

Ligature Versus Transvenous Endovenorrhaphy for Closure of Side-to-Side Arteriovenous Fistula Created for Hemodialysis

Jalaladin Khoshnevis, Mohammad Reza Sobhiyeh, Niki Tadayon, Hojat Molaee Govarchin Ghalae, Mohammad Reza Kalantar Motamedi

Purpose: To report a novel technique for arteriovenous fistula (AVF) closure in side-to-side fistulas.

Materials and Methods: One hundred and sixty-two patients with side-to-side AVFs, who were candidates for AVF closure, were randomly divided into two groups: group A (84 patients) who underwent AVF ligation and group B (78 patients) who underwent AVF closure using transvenous endovenorrhaphy technique. Both procedures were conducted by the same surgical team. The patients were followed up for 6 months.

Results: Of 124 patients with proximal AVFs, 65 (52%) subjects underwent ligation and 59 (42%) transvenous endovenorrhaphy. Of 38 patients with distal AVFs, half underwent ligation and for the remainder, transvenous endovenorrhaphy was done. Failure of AVF closure was detected in 28 (17%) patients; 25 (89.28%) were in group A and 3 (10.71%) were in group B. All of these recurrences were successfully treated by transvenous endovenorrhaphy technique.

Conclusion: We claim that significant lower failure rate of transvenous endovenorrhaphy makes it the technique of choice, especially for side-to-side AVFs.

Keywords: arteriovenous fistula, hemodialysis, treatment outcome, prospective studies

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INTRODUCTION

Revolutionary changes in management of end-stage renal disease have led to increase in the need for hemodialysis during the last two decades. It is estimated that its incidence is rising at a rate of 2% to 4% annually.⁽¹⁾

Vascular access is essential for chronic hemodialysis and persists as a surgical challenge. More than 60% of all the patients with end-stage renal disease, who require chronic hemodialysis, are accessed through a native arteriovenous fistula (AVF) or bridge fistula made by polytetrafluorethylene graft

(arteriovenous graft).⁽¹⁾

Native AVF provides the best possible vascular access. Compared with the prosthetic bridge graft, AVF is more durable and has better long-term patency and fewer complications, including a lower incidence of infection and vascular steal syndrome.⁽²⁾

Patients who are candidate for AVF creation, must be evaluated pre-operatively and selected meticulously to prevent serious complications. Superficial or deep venous stenosis or thrombosis can result in venous hypertension,⁽³⁾

Department of General and Vascular Surgery, Shohada-e-Tajrish Hospital, Tehran, Iran

*Corresponding Author:
Mohamad Reza Sobhiyeh, MD
Department of General and Vascular Surgery, Shohada-e-Tajrish Hospital, Tehran, Iran
Tel: +98 21 227 180 0112
Fax: +98 21 2272 1144
E-mail: MReza_Sobhiyeh@yahoo.com*

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and missed arterial insufficiency may lead to steal syndrome with critical limb ischemia necessitating AVF closure.^(4,6) Incorrect technique of puncture may cause pseudoaneurysms and possibly life-threatening bleeding.^(7,8)

Some patients with successful renal transplantation may prefer to have the AVF being closed without developing any complications.⁽⁹⁾ Different techniques have been introduced for AVF closure. The most popular one is ligation of fistula's tract or ligation of proximal and venous part, including side-to-side AVF.⁽¹⁰⁾ Despite tedious dissection and difficult arterial and venous control, serious complications, such as pseudoaneurysm and venous aneurysms formation may occur.⁽¹¹⁾

MATERIALS AND METHODS

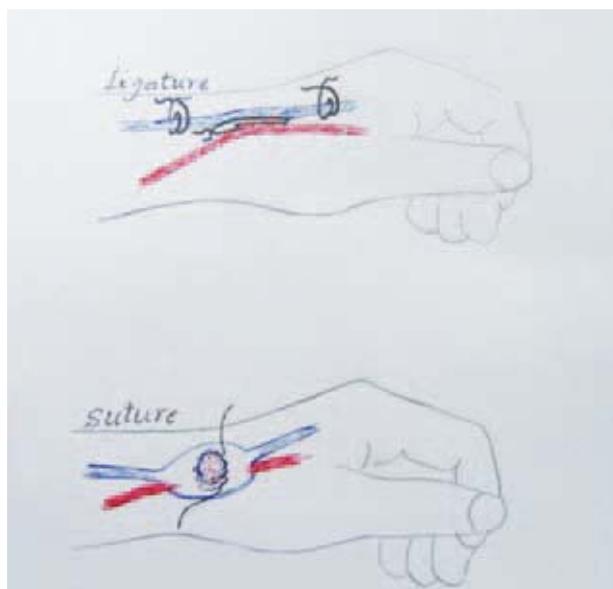
Between October 2002 and September 2008, 168 patients with side-to-side AVFs, who were candidates for AVF closure due to complication or successful kidney transplantation, regardless of age, gender, and underlying disease, were randomly divided into two groups: group A had ligation and group B underwent fistula closure using transvenous endovenorrhaphy technique. Both procedures were performed by the same surgical team.

The patients were followed (up to 6 months) by another team which were blinded to the surgical technique. Thrill palpation or bruit auscultation in the site after AVF closure was considered as the closure failure. Results were assessed on the 1st postoperative day and monthly thereafter.

