Creation of permanent hemodialysis vascular access in patients with failed arteriovenous fistula

Majid Moini, MD, *Mohammad R. Rasouli,* MD, *Hussein Rayatzadeh,* MD.

ABSTRACT

Objective: To compare the patency rate and complications of arteriovenous fistula (AVF) with synthetic graft in patients with previous history of failed AVF.

Methods: This study was carried out at Sina Hospital, Tehran, Iran from April 2002 to July 2003. Patients who had been referred to our center with previous failed attempt for creation of AVF were collected. We again tried to create an AVF in some of these patients according to physical examination and clinical judgment of the vascular surgeon. A synthetic graft was inserted for the remainder of the patients. All patients were followed up for 3 months.

Results: Elbow fistula placement was possible in 43% of patients including half of patients with diabetes and half of those more than 65 years old. Failure occurred in 33% of grafts versus 19% of fistulas. The complications were venous hypertension in one case and infection in 2 cases, all from the graft group.

Conclusion: Our results show lower failure, mortality, and complication in AVFs than the synthetic graft, similar to previous reports. However, there were some limitations such as small sample of patients and short duration of follow up in our study. We suggest that AVF is an option even in patients who had previous multiple procedures with the advantage of being cost-effective, and with fewer complications. However, we cannot conclude any superiority for one method, as it is not a properly designed comparative trial.

Saudi Med J 2007; Vol. 28 (2): 213-215

From the Division of Vascular Surgery, Sina Hospital, Tehran University of Medical Sciences, Tehran, Iran.

Received 24th April 2006. Accepted 4th October 2006.

Address correspondence and reprint request to: Dr. Majid Moini, Section of Vascular Surgery, Sina Hospital, Hassan-Abad Square, Tehran 1136933511, Iran. Tel. +989 121374860. Fax. +98 (21) 66716545. E-mail: moinim@hotmail.com

Radial artery-cephalic vein wrist fistula has remained the access procedure of choice and is generally considered the fistula with the longest patency and fewest complications.[1-3] However, the nature of its construction makes it unfeasible for some patients.[4] Upper arm arteriovenous fistulas (AVF) are alternative vascular access sites for patients who are not candidates for radiocephalic AVF. Grafts are less desirable than native fistulas, as they have much shorter primary and secondary patencies than do native fistulas, and they require more procedures.[5] However, subsequent widespread use of polytetrafluoroethylene (PTFE) grafts instead of AVF have occurred due to the ease of the surgical technique, the immediate availability of the graft for puncture, the need of high blood flow for high-efficiency and short-duration hemodialysis sessions.[6] However, in the Dialysis Outcomes Quality Initiative guidelines, this has led to the recommendation that AVF should be the first option; however, this advice has not been followed uniformly.[2] In this series, we compared the results of AVF and synthetic grafts in patients who had previous history of failed AVF.

Methods. In this case series, we collected end stage renal disease patients with previous failed attempts for creation of AVF during a 15-month period from April 2002 to July 2003. They had been referred for graft placement due to their previous failed attempt for creation of AVF. All patients had 1-4 failed native AVF (median = 2). Our study was approved by the Investigational Review Board for Human Studies at Tehran University of Medical Sciences and patients consent forms were completed accordingly. In addition to demographic data, some information such as presence of comorbid diseases including congestive heart failure, hypertension, diabetes mellitus, and number of previous failed accesses were obtained. Preoperatively, a vascular surgeon evaluated patients by clinical examination. Clinical judgment and physical examination were used for selection of patients for native fistula placement. Therefore, patients with appropriate vessels (adequate size of vein and artery, which were more than 2.5 and 3 mm respectively) underwent AVF creation, while graft placement was performed for the remainder.

Surgical technique. 1. Creation of AVF. The procedures were performed under axillary block, or local anesthesia. For native fistula placement, the brachial artery and the cephalic or basilic vein were exposed using the same incision. Only arteries larger than 3 mm in diameter and veins larger than 2.5 mm in diameter were utilized. Veins too distant from arterial inflow for standard AVF creation were mobilized and transposed to a volar subcutaneous tunnel to allow fistula creation. The vein was anastomosed to the brachial artery in side-to-side or end to side fashion using polypropylene vascular suture. In some cases, the perforating vein was anastomosed directly to the brachial artery in an end to side fashion. 2. Insertion of AV synthetic graft: For graft placement, incisions were made over the medial aspect of the arm proximal to the elbow and in the axilla. Six to eight millimeter diameter, standard or stretch wall expanded PTFE grafts are tunneled and anastomosed to the brachial artery and axillary vein in an end to side fashion.

