

Treatment of aneurysms of hemodialysis access arteriovenous fistulas

Hemodiyaliz amaçlı açılan arteriyovenöz fistül anevrizmalarının tedavisi

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Background: This study aims to present the results of the surgical techniques employed to repair the aneurysms which occurred in arteriovenous fistulas (AVFs) and to ensure fistula continuity.

Methods: A total of 30 cases (14 males, 16 females; mean age 52 years; range 35 to 70 years) with aneurysms of 4 cm or over in AVFs for hemodialysis in Antakya State Hospital, Clinic of Cardiovascular Surgery and Mustafa Kemal University, Department of Thoracic Surgery were evaluated retrospectively. In 21 patients, the AVF was radiocephalic, and in seven it was brachiocephalic. All patients were evaluated with Doppler ultrasonography before surgery. Twenty-eight of the patients had a palpable pulsatile mass. Four of these patients additionally had coldness and hand numbness, two had hand edema and skin lacerations, and two had NYHA (New York Heart Association) degree 3-4 heart failure. The method of surgery was determined by considering the artery and vein structures of the patients.

Results: All patients were discharged on the first day after surgery. No complications, such as hematoma, ischemia, wound infection, or neurological damage, were observed. The mean follow-up period after surgery was 12 months.

Conclusion: Surgical repair remains the gold standard for AVF aneurysms. In our clinic, the plication method is applied to the aneurysm sac in appropriate cases. We believe that this method is effective to ensure the continuity of the fistula.

Key words: Aneurysm; arteriovenous fistula; plication.

Amaç: Bu çalışmada arteriyovenöz fistül (AVF)'lerde meydana gelen anevrizmaların tamiri ve fistülün devamlılığının sağlanması için kullanılan cerrahi tekniklerin sonuçları sunuldu.

Çalışma planı: Antakya Devlet Hastanesi Kalp Damar Cerrahisi Kliniği'nde ve Mustafa Kemal Üniversitesi Göğüs Cerrahisi Anabilim Dalı'nda hemodiyaliz için açılan AVF'lerinde 4 cm ya da üzerinde anevrizması olan toplam 30 hasta (14 erkek, 16 kadın; ort. yaş 52 yıl; dağılım 35-70 yıl) geriye dönük olarak değerlendirildi. Arteriyovenöz fistül 21 hastada radyosefalik, yedi hastada ise brakiosefalik idi. Tüm hastalar ameliyattan önce Dopplerli ultrasonografi ile değerlendirildi. Hastaların 28'inde palpe edilebilir pulsatil kitle mevcuttu. Bu hastaların dördünde ilave olarak elde soğukluk ve uyuşma, ikisinde elde ödem ve ciltte laserasyon ve ikisinde NYHA (New York Kalp Birliği) derece 3-4 kalp yetmezliği mevcuttu. Ameliyat yöntemi hastaların arter ve ven yapıları değerlendirilerek belirlendi.

Bulgular: Tüm hastalar ameliyattan sonraki birinci günde taburcu edildi. Hematom, iskemi, yara enfeksiyonu ya da nörolojik hasar gibi hiçbir komplikasyon gözlemlenmedi. Ameliyattan sonraki ortalama takip süresi 12 aydı.

Sonuç: Cerrahi onarım AVF anevrizmaları için altın standart olmaya devam etmektedir. Kliniğimizde uygun olan olgularda anevrizma kesesine plikasyon yöntemi uygulanmaktadır. Bu yöntemin fistülün devamlılığının sağlanmasında etkili olduğuna inanmaktayız.

Anahtar sözcükler: Anevrizma; arteriyovenöz fistül; plikasyon.

