Hybrid Technique for Management of Thrombosed Hemodialysis Autogenous Arteriovenous Fistulas

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Abstract

Purpose: For the successful treatment of thrombosed autogenous arteriovenous fistula (AVF), a hybrid technique in which endovascular combined with surgical thrombectomy was done.

Methods: In thirty cases of thrombosed AVFs a hybrid procedure was performed. The procedure consisted of surgical thrombectomy and balloon angioplasty. Procedure related outcomes such as technical success rates and primary patency rates were analyzed, prospectively.

Results: Technical success rates 27 cases (92.5%) and primary patency rates (85.9%) at 6 months, 81.1% at 12 months, 81.1% at 18 and 24 months respectively.

Conclusion: Hybrid surgery for thrombosed autogenous arteriovenous fistula is feasible with good technical success and patency rates.

Key Words: Arteriovenous fistula – Hybrid surgery – Thrombosis.

Introduction

AUT GENOUS arteriovenous fistula (AVF) has been recommended more than artificial graft. The cost of maintaining autogenous AVF is less than synthetic grafts because of lower surgical morbidity, mortality, incidence of infection and good patency rate [1]. However, when autogenous AVF was occluded by thrombosis, the salvaging procedures, didn’t show satisfactory results reference. The National Kidney Foundation Dialysis Outcomes Quality Initiatives suggests that choosing the method of salvage procedure depends on the capabilities of each institution [2].

To improve the technical success rates of thrombosed autogenous AVFs salvage and to prolong the patency rates, two treatment modalities of both surgical and endovascular treatment have been combined and performed in the same operative setting.

Patients and Methods

Thirty patients with thrombosed autogenous AVF were included. From November 2013 to November 2015 managed with hybrid surgery. The medical records of consecutive patients with thrombosed autogenous AVFs who underwent hybrid surgery were reviewed. The radiologic image records were reviewed to identify the location of vascular stenosis in each patient. The patients’ demographics including types of vascular access, age of AVFs, length of time between thrombosis and salvage procedure, operating time, technical success rates and procedure related complications were collected. The patients inclusion criteria include recent thrombosed AVF with thrombus load and thrombosed fistula with aneurysm. The patients excluded were those with stenosed AVF and those with thrombosed AVF more than one month.

Technical success rate was defined as the successful restoration of AVF flow with satisfactory dialysis utilizing the restored vein after the procedure. Primary patency was calculated from the date of the initial salvage procedure to the next subsequent access intervention. Under the circumstance where the majority of patients were referred from other dialysis centers and referred back after successful treatment, patency rate was confirmed by successful dialysis.

Technique:

Under local anesthesia, an approximately 3cm transverse skin incision was made over non-punctured fistulated vein. The vein was dissected
from the surrounding tissue and controlled with a vessel loop proximally and distally. A transverse venotomy was made and the distal thrombus was removed with forceps and/or a 4 or 5-F Fogarty balloon catheter. In cases where the thrombectomy was incomplete, the remaining thrombus was removed by manual squeezing. Afterwards, a 6-F introducer (Terumo Co.) was introduced via distal fistulotomy opening and a fistulogram was taken to identify the etiology of the blood flow blockage and remnant thrombus. The proximal fistulogram was taken in the same manner. If remnant thrombus was found at fistulography, manual squeezing and passes of thrombectomy catheter were repeated. After thrombectomy, luminal narrowings were confirmed by fistulography. When stenotic lesions were identified by fistulography, a 0.035" angled guide wire was introduced and passed the stenotic lesions. Balloon angioplasty was performed to correct the stenotic lesions using 6mm noncompliant balloon for draining vein and 12mm for central vein, and 4 to 6mm for juxta-anastomosis. If the stenotic lesions were completely corrected after balloon angioplasty in the fistulogram, the venotomy was closed with 6/0 polypropylene sutures. All procedures were performed in an operation unit, and fistulography was obtained using C-arm fluoroscopy.

Results

This study was conducted on 30 ESRD patients 21 patients were males, and 9 were females. The mean age was 53.8±14.5 years (ranging from 23-76 years). The causes of ESRD in the study patients were hypertension in 66% of patients, diabetes in 25% of patients, glomerulonephritis in 5% of patients, systemic lupus in 5% of patients and 10% of patients the cause was obstructive uropathy and 20% of patients the causes of renal failure were unknown. There were 20 brachiophelial fistulas and 10 brachiobasilic fistulas with basilica vein transposition. The age of AVF ranged from 20-36 months. The primary lesions were categorized according to the site as the following: 18 juxta-anastomotic, 20 in the draining vein and 3 in central vein. A thrombosed aneurysm was encountered in 8 cases. There were 3 failures, two due to central occlusion that prevented guidewire passage and one due to tight stricture at the cephalic arch that led to recoil after balloon angioplasty. Technical success was recorded in 27cases (92.5%). Primary patency of salvaged AVF by hybrid technique was 85.9% and 81.1% at 6 months and 12 months, respectively. The decreased patency mostly due to lesion recurrence at the site of balloon dilation.

