

COMPARISON BETWEEN NATIVE ARTERIOVENOUS FISTULA AND GRAFT IN PATIENTS REFERRED FOR HEMODIALYSIS ACCESS PLACEMENT

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Abstract- Arteriovenous fistula is considered as a prerequisite in patients with chronic renal failure undergoing hemodialysis. The purpose of this study was to compare the effectiveness and side effects if any of native vein and synthetic grafts in these patients. From April 2002 till July 2003, a total of 37 patients were referred to us for the utilization of these grafts. In 16 out of these patients we utilized native vein at the elbow joint, and in 21 patients we used polytetrafluoroethylene (PTFE) graft. In the native group, the results were better and side effects minimal and economically was in the interest of the patients. We advocate native vein as far as possible and give it a top priority.

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INTRODUCTION

Vascular access patency and adequate hemodialysis are essential for optimal management of hemodialysis patients with end-stage renal disease (ESRD). Since the introduction of the Brescia-Cimino fistula in 1966, this radial artery-cephalic vein (CV) wrist fistula has remained the access procedure of choice and is generally considered the fistula with the longest patency and fewest complications (1). However, the nature of its construction makes it unfeasible for a number of patients because of the poor quality of the distal cephalic vein resulting from prior venipuncture, thrombosis, or small size (2). Two alternatives are the side-to-side brachio-cephalic elbow fistula and the brachial artery (BA)-basilic vein (BV) fistula which were introduced by Carcardo *et al.* and Dagher *et al.*, respectively (3, 4).

Grafts are less desirable than native fistulas, as they have much shorter primary and secondary patencies than do native fistulas, and they require many more procedures (5). Patency is improved on a 6-8 mm graft as compared with a straight 6 mm one, but steal is more common and so it should probably be avoided in diabetic and older patients (6). In addition, in some countries such as Iran, grafts are expensive and native fistula placement is much more cost-effective.

In this study we examined to place elbow fistula instead of graft in patients who were referred for graft placement.

MATERIAL AND METHODS

ESRD patients with previous failed attempts for arteriovenous fistulas referred for graft placement were recruited. All patients had one to four failed native arteriovenous fistulas (median = 2). Preoperatively, a vascular surgeon evaluated patients by clinical examination. Clinical judgment and physical examination were used for selection of patients for native fistula placement instead of graft.

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Therefore, patients with appropriate vessels underwent arteriovenous fistula creation whereas; graft placement was performed for remaining. Preoperative arterial and venous mapping of the upper extremities by Doppler ultrasound was not obtained prior to access creation and venography for preoperative evaluation of upper extremity veins was not used. 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 arteriovenous fistula 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 brachial artery in an end to

For graft placement, incisions were made over the medial aspect of arm proximal to the elbow and in the axilla. Six to eight millimeter diameter, standard or stretch wall expanded polytetrafluoroethylene (PTFE) grafts were tunneled and anastomosed to the brachial artery and axillary vein in an end to side fashion. Our study was approved by investigational review board for human studies at Tehran University of Medical Sciences and patient consent forms were completed accordingly.

Baseline data included patient demographics, presence of comorbid diseases including CHF, hypertension, diabetes mellitus, and number of previous accesses. Failure was defined as thrombosis of 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 three months.

Analysis was performed using SPSS version 10.0. 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 the 15 month period from April 2002 to July 2003 a total of 37 patients were referred for graft placement to our hospital. Native arteriovenous fistula creation was possible in 16 (43%) of patients. The mean ages of fistula group and graft group were 54 (13 to 75) and 53 (22 to 73) respectively. 27% (10/37) of patients were more than 65 years old. Demographics and clinical features of patients are summarized in table 1. 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 more than graft group, there was no clinically significant difference in comorbid diseases between fistula and graft groups.

We could place elbow fistula for half (8/16) of patients with diabetes and half (5/10) of those with 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 vs. 3/16 (19%) of fistulas as shown in table 2. Failure rate was 30% (5/15) in diabetic patients, two patients of fistula group and three patients of graft group. Similarly failure rate of 30% (3/10) was observed in patients more than 65 years old, two patients of fistula group and one patient of graft group. The complications were venous hypertension in one case and infection in two cases and all were from graft group.

Table 1. Demographics and clinical features*

Patients characteristics	Fistula group	Graft group	<i>P</i> value
Male gender	6 (38%)	12 (57%)	NS
Age > 65	5 (31%)	5 (24%)	NS
Diabetes	8 (50)	7 (33%)	NS
Hypertension	9 (56%)	13 (62%)	NS
CHF	4 (25%)	1 (5%)	NS
Former dual lumen catheter	12 (75%)	19 (90%)	NS

Abbreviation: NS, not significant.