In patients with chronic renal failure who are undergoing hemodialysis, arteriovenous fistulas (AVF) are used as permanent vascular access points. One of the late complications of AVF is aneurysm development, with an incidence rate of 5-8%.^[1-3] After

AVF operations, aneurysms or pseudoaneurysms can be observed at the site of anastomosis or venous puncture. The excessive dilatation and mobilization of the vein causes damage to blood vessel walls leading to aneurysm formation.^[4] Anastomotic technique

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errors, repeated injections, trauma to the entrance site, and infection are factors causing the development of pseudo- or true venous aneurysms.^[5] If not treated, these can cause embolization and thrombosis and can also lead to bleeding and infection by abrading the overlying skin.^[3] To prevent the development of aneurysms, fistula diameters should not exceed 5 mm or 75% of the artery diameter, and repeated punctures should not be made at the same site. In this study, we analyzed the results of the surgical techniques we employed for true aneurysms which developed after AVFs.

PATIENTS AND METHODS

Thirty patients (mean age 52 years; range 35 to 70 years) who developed aneurysms of 4 cm or more in AVFs created for hemodialysis in the Antakya State Hospital, Clinic of Cardiovascular Surgery and Mustafa Kemal University, Department of Thoracic Surgery, between December 2008 and October 2009 were evaluated retrospectively. Twenty-one patients had radiocephalic fistulas, and seven patients had brachiocephalic fistulas. All patients were evaluated with color Doppler ultrasonography (USG) before surgery, and the method of surgery was determined by considering the artery and vein structures of the patients. Upon physical examination before the operation, 28 patients had a pulsatile mass and continuous murmur in the arm (Figure 1). Radial and ulnar pulses could be palpated at the extremity where the aneurysm developed. Additional symptoms were cooling and numbness of the hand in four patients, hand edema and skin laceration in two patients, and anesthesia with Bupivacaine (Astra Zeneca USA). Bupivacaine hydrochloride 5 mg/ml, 150 mg was used subcutaneously for NHYA (New York Heart Association) class 3-4 heart

failure in two patients. The surgery was performed under local surgical procedures. The skin on top of the cyst was incised directly, and the thin subcutaneous tissue covering the aneurysm was raised. The sac was controlled by proximal and distal suspension of the brachial and radial arteries. It was determined that all aneurysms were true aneurysms. The surgical choice in 25 patients was plication of the aneurysm and constriction of the arteriovenous anastomosis. Skin and subcutaneous areas were anesthetized with local anesthesia. Three incisions were performed; two to the aneurism area and one to the brachial artery area. Brachial artery was suspended. Area of aneurism was resected and the remaining part was narrowed and plicated. The remaining part was narrowed and plicated to resect the redundant part, and the width of the aneurysm was reduced to the diameter of the artery. The site of anastomosis was constricted with silk sutures during exploration (Figures 2, 3). The aneurysm was resected in three patients with a graft placed between the artery and vein. In two cases, a percutaneous stent was placed. When necessary, a hemovac drain (Bıçakçılar, Türkiye, Bvak 400, drainage kit 12ch), was placed to the region of the aneurysm and the layers were duly closed with type and diameter of suture (5/0 prolene Ethicon, USA).

RESULTS

All patients were discharged on the first day after surgery. No complications, such as hematoma, ischemia, wound infection, or neurological damage, were observed. The mean follow-up period after surgery was 12 months, and the results of their Doppler USG were normal in the sixth month of follow-up. Currently, the hemodialysis programs of the patients have been continuing without any problems.



Figure 1. Pulsatile mass in the forearm.



Figure 2. Surgical image of aneurysm.



Figure 3. Plication of aneurysm.

DISCUSSION

Kidney transplantation is the basic treatment for patients with chronic renal failure (CRF). Although it is a supportive treatment, hemodialysis is the only choice of treatment in our country for most diabetic patients due to an insufficient number of kidney donors when compared with the increasing number of patients.^[1]

The number of CRF patients undergoing dialysis is growing gradually due to the increasing availability of hemodialysis facilities. This brings about problems in the performance and follow-up of AVF for hemodialysis. Arteriovenous fistula is the most reliable and long-functioning permanent vascular access and has been the first choice in application (in order to enter patients' long-term and safe way hemodialysis arteriovenous fistula).^[6] Since the risk of infection and thrombosis is less with AVF than with synthetic grafts, it is more commonly preferred.^[7]