Discussion

An increasing number of patients with renal failure are requiring long-term dialysis for 5 to 10 years or even longer. If the clotted vascular access is routinely abandoned, there will be a large number of patients in most dialysis populations who will exhaust the more desirable upper extremity access sites and require alternate sites such as the leg or chest wall. In some patients, all available sites may eventually be used, prohibiting further hemodialysis.

Therefore, salvage of thrombosed vascular access is also important due to the limited resources of blood vessels available for the creation of new access and the sparing hemodialysis catheter needed during access maturation.

Most clotted AVFs have one or more underlying stenotic lesions, a complete thrombectomy in conjunction with angioplasty of the stenotic lesions should be required to successfully treat the AVF thrombosis and to save the previous dialysis access site [4].

Traditionally, the treatment of thrombosed AVFs consisted of surgical thrombectomy followed by local revision of the access. It is often difficult to completely remove the thrombus adjacent to an anastomosis of the fistula and an aneurysm within the fistula, which can prevent it from passing the thrombectomy catheter. Therefore, surgical thrombectomy of autogenous AVFs is often thought to be a challenging and fruitless endeavor.

Several comparative studies of surgical versus endovascular treatment of thrombosed accesses have reported that surgery was superior to endovascular treatment in terms of success rate and long-term patency rate, although endovascular treatment has been used worldwide because of its convenience [5-8]. However, clots could be retained in multiple areas of aneurysmal dilatation, and the major cause of technical failure included incomplete thrombectomy after percutaneous procedures. During hybrid surgery, clots, even large pieces of thrombus, contained in aneurysm, could be removed feasibly by manual squeeze, multiple passes of thrombectomy catheter and surgical curettage. After the surgical procedure, luminal patency could be improved by balloon angioplasty.

Most episodes of access thrombosis coincide with the presence of stenosis. It is necessary to detect its sites and to correct the lesions promptly for access salvage. The surgical revision of thrombosed AVFs is often considered a struggle for the
vascular surgeon because it is difficult to accurately detect and completely correct stenotic lesions. Although Jain et al. [9] have reported improved technical success rates of percutaneous mechanical thrombectomy (76.0%) for recently thrombosed autogenous AVFs, primary fistula patency was fairly short-lived, and the fistula required repeated interventions to achieve long-term survival. Though the technical success rate (68.4%) and primary patency rate (36.8% at 6 months) of percutaneous mechanical thrombectomy in our institution were comparable to other reports, more improved results were needed. Therefore, a new salvage technique was tried to improve technical success rates and primary patency rates. Surgical revision at the time of thrombectomy, as directed by fistulography, has been demonstrated to improve patency rates [10,11]. Combined surgical thrombectomy with endovascular treatment for salvage of thrombosed autogenous AVFs have been introduced and reported reasonable success rates (70%) compared to others [12]. To obtain the synergy effect of both surgical and endovascular treatment and to improve the technical success rate, hybrid technique has been used for thrombosed autogenous AVFs salvage.

Hybrid technique is able to remove thrombus feasibly in the surgical fields and correct underlying causative lesions disclosed by the intra-operative fluoroscopy. As a consequence, hybrid technique has shown much-improved technical success rates (92.5%), and higher primary patency rates than percutaneous mechanical thrombectomy in other reports [9].

The most substantial contribution to a cost difference might have been due to significant differences in technical success or complication rates because the need for repeated procedures would likely overwhelm the moderate per-procedure costs, as could excess hospital stay and other costs of treatment complications. Hybrid technique for treatment of thrombosed AVFs has several advantages. First, the thrombus could be removed more feasibly than percutaneous thrombectomy. Second, endovascular treatment could be performed in both proximal and distal vessels with a single skin incision and venotomy. Third, endovascular or surgical angioplasty was possible by the accurate detection of the stenosis site by fistulogram during surgery. Lastly, this operation setting permits easy conversion to surgical angioplasty. In conclusion, salvage procedures for thrombosed autogenous AVFs could be performed in an operation unit under the intra-operative fluoroscopy to define the cause of AVF thrombosis and to determine the method of appropriate revision. In this study, hybrid surgery showed higher a technical success rate and primary patency rate than those of percutaneous mechanical thrombectomy, thereby, avoiding the need for placement of a dialysis catheter.

References

استخدام الجراحة الهجينة كعلاج لفشل إستخدام أنواع الشريانية الوريدية

إن الجراحة الهجينة عن طريق دمج الفتح الجراحي مع التوسيع البالوني للوصلات الشريانية الوريدية المتخصصة دور كبير في اتخاذ هذه الوصلات من التطرف حيث أن نسبة النجاح الفني لهذا الإجراء عالية وكذلك عدة مزايا ومنها أنها غير مختارة نسبياً، تحتاج لوقت أقل، احتمالات حدوث عدوى بكبيرة أقل، تحافظ على أوردة المريض وتمكن المريض من الاستخدام الفوري للوصلة الشريانية الوريدية في عملية الفسيل الكلي.