Follow up. Failure was defined as thrombosis of the graft or fistula or inability to cannulate fistula. Venous hypertension was suspected when considerable upper arm edema and bluish discoloration of skin occurred. Mean follow up time was 3 months.

Statistical analysis was performed using version 10.0 of the SPSS software. Differences in proportions were compared with chi-square tests, and continuous variables were compared with unpaired t tests, with significance attributed to $p<0.05$.

Results. During this time, 37 patients were referred for graft placement to our hospital. Native AVF creation was possible in 16 (43%) patients. The mean ages of the fistula group and graft group were 54 (13-75) and 53 (22-73) years. Ten (27%) patients were more than 65 years old. There was no clinically significant difference in clinical features between fistula and graft groups. comorbid diseases included hypertension (22/37, 59%), diabetes mellitus (15/37, 41%), and congestive heart failure (5/37, 14%). Although congestive heart failure in patients with native fistula was higher than the graft group, there was no clinically significant difference in comorbid diseases between fistula and graft groups. We placed an elbow fistula for half (8/16) of patients with diabetes and half (5/10) of those more than 65 years old. Patients were followed for 3 months after surgery. Causes of failure were thrombosis and infection. Failure occurred in 7/21 (33%) of grafts versus 3/16 (19%) of fistulas. The failure rate was 30% (5/15) in diabetic patients, 2 patients of the fistula group and 3 patients of the graft group. Similarly, a failure rate of 30% (3/10) was observed in patients more than 65 years old, 2 patients of the fistula group and one patient of the graft group. The complications were venous hypertension in one case and infection in 2 cases, all were from the graft group.

Discussion. As the number of diabetic and elderly people with end-stage renal disease has grown, the establishment and maintenance of functional vascular access sites has increased.[7] Unfortunately, over the past 20 years the prevalence of AVF has declined.[8] In Iran, we have no national registration, however, local data indicates that approximately 90% of vascular accesses are native AVF. To be used successfully for dialysis, a new fistula must meet several conditions. First, the draining vein must dilate adequately to permit frequent cannulation. Second, the blood flow through the fistula must be high enough to enable a dialysis blood flow of 350 mL/min. Finally, the fistula must be sufficiently superficial to allow appreciation of the anatomic landmarks and safe cannulation.[9] Grafts have a higher rate of infection than do fistulas, and unfortunately antibiotics alone are frequently inadequate and surgical procedures are needed.[10] Patients with graft had a 50% higher relative risk for hospitalization and even for patients older than 65 years, grafts had a 24% higher relative risk of failure when compared with native fistula.[11,12] Finally a higher mortality rate was found for graft accesses compared with native fistulas.[13] In this study, the complications and mortality rate of grafts were higher than native fistulas, which are compatible with previous studies. The commonly cited reasons for the switch to PTFE grafts are the aging of the ESRD population and the increasing number of patients with comorbidities, including diabetes and vascular disease.[8] However, this study shows that elbow fistula can be a good alternative to graft in diabetic patients and in patients older than 65 years.

In most parts of Iran, AVF procedures are performed by general surgeons as well as vascular surgeons. A graft is expensive and multiple attempts for AVF placement are usually carried out before graft placement. Therefore, most patients are candidates for arteriovenous graft after multiple failed access procedures. Our hospital is a referral center for complicated arteriovenous access cases, and the majority of patients have had more than

Related topics

Talaiezadeh A, Paziar F. The factors of arteriovenous fistula failure in hemodialysis patient. ***Saudi Med J*** 2006; 27: 114-116.

Karabay O, Yetkin U, Onol H. Arteriovenous fistulas for hemodialysis. Patency rates and complications. ***Saudi Med J*** 2004; 25: 1518-1520.