*Data are given as number (percent).

Table 2. Complications and outcome*

Characteristics	Fistula group	Graft group	P value
Number	16	21	NS
Failure	3 (19%)	7 (33%)	NS
Steal	0	0	NS
Venous hypertension	0	1 (5%)	NS
Infection	0	2 (10%)	NS
Mortality	4 (25%)	9 (43%)	NS

Abbreviation: NS, not significant.

*Data are given as number (percent).

DISCUSSION

As the number of diabetic and elderly people with ESRD has grown, the establishment and maintenance of functional vascular access sites has increased (7). The National Kidney Foundation Kidney/Dialysis Outcomes Quality Initiative (NKF-K/DOQI) guidelines recommend increasing placement of arteriovenous fistulas in patients with end-stage renal disease (ESRD) (8). These guidelines are based on studies that suggest improved access survival and function for native arteriovenous fistula when compared with arteriovenous graft. Unfortunately, over the past 20 years the prevalence of arteriovenous fistulas has declined. For example in the United States it is now represents approximately 28% of accesses in use (9). Unavailable or poor pre-ESRD programs and planning, the frequent need for emergent dialysis and patient resistance to the reality of impending ESRD are among the reasons for the declining use of arteriovenous fistulas (9). However, in some parts of the world, arteriovenous fistulas continue to be used in the majority of patients. Arteriovenous fistula prevalence ranges from 55 to 60% throughout Europe and Canada and is 84% in Japan (10). In Iran, although we have not a national registration, a local data gathering indicates that about 90% of vascular accesses are native arteriovenous fistula.

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 (11). Grafts have a higher rate of infection than do fistulas, and unfortunately antibiotics alone are frequently inadequate and surgical procedures are needed (12). Patients with graft had a 50% higher relative risk for hospitalization and even for patients older than 65 years, graft had a 24% higher relative risk of failure when compared with native fistula (13, 14). Finally a higher mortality rate was found for graft accesses compared with native fistulas (15). In this study the complications and mortality rate of grafts were higher than native fistulas which is 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 (9). However this study shows that elbow fistula can be a good alternative to graft in diabetic patients and in patients older than 65 years. The long maturation time of native arteriovenous fistulas is also cited as a reason for the switch to PTFE grafts. However, regarding the timing of first cannulation of arteriovenous fistulas, there is a significant differences in clinical practice between countries: Japan, 25 days; Italy, 27 days; Germany, 42 days; Spain, 80 days; France, 86 days; United Kingdom, 96 days; and the United States, 98 days (16). In Iran the first cannulation time of arteriovenous fistulas is about one and half months after surgery (local data registration). However, as one study showed, the selection of the optimal location of the first fistula, for example, a preference for the elbow region in diabetic, older, and hypertensive patients, will provide rapid maturation which is compatible with our results (17). Furthermore, placement of these upper arm fistulas does not preclude future placement of the graft, should the fistula fail. However, one study found that placement of upper extremity grafts often results in thrombosis or stenosis of the upper arm superficial and deep veins, making future placement of a native fistula more demanding (2).

In most parts of Iran, arteriovenous fistula procedures are performed by general surgeons as well as vascular surgeons. Graft is expensive and multiple attempts for arteriovenous fistula placement are usually done before graft placement.

Therefore most patients candidate 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 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 had been referred for graft placement after previous failed native arteriovenous fistula procedures including upper arm arteriovenous fistulas. Financial reasons as well as less infection and occlusion rate (18) and lower mortality and morbidity (19, 20) of native arteriovenous fistulas promoted us to investigate whether we could place a successful native upper arm arteriovenous fistula in these patients.

Of 37 patients referred for arteriovenous graft, elbow fistula could be placed successfully in 43% of patients. The mean time to maturation was 1.5 months and the mean follow up time was 3 months. No infection, steal and venous hypertension were found in the native arteriovenous cases and about 80% of them were successfully used for dialysis with acceptable maturation time. Although there was no steal in the graft group, venous hypertension and infection were found in one and two patients respectively. Considering a major portion of patients were old and diabetic, the native upper arm arteriovenous fistula was a good and cost-effective alternative to graft with decreased perioperative morbidity.

Therefore, in agreement with some other groups, we emphasize the placement of elbow fistulas in elderly and diabetic patients (9, 17). However, our hospital is a referral center and expertise of the surgeons coupled with educational efforts directed at patients and nurses has probably offered the opportunity to create native arteriovenous fistula in patients with multiple prior failed native arteriovenous fistula procedures. Therefore, this study shows that the number of arteriovenous fistulas can be increased in the dialysis population by understanding the methods to maximize successful arteriovenous fistula creation.

Conflict of interests

We have no conflict of interests.

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