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'EVIDENCE DRIVEN' CLINICAL SCENARIO

Preferred Strategy for Hemodialysis Access Creation in Elderly Patients

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CLINICAL VIGNETTE

A 66 year old man with progressive loss of kidney function is referred because he will need dialysis within a few days. His radial artery is calcified and the cephalic vein very small. Should one opt for an autologous arteriovenous fistula combined with a temporary central vein catheter with uncertain prognosis, or an early cannulation AV prosthetic graft, thereby avoiding a central venous catheter?

Background: Adequate functioning vascular access is the key to successful hemodialysis. The use of an autologous arteriovenous fistula (AVF) is advised because of good long-term patency and a low incidence of complications. However, the number of patients with AVFs is declining because of the change in the demography of the dialysis population, with increasing numbers of very old patients with multiple comorbidities.

Methods: In this vignette an elderly patient is described with calcified distal arteries and a small cephalic vein who is referred at a late stage for access creation. The results and performance of different types of vascular access (AVF; arteriovenous graft; central vein catheter), in relation to late referral and patient demographics, are described. In addition, patient morbidity and mortality versus the type of access are discussed.

Conclusions: The patient described in this vignette appears to be unsuitable for the creation of a forearm AVF because of calcified distal arteries and a small cephalic vein. The risk of non-maturing autologous AVFs is high in elderly patients and this observation might justify the use of early stick grafts. High risk patients may benefit from permanent central vein catheters.

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THE CLINICAL PROBLEM

Worldwide more than two million patients with end-stage renal disease (ESRD) have renal replacement therapy (RRT) by either renal transplantation, peritoneal dialysis (PD), or intermittent hemodialysis (HD). The number of elderly (>65 years of age) patients on HD is growing more rapidly than younger age groups. The associated comorbidities in elderly patients (diabetes, arteriosclerosis) usually make vascular access (VA) creation more difficult.

Adequate functioning vascular access is the key factor for successful HD treatment. Guidelines advise the creation and use of autologous arteriovenous fistulae (AVFs) for HD, because of good long-term patency and a low incidence of complications.[1,2] The morbidity and mortality in patients with AVFs is significantly lower than in patients with arteriovenous prosthetic grafts (AVGs) or central vein catheters (CVCs).[3] In addition, healthcare costs are considerably lower with the use of AVFs than other access modalities.[4]

Despite the development of guidelines and better insight into the process of vessel remodeling and maturation after the creation of an arteriovenous anastomosis, the number of HD patients with autologous AVFs is declining. The major cause for this observation is the change in the demography of the dialysis population with increasing numbers of very old patients accepted for RRT, with multiple comorbidities including obesity, chronic heart failure, diabetes mellitus, peripheral vascular disease (PVD), and hypertension. Poor vessel quality, previous vein punctures, and infusions hamper the successful creation of autologous AVFs in these patients. Other factors negatively influencing AVF outcome are late referral for access creation and cannulation failure.

LATE REFERRAL AND VASCULAR ACCESS CREATION AND OUTCOME

An early referral to the vascular surgeon for vascular access creation is pivotal for deciding on a patient-specific strategy

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for planning access. Guidelines advise referral at least 3—6 months before the expected start of HD, because time is needed for AVF maturation and possible repeat interventions when it is impaired. An early referral results in more autologous AVFs, which have a better long-term patency, whereas late referral results in a greater risk of AVF non-maturation and failure and therefore the need for additional CVCs to initiate dialysis.[5] There is a great variety with regard to timing of patient referral and access creation, in particular between the United States and Europe. Planning for access surgery after referral varies from fewer than 5 days (Italy) to more than 42 days (UK).[6] Streamlining patients with better predialysis care and the implementation of vascular access coordinators may improve referral, access planning, and outcome.[7,8]