Six patients missed follow-ups; therefore, they were excluded from the study. The data of the remaining 162 patients were analyzed using SPSS software (the Statistical Package for the Social Sciences, Version 9.0, SPSS Inc. Chicago, Illinois, USA) by Chi-square method.

Surgical Techniques

Because of the general medical condition of these patients, every effort was made to use local anesthesia. Therefore, lidocaine 2% was injected with the dosage of 5 to 10 mL at the site of the maximum thrill palpation.



Techniques for arteriovenous fistulas closure.

Technique of ligation: Arteriovenous fistula was exposed through an incision slightly longer than the previous incision scar. Dissection was continued to expose four limbs of the AVF. A loop of silk-0 was encircled around the venous limbs and AVF tract, and was ligated. Hence, the thrill would no longer be palpable (Figure).

Technique of transvenous endovenorrhaphy: Maximum thrill palpation site was marked. Thereafter, a tourniquet was applied on the arm. A bloodless field was provided by smarch band (elastic band) around the limb and inflating the tourniquet, which was set on 250 to 300 mmHg pressure. After removing the smarch band, an incision was made exactly on the premarked area, which corresponds to the previous incision scar. Without creating skin flaps and exposing limbs, venotomy was performed. Four ostia, two belonging to the arterial source of AVF and the other two belonging to the vein side, became evident. The ostia of AVF (connection) were obliterated with prolene 5-0 suture. Thereafter, the ventomy was repaired by the same suture (Figure). To prevent superficial thrombophlebitis, elastic bandage was applied for one week.

RESULTS

The participants consisted of 90 (55.5%) men and 72 (44.4%) women, with the mean age of 52 years.

Indications for AVF closure

| Indication | Number | Percentage |
|------------------------|--------|------------|
| AVF hypertension | 117 | 72.22 |
| Venous aneurysm | 20 | 12.34 |
| Steal syndrome | 18 | 11.12 |
| Kidney transplantation | 7 | 4.32 |
| Totally | 162 | 100 |

One hundred and twenty-four (76.5%) AVFs have been created in the antecubital fossa (side-to-side brachiocephalic or side-to-side brachio basilic type) and remaining 38 (23.4%) were at the wrist or snuffbox region (side-to-side brachiocephalic type).

Indications for AVF closure are demonstrated in Table. In patients with proximal AVFs, fistula closure was done using ligation and transvenous endovenorrhaphy, in 65 and 59 patients, respectively. Of 38 patients with distal AVFs, half underwent ligation and the other half had transvenous endovenorrhaphy.

AVF closure failed in 28 patients; 25 (89.28%) were in group A (17 in antecubital and 8 at the wrist) and 3 (10.71%) were in group B (1 in antecubital and 2 at the wrist). The rate of closure failure was 15.4% and 1.8% in ligation and transvenous endovenorrhaphy groups, respectively ($P = .000$). The rate of closure failure was 11.1% in the proximal (antecubital) AVF group and 23.3% in the distal (snuff box) and wrist group.

These recurrences were detected from first postoperative day up to 6 months with the mean of 43-day interval. The mean age of patients with fistula recurrence was 50.5 years. All of these recurrences were successfully treated by transvenous endovenorrhaphy technique. In 15 (53.5%) subjects, there was a painful palpable mass in addition to the presence of bruit.

DISCUSSION

There are complications cited for permanent hemodialysis access, including refractory heart failure and dialysis shunt-associated steal syndrome (DASS).^(12,13) In addition to steal phenomenon (stage I), which can be treated conservatively, there are three stages of DASS following autogenous hemodialysis access that require surgical intervention (stage II, no acral

lesions; stage III, small acral lesions; and stage IV, extended acral lesions).⁽¹⁴⁾

Correction of symptomatic vascular steal distal to an AVF requires either fistula ligation or banding, which can be done using substances such as Amplatzer Vascular Plug Type II (AVP II). It is a self-expandable Nitinol wire-mesh device.⁽¹⁵⁾

Ligation carries the obvious disadvantage of destruction of a functioning angioaccess, whereas banding procedures have been plagued by the complexity of many of the reported techniques and the difficulty of balancing fistula flow with distal perfusion.⁽¹⁶⁾

There is no consensus about the best technique for AVF closure. However, ligation technique has been used traditionally. Considering personal technical skills, ligation may provide acceptable results, but our study showed that it is associated with high failure rate.

Dissection in scar tissue may damage artery or vein, and lead to pseudoaneurysm formation. Scarred tissue has less elasticity and may be cut when silk-1 is going to be tied. Accordingly, there is some resistance to closure due to its inherent rigidity and gradual opening by each arterial pulse. Additionally, the arterial pulse is intensified due to chronic artery hyperfunctioning and hypertrophy. This may also underline the pseudoaneurysm formation. Therefore, failure may occur, which can be diagnosed clinically by thrill palpation, bruit auscultation, or pulsatile mass.^(5,17,18)

In our experience, transvenous endovenorrhaphy was associated with significantly less failure rate than ligation technique ($P = .000$). This technique also has the advantage of less operation time, minimal bleeding, and simplicity.

CONCLUSION

Our results indicated that transvenous endovenorrhaphy is a versatile technique with lower failure rate, especially for closure of side-to-side AVFs.

CONFLICT OF INTEREST

None declared.

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