The most widespread late-term complication in AVF for hemodialysis is an aneurysmal dilatation, which often has the characteristics of a true aneurysm.^[5] All cases in our study were true aneurysms. If aneurysms remain untreated, short-term complications, such as symptoms resulting from local compression, emboli, endocarditis, or rupture or long-term complications, such as dilatation, venous hypertension, or distal ischemia, can develop.^[7] If skin infections or fistulas develop or if there are indications of distal vascular failure in the extremity, the aneurysm should be operated on due to the risk of rupture. In our study, in addition to the palpable pulsatile mass, four patients experienced hand cooling and numbness, two patients had hand edema and skin lacerations, and two patients had NHYA class 3-4 heart failure. In a study investigating the diagnosis and

treatment strategies along with their results in upper extremity aneurysms distal to the axillary artery, it was stated that 67% of the patients consulted due to a pulsatile mass.^[8] The second most common symptoms were pain and/or paresthesia.^[8] If the lesion is deeper or is shaded by the surrounding hematoma, these symptoms may not occur.^[5] In our study, the main complaint in 28 patients was a palpable mass and findings of a thrill upon physical examination.

The history of the patient and the physical examination findings are very helpful for diagnosing and determining the surgical treatment method. In many cases, duplex scanning was also found to be very useful with an excellent range of sensitivity and specificity. This technique not only shows the blood filling the cavity but also the jet flow passing through the arterial defect.^[9,10] The color Doppler USG performed on our patients helped us in the diagnosis and determination of the surgical approach criteria. Most authors have reported that color Doppler USG is sufficient enough, even in late-term follow-up.^[9] The patients in our study were evaluated with color Doppler USG in the postoperative sixth month, and it was observed that all AVFs were in good condition.

Such methods as ligation, USG-guided compression, endovascular graft implantation, or thrombin injection are employed in the treatment of AVF aneurysms.^[10-12] The use of stents for AVF aneurysms is quite a new technique. By using the Seldinger technique, it can be applied to patients who have fusiform aneurysms but cannot undergo surgery. There are stents ranging from 20 mm to 14 cm. With the help of this technique, a stent with the appropriate length and width is inserted in the AVF resulting in the space between the stent and the aneurysmal sac becoming thrombosed without any aneurysmal rupture risk. Furthermore, access to dialysis through these stents is an advantage. We applied the technique to two of our patients who we thought could not undergo surgery, and these patients still have successful access to hemodialysis. Although endovascular interventions have increased in recent years, this method has some disadvantages, such as a higher cost or infection due to foreign bodies. It also makes cannulation impossible at the stent site and has no long-term follow-up results. We believe that studies with larger series are needed to test the effectiveness of the technique.

Surgical repair still remains the gold standard.^[13] The surgical treatment of choice can either be closure of the fistula with ligation or preserving the continuity of the fistula by partial resection of the aneurysm sac.^[14,15] It is an effective method for the elimination of the aneurysm, and the risk of bleeding during surgery

is less with this method than with other methods. However, it has a disadvantage in that the fistula cannot be used again. Furthermore, these patients require catheter insertion for the continue of dialysis, which can cause various complications.^[16] The same study stated that by performing plication of the fistula aneurysm, the incidence of complications and the length of hospital stay can be reduced; in addition, it is possible to carry on the dialysis through the aneurysm. It was also stated that in cases where there is no urgency, plication should be preferred instead of resection or ligation.^[16] We also preferred the same method in 28 of our cases. Another study reported that fistula patency rates decreased after surgery was performed on complicated aneurysms where thrombosis, bleeding, or infection developed. Therefore, surgical intervention should precede the development of complications.^[17] Furthermore, early intervention was reported to be important since the risk of spontaneous rupture is a life-threatening complication.^[15,18] In our cases, we operated on the aneurysm in the early period before the development of any complications. Therefore, we think that it is more efficient to do plication along with partial resection of aneurysm.

In conclusion, AVF aneurysms should be treated before the development of any complications. Surgical treatment is still of great importance. Because of the difficulty in achieving permanent vascular access in patients with renal failure, we believe that to ensure the continuity of the fistula, constriction of the anastomosis or constriction of the aneurysm sac alone can be employed as a safe and effective surgical method which can replace ligation in the short- and medium-term.

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