A large study cohort of 17,511 patients > 67 years old, with an AVF placed as the first predialysis access, studied the optimal time for AVF placement. AVF success was defined as dialysis initiation using the AVF, with time between AVF placement and starting dialysis as the primary variable of interest. Overall, 54.9% of patients initiated dialysis using an AVF, and 45.1% used an AVG or CVC. An *a priori* time period from AVF placement to HD initiation was set into five categories (1—3, 3—6, 6—9, 9—12, and >12 months) and the success rate in each category was compared with a reference time point of >12 months from AVF creation to HD initiation. The odds ratio (OR) for success increased as the time from AVF creation to HD initiation increased in the categories of 1—3, 3—6, and 6—9 months (OR 0.49, 95% confidence interval [CI] 0.44—0.53; OR 0.93, 95% CI 0.85—1.02; and OR 0.99, 95% CI 0.88—1.11, respectively) but then stabilized. Thus, placing an AVF > 6—9 months predialysis is not associated with greater success. The number of additional interventional access procedures to enhance AVF maturation and assisted primary patency increased over time starting at 1—3 months, with a mean of 0.64 procedures/patient for AVFs created 6—9 months before HD start compared with 0.72 for AVFs created 12 months before the start of HD ($p > .001$). From this study one may conclude that referral 6 months before access creation might be ideal. With larger time intervals, the incidence of access revisions will increase, which is undesirable.[9]

Another study showed that the rate of renal deterioration may be of importance for the decision to create AVFs at an early stage. A Markov model was used to compare two strategies: refer all Stage 4 (glomerular filtration rate < 15 mL/min) ESRD patients for an AVF versus wait until the patient starts dialysis. The wait strategy resulted in a higher life expectancy (66.6 vs. 65.9 months) and quality adjusted life expectancy (38.9 vs. 38.5 quality adjusted life months) than immediate AVF creation. These results suggest that despite the recommendation to consider creation of AVF early in the pre-dialysis period, this may not apply to all patients. It might be prudent to wait in patients who have a slow rate of progression and high rates of competing events. On the other hand, it is not optimal to wait in patients with a high rate of progression (such as proteinuric diabetic nephropathy). The conclusion was that early creation of an AVF is not always the preferred strategy for all predialysis patients.[10]

ACCESS FAILURE VERSUS LONG-TERM PATENCY AND INTERVENTIONS

Pre-operative vessel assessment with ultrasonography results in significantly more and better functioning autologous AVFs. A randomized study showed an obvious difference between the early failure rate and long-term patency of radiocephalic AVFs in patients assessed with ultrasound versus clinical examination alone.[11] A meta analysis showed that certain patients may benefit from pre-operative ultrasonography in terms of more and better functioning autologous AVFs.[12] There remains a debate about the acceptable lower limits of arterial and venous vessel diameters and the presence of calcification in relation to the chance of successful maturation. Arterial calcification impairs outward remodeling of the inflow artery and thus hampers the flow increase and resulting arterial and venous dilatation. Calcification in the forearm arteries detected on

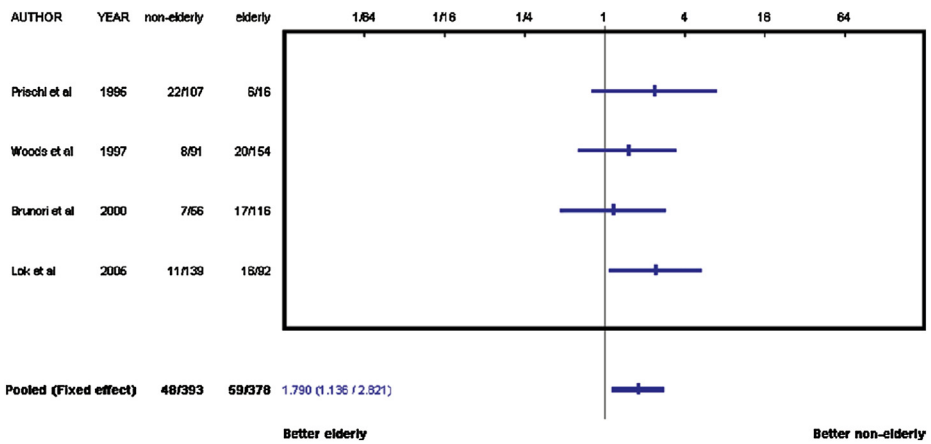

Figure 1. Forest plot compares the odds ratio (95% confidence interval) of the primary failure rate of radiocephalic arteriovenous fistula in elderly and non-elderly patients. The number before the slash refers to the number of failures, and the number after the slash refers to the total number of patients at risk. The solid central line represents no difference in the odds ratio. The pooled effect is demonstrated at the bottom with a bold line.[14]