

One-Year Efficacy of Expanded Polytetrafluoroethylene Vascular Graft in Eighty-Three Hemodialysis Patients

AFSHAR R¹, SALIMI J², SANAVI SR³, MODAGHEGH MH², NIAZI F, FALLAH N⁴

¹Department of Nephrology, Shahed University, Tehran, Iran

²Department of Surgery, Tehran University of Medical Sciences, Tehran, Iran

³Department of Nephrology, Shaheed Hasheminejad Hospital, Iran University of Medical Sciences, Tehran, Iran

⁴Department of Biostatistics, Shahed University, Tehran, Iran

ABSTRACT

Purpose: To evaluate the patency and efficacy of expanded Polytetrafluoroethylene (ePTFE) vascular graft in hemodialysis patients.

Materials and Methods: In a prospective study from January 1999 to January 2001 at Sina hospital 41 patients underwent implantation of 6-mm vascular grafts and 42 underwent implantation of 8-mm grafts in order to make vascular assess for hemodialysis. They were followed up to 12 months, observing the complications.

Results: Mean patients' age was 52.2 years. Thirty-seven of them were females and 46 were males. Over a 12 months period of follow-up, 12 cases of graft infection (14.5%), 21 cases of thrombosis (25.3%), 7 cases with both complications (8.4%), and 1 case of pseudoaneurism (1.2%) were observed. One-year patency rate was 34.9%. Diabetes was the only factor associated with lower patency rate (27% versus 57%, $p < 0.05$).

Conclusion: ePTFE vascular graft seems to be an appropriate substitute for arteriovenous fistula as a vascular assess in hemodialysis patients. Educating patients and good care can decrease the rate of infection, thrombosis, and other complications, resulting in a better patency and lower morbidity rate.

KEY WORDS: ePTFE, hemodialysis, patency rate

Introduction

Developed in the mid 40's, hemodialysis rescued patients with end stage renal disease, but it accompanied with the challenging problem of finding a method to provide vascular assess. Quinton and colleagues developed extracorporeal shunts in 1960.⁽¹⁾ Using arteriovenous fistula (AVF) was first introduced by Brescia et al in 1966.⁽²⁾ In spite of many remarkable advantages of AV fistula, atherosclerosis can make AVF useless in many patients. Thus, investigators have tried innovative approaches in order to connect arteries and veins, which are distal to each other, and have offered the usage of bovine carotid artery,⁽³⁾ Dacron grafts,⁽⁴⁾ saphenous vein, and

umbilical vein.⁽⁵⁾ Synthetic prostheses made of polytetrafluoroethylene (ePTFE) were first introduced in 1970.⁽⁶⁾ Nowadays, they are the most common exogenous prostheses used for providing vascular access. They are also increasingly implementing in our country. However, evaluating the patency rate and the causal factors of graft failure can help selecting patients and promoting methods of graft care. This study aimed to evaluate demographic factors associating with patency rate of graft and to define the incidence of complications and risk factors in two types of grafts with different sizes.

Materials and Methods

As a prospective study, hemodialysis patients

with non-functioning AVF, in whom providing a new fistula was not feasible, were selected. Eighty-three patients were referred to the vascular surgery department of Sina hospital to implant vascular graft between January 1999 and January 2001. Vascular graft of ePTFE (Gore-Tex®) was used for 83 patients who were randomly assigned into two groups in order to receive either 6-mm or 8-mm grafts in the upper arm. Preceding hospitalization, demographic factors including age, gender, times of dialysis per week, and history of diabetes and hypertension were taken using a questionnaire. Patients with primarily non-functioning grafts or who underwent transplantation during the period of the study were excluded. The remained patients, in whom a thrill was palpable in the graft location and a proper function was achieved, completed the study. They were followed up by the questionnaires sent to the respective dialysis wards or by regular visits; cases of non-functioning grafts and complications such as thrombosis, infection, and pseudoaneurism were recorded. As none of the recanalization methods were used after the first surgery, all the records were indicative of primary patency rate. Follow-up period was 12 months for all the patients and the cumulative time of the study was 24 months.

Statistical analysis was done by Kaplan-Meier and Log Rank tests using SPSS software.

Results

A total of 83 patients were evaluated, whose mean age was 52.2 (range 12 to 91) years. Thirty-seven of them (44.6%) were female and 46 were male (55.4%). Six-mm grafts were used in 41(49.4%) and 8-mm grafts in 42(50.6%). Hemodialysis had been carrying out three times a week in 53 patients (63.9%), twice a week in 25 (30%), and once a week in 5 (6%). Hypertension, diabetes, or both were the present risk factors for atherosclerosis in 25 (30%), 11 (13%), and 20 (24.1%) of the patients, respectively.

During a 12-month follow-up, 12 (14.5%) cases of graft infection, 21(25.3%) cases of thrombosis, 7 (8.4%) cases with both thrombosis and infection, and 1 (1.2%) case of pseudoaneurism were observed. According to Kaplan-Meier analysis, patency rate after 0, 1, 3, 6, 9 and 12 months were 85.5%, 78.5%, 65%, 49%, 40%, and 34.9%, respectively (fig. 1). Using Log Rank test, the impact of age, gender, hypertension, diabetes, graft size, and times of dialysis per week on

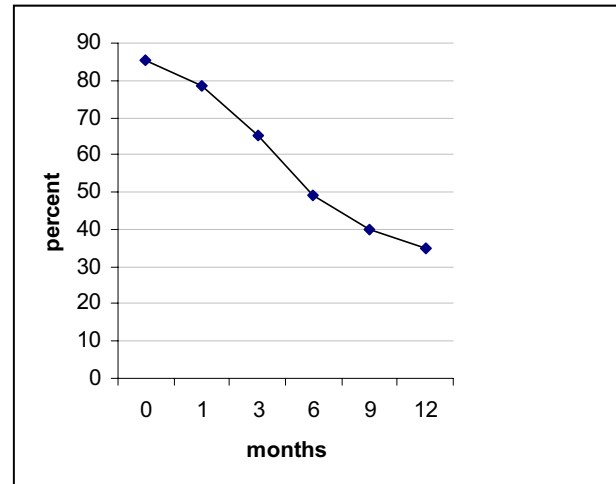


FIG. 1. Graft patency rate in 12 months

patency rate and on the type and rate of complications were evaluated; none of the above-mentioned factors had a meaningful association with 1-year patency rate or incidence of complications, except for diabetes, in which 1-year patency rate was 56% in non-diabetic and 27% in diabetic patients ($p < 0.05$), corresponding to a lower patency in diabetic ones.

