after surgery. Infections, aneurysms (real or imagined), fistula vein stenosis, congestive heart failure, steal syndrome, ischaemic neuropathy, thrombosis, and fake aneurysms are all possible later problems.

Infections

Just 20% of AVF problems are due to infection, which is 10% lower than the AVG infection incidence. When an AVF infection occurs, the most common symptom is perivascular cellulitis, which is often self-limiting and presents with localised redness and swelling. Serious infections involving anatomical anomalies, such as abscesses, haematomas, or aneurysms, necessitate surgical removal and drainage.

Antibiotics given for four to six weeks in a row usually cure mild to moderate AVF infections.

Aneurysm

Repeated penetration of the same blood artery wall can lead to an aneurysm, a pathological swelling of that wall. Risk of perforation and ulceration, bleeding components, and insufficient puncture space due to aneurysm size all indicate the need for surgical intervention.

Stenosis

Typically described as an irregular constriction of a blood artery. Reductions of more than 50% are considered substantial stenosis of the vascular lumen according to KDOQI criteria. Several signs corroborate the clinical suspicion of stenosis: decreased dialysis quality, puncture complications (such as prolonged bleeding after an AVF puncture), fistula region discomfort, or elevated venous pressure. Stent implantation, balloon dilatation, or surgical revision are the methods used to treat stenosis.

Induced Ischemia

It is possible for hypoxia, ischaemia, and necrosis to occur when blood flow is decreased distal to an arteriovenous anastomosis due to a formed AVF. People with diabetes and the elderly are at a heightened risk of ischaemia and the development of this illness, which is referred to as the steal syndrome in the medical literature. Sufficient hand perfusion is threatened by retrograde flow in the palmar arch region and low resistance in the fistula vein system.

For ischaemia to occur in a fistulated hand, several circumstances must be met, the most common of which is a decrease in blood flow via the arterial system as a result of arterial occlusive disease. Ten to twenty-five percent of patients with brachiocephalic or brachio basilic vascular access will experience symptomatic ischaemia, with four to six percent developing at the forearm level and one to two percent at the radiocephalic level, according to the literature. Due to the difficulty of treating this disorder, efforts should be directed on preventing it.

Thrombosis

A major reason an AVF stops working is thrombosis. In most cases, it manifests itself close to a stenosis, anastomosis, or fistula vein. As stenosis worsens, the likelihood of thrombosis rises. According to the majority of research, the propensity towards greater bleeding is explained by abnormalities in platelet adhesion. It is thought that attachment to the extracellular circulatory system and the turbulence in blood flow caused by the vascular access activate HD platelets.

There was no increase in bleeding episodes over the 6-week administration period of clopidogrel, and the prevalence of early thrombosis of new AVFs was decreased, according to significant investigations. Because fistula formation requires maintenance of patency, preventing early thrombosis would increase the pace of fistula maturation. An increased propensity for thrombosis is a major risk factor for HD patients. Venous neointimal proliferation, in which smooth muscle cells proliferate, is the leading cause of vascular access thrombosis. Vascular stenosis and fistula thrombosis are the results of this.

V. CHALLENGES AND OPTIMAL MANAGEMENT OF AVF/AVG IN ELDERLY HD PATIENTS

Vascular ageing, other health problems, and patient-specific variables all contribute to the substantial clinical hurdles of creating AVF in older HD patients. Vascular calcification and decreased blood vessel flexibility are common in elderly people. The AVF's development and subsequent loss of function can be accelerated in patients with comorbidities such as diabetes and cardiovascular disease. Timely creation of an AVF is of the utmost importance. Those with a short life expectancy or poor vascular health may not be good candidates for early insertion, while it might help HD patients who need long-term care. Despite the potential benefits of AVF, such as reduced infection rates and better durability compared to catheters, the maturation times and rates of primary failure are often longer in older persons. This is particularly true when underlying vascular problems impede the establishment of fistulas.

In an ideal world, the duration of dialysis, the HD patient's comorbidities, and their quality of life would all be taken into account when deciding where to install an AVF. When it comes to overseeing AVF treatment, nursing professionals are quite essential, particularly for the older generation. As part of good maintenance, the fistula should be checked for infection, stenosis, or thrombosis on a regular basis, and bruit and blood flow should be monitored to make sure the fistula is open. Patients are better able to take an active role in their care when they are taught self-monitoring procedures like palpating for thrill and identifying early warning indications of problems. Preserving fistula function also requires improved procedures to minimise vascular stress and strict cleaning during cannulation.

VI. CONCLUSION

It is inappropriate to base the selection of vascular access just on age. Arteriovenous access installation should be explored for elderly patients because CVCs are regularly linked to greater death rates. When it comes to VAs, proximal AVFs are the way to go for older people who have fewer health issues and a longer lifespan. When it comes to VA implantation, ultrasonography vascular mapping can give helpful information about maturation rates. Because of their lower catheter times and better primary success rates, AVGs are a good first-line option for VA in patients who are at a higher risk of AVF primary failure. However, central venous catheters (CVCs) might be a good way to enhance quality of life for patients who have high frailty scores and short life expectancy. Considerations such as comorbidities, functional level, maturation time, expenses, and life expectancy should be included of vascular access planning for older patients.

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