Kayardi M, Icagasioglu S, Yilmaz A, Candan F. Serum leptin levels and malnutrition in patients with chronic renal failure. ***Saudi Med J*** 2006; 27: 477-481.

one failed arteriovenous access before. As the data shows a major portion of them are old and diabetic. In this study, we selected the patients that had been referred for graft placement after prior failed native AVF procedures including upper arm AVF. Financial reasons, as well as less infection and occlusion rate[14] and less mortality and morbidity[15,16] of native AVF make us try one more time to place a native upper arm AVF in these patients. Of 37 patients referred for arteriovenous graft, elbow fistula was placed successfully in 43% of patients. The mean time to maturation was 1.5 months. The mean follow up time was 3 months. No infection, steal syndrome and venous hypertension were found in the native arteriovenous cases and approximately 80% of them were successfully used for dialysis with acceptable maturation time. Although there was no steal syndrome in the graft group, venous hypertension and infection were found in one and 2 patients. By considering this fact that a major portion of patients was old and diabetic, the native upper arm AVF was a good and cost-effective alternative for synthetic graft with decreased perioperative morbidity. However, we cannot conclude any superiority for one method, as it is not a properly designed comparative trial.

In brief, although our results showed lower complications, mortality and failure this study has some limitations such as the type of the study, the small number of patients, and the short duration of follow up.

References

1. Brescia M, Cimino J, Appel K, Hurwich B. Chronic hemodialysis using venipuncture and surgically created arteriovenous fistula. ***N Engl J Med*** 1966; 275: 1089-1092.
2. National kidney foundation: NKF-DOQI clinical practice guidelines for vascular access. ***Am J Kidney Dis*** 2001; 37 (Suppl 1): s137-s181.
3. Ethier JH, Lindsay RM, Barre PE, Kappel JE, Carlisle EJ, Common A. Clinical practice guidelines for vascular access. Canadian society of nephrology. ***J Am Soc Nephrol*** 1999; 10 (Supl 13): s297-s305.
4. Ascher E, Hingorani A, Gunduz Y, Yorkovich Y, Ward M, Miranda J, et al. The value and limitations of the arm cephalic and basilic vein for arteriovenous access. ***Ann Vasc Surg*** 2001; 15: 89-97.
5. Huber TS, Seeger JM. Approach to patients with 'complex' hemodialysis access problems. ***Semin Dial*** 2003; 16: 22-29.
6. Konner K, Nonnast-Daniel B, Ritz E. The arteriovenous fistula ***J Am Soc Nephrol*** 2003 14: 1669–1680.
7. D'Cunha PT, Besarab A. Vascular access for hemodialysis: 2004 and beyond. ***Curr Opin Nephrol Hypertens*** 2004; 13: 623-629.
8. Sands JJ. Increasing AV Fistulas: Revisiting a time-tested solution. ***Semin Dial*** 2000; 13: 351-353.
9. Miller CD, Robbin ML, Allon M. Gender differences in outcomes of arteriovenous fistulas in hemodialysis patients. ***Kidney Int*** 2003; 63: 346-352.
10. Ryan SV, Calligaro KD, Scharff J, Dougherty MJ. Management of infected prosthetic dialysis arteriovenous grafts. ***J Vasc Surg*** 2004; 39: 73-78.
11. Churchill DN, Taylor DW, Cook RJ, La Plante P, Barre P, Cartier P, et al. Canadian hemodialysis morbidity study. ***Am J Kidney Dis*** 1992; 19: 214-234.
12. Woods JD, Turenne MN, Strawderman RL, Young EW, Hirth RA, Port FK, et al. Vascular access survival among incident hemodialysis patients in the United States. ***Am J Kidney Dis*** 1997; 30: 50-57.
13. Taylor G, Gravel D, Johnston L, Embil J, Holton D, Paton S, et al. Prospective surveillance for primary bloodstream infections occurring in Canadian hemodialysis units. ***Infect Control Hosp Epidemiol*** 2002; 23: 716-720.
14. Sands J, Perry M. Where are all the AV fistulas? ***Semin Dial*** 2002; 15: 146-148.
15. Polkinghorne KR, McDonald SP, Atkins RC, Kerr PG. Vascular access and all-cause mortality: a propensity score analysis. ***J Am Soc Nephrol*** 2004; 15: 477-486.
16. Rayner HC, Pisoni RL, Bommer J, Canaud B, Hecking E, Locatelli F, et al. Mortality and hospitalization in hemodialysis patients in five European countries: results from the Dialysis Outcomes and Practice Patterns Study (DOPPS). ***Nephrol Dial Transplant*** 2004; 19: 108-120.