Discussion

Due to the progresses in diagnostic and therapeutic methods, the number of hemodialysis patients has increased. Most of them are at risk of vascular diseases, because of elderliness, diabetes, hyperlipidemia, hypertension, and early atherosclerosis. Subsequently, AVF may not work properly in all patients and in case of the disruption of AVF, no appropriate vascular access would be available. Regarding its special advantages such as low thrombogenicity, ample durability, and the availability of its different diameters, ePTFE grafts could be a connector of arteries and veins distal to each other, providing an appropriate vascular access. Considering the high costs of vascular grafts and difficulties of vascular surgeries, preserving the implanted grafts is of high essence. One-year efficacy of grafts has been reported as 83% in a study on 46 cases.⁽⁷⁾ Two other reports have indicated a rate of 36% in 62 and 49% in 83 cases,^(8,9) in which only the age of 60 or more was associated with lower patency rate ($p < 0.05$).^(9,10,11) However, our study did not support this finding.

The average patency rate cited in different studies seems to be roughly 62%.^(7,10) Accordingly, all the studies have reported a higher patency rate than that in our study. Such differences can be

due to a series of factors: 1. surgeon's experience, 2. usage of grafts with different diameters at each end, resulting in the ability of connecting various arteries and veins, 3. the staff experience in IV injections and haemostasis after dialysis, and 4. regular graft care services.

In contrast to the studies reviewed, recanalization of grafts had not performed in any of our patients.⁽¹⁰⁻¹⁴⁾ It seems that on-time referral had not been done, leading to lose the golden time for treatment. Since recanalization is reported in almost 42.5% of obstruction cases in various studies and secondary patency rate could be raised up to 80%, educating the patients to have regular visits is very demanding.

The most common complication, leading to graft loss was thrombosis in our study, the same as that in other studies, and stenosis in the venous anastomotic site is the most important cause of thrombosis. According to the suggestion of National Kidney Foundation, follow-up for graft surveillance technique should contain calculation of recirculation percent, graft blood flow rate, and venous line pressure.⁽¹²⁾ Considering such items helps early diagnosing of grafts with low blood flow rate, which is indicative of a stenosis. Surgical intervention, then, can increase the graft patency.

Conclusion

It is suggested that graft surveillance technique could help finding at risk cases and promoting graft patency as well as educating dialysis ward staff and patients about graft care. Furthermore, elimination and control of risk factors such as smoking, diabetes, hypertension, and hyperlipidemia seems to be effective.

References

1. Quinton WE, Dillard D, Scribner BH. Cannulation of blood vessels for prolonged hemodialysis. *Trans Am Soc Artif Intern Organs* 1960; 6: 104-113.
2. Brescia MJ, Cimmino JE, Apple K, Hurwich BJ. Chronic hemodialysis using venipuncture and a surgically created arteriovenous fistula. *N Engl J Med* 1966; 6: 1089-1092.
3. Oakes DD, Spees EK Jr, Light JA. A three year experience using modified patients requiring hemodialysis. *Ann Surg* 1978; 187: 423-429.
4. Burdick JF, Scott W, Cosimi B. Experience with Dacron graft arteriovenous fistulas for dialysis access. *Am Surg* 1978; 187: 262-266.
5. Dardik H, Ibrahim IM, Dardik I. Arteriovenous fistula constructed with modified human umbilical cord vein graft. *Arch Surg* 1976; 111(1): 60-2.
6. Baker LD Jr, Johnson JM, Goldfarb D. Expanded PTFE subcutaneous arteriovenous conduit: an improved vascular access for chronic hemodialysis trans. *Am Soc Artif Intern Organs* 1976; 22: 382-387.
7. Henrich WL. Principles and practice of dialysis. Lippincott Williams & Wilkins; 1999. p. 45-47.
8. Daguirdas JT, Blake PG, Ing TS. Handbook of dialysis. 3rd ed. Lippincott Williams & Wilkins; 2001. p. 86-90.
9. Tellis VA, Kohlberg WI, Bhat DJ, Driscoll B, Veith FJ. ePTFE fistula for chronic hemodialysis. *Ann Surg* 1979; 189(1): 101-5.
10. Chen CY, Teoh MK. Graft rescue for haemodialysis arterio-venous grafts: is it worth doing and which factors predict a good outcome? *J R Coll Surg Edinb* 1998 Aug; 43(4): 248-50.
11. Cinat ME, Hopkins J, Wilson SE. A prospective Evaluation of PTFE graft patency and surveillance technique in hemodialysis access. *Ann Vasc Surg* 1999 Mar; 13(2): 191-8.
12. NKF - DOQI guideline for vascular access. *Am J Kidney Dis* 2001; 37(supple 1): 5137.
13. Munda R, First R, Alexander W, Linneman CC. PTFE graft survival in hemodialysis. *JAMA* 1983; 249: 219.
14. Schwab SY. Vascular access for hemodialysis. *Kidney Int* 1999; 55: 2078.