Postoperative Complications Following Hemodialysis Access Procedures

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✔ From July 1986 to September 1996, 322 arteriovenous fistulas were constructed in 250 patient for permanent hemodialysis: 315 autogenous and 7 graft fistulas (polytetraflouroethylen (PTFE)-4, dacron-3). 269 snuff box (84%), 29 radiocephalic (8%), 24 brachiocephalic (7%) and 1 subclavian (0.3%) arteriovenous fistulas were performed. Successfull rate at first operations (255/322) was 79%. In the immediate postoperative period, 54 snuff box fistulas (20%) developed complications (52 early occlusion and 2 postoperative local bleeding) while 6 radiocephalic fistulas (20.6%) developed immediate postoperative complications (5 early occlusion and 1 anastomotic hemorrhage). Brachiocephalic fistulas didn't developed any immediate postoperative complications. In the long-term period 9 brachiocephalic fistulas (37.5%) developed complications (4 venous return dysfunction 3 aneurysm 1 graft infection and 1 late trombosis) while 4 snuff box fistulas and 1 radiocephalic fistulas developed late trombosis. Based on this complication rates, we should make every effort to construct the autogenous snuff box fistula as the first choice of hemodialysis access procedure in properly selected patients.
Key words: *Complication, hemodialysis, arteriovenous fistula*

✔ **Hemodiyaliz Amaçlı Arteriovenöz Fistül Uygulamalarında Ameliyat Sonrası Gelişen Komplikasyonlar**

Haziran 1986-Eylül 1996 yılları arasında kronik böbrek yetmezliği olan 250 hastaya hemodiyaliz amaçlı toplam 322 arteriovenöz fistül uygulaması yapıldı. 269 (%83.3) snuff box, 28 (%8,6) radiosefalik ve 24 (%7.4) brakiosefalik arteriovenöz fistül operasyonu gerçekleştirildi. 7 hastaya sentetik greft uygulandı (PTFE-4, dakron-3). Ilk operasyonda başarı oranı %79 (255/322) idi. Ameliyat sonrası erken dönem komplikasyon oranları; snuff box fistül uygulananlarda %20 (52 erken tıkanıklık, 2 lokal kanama) ve radiosefalik fistül uygulanlarda %21.4 (5 erken tıkanıklık, 1 anastomoz bölgesinden kanama) idi. Brakiosefalik fistül uygulananlarda herhangi bir erken dönem komplikasyonu gelişmedi. 9 (%37.5) brakiosefalik fistül uygulamasında geç dönem komplikasyonu (4 venöz dönüş yetersizliği, 3 anevrizma formasyonu, 1 greft infeksiyonu ve 1 geç tromboz) gelişirken, 4 snuff box ve bir radiosefalik fistül uygulamasında geç tromboz meydana geldi. Bu komplikasyon oranları dikkate alındığında, uygun hastalarda snuff box fistül uygulamasının öncelikle tercih edilmesi gerektiği görülmektedir.
Anahtar kelimeler *Komplikasyon, hemodiyaliz, arteriovenöz fistül*

Hemodialysis requires repeated reliable access to blood vessels capable of providing rapid extracorporeal blood flow. This access is currently provided by autogenous or arteriovenous graft fistulas[1,2]. Due to inadequate vessels to support a primary autogenous arteriovenous fistula in some patients, synthetic grafts have gained

acceptance for hemodialysis access.

Contrary to reports emphasizing long-term complications, there are no reports in the literature solely addressing the immediate postoperative complications following vascular access procedures. This study is a retrospective review of 322 hemodialysis access procedures and was designed to assess immediate and late postoperative complications for each type of procedure chosen.

MATERIAL AND METHODS

A total of 322 operations were performed for permanent hemodialysis access in 250 patients (142 males aged 5-75 years, mean 40.46 and 108 females aged 4-68 years, mean 42.94). 47 patients (18.8%) underwent reoperation; reoperation was performed once in 32 patients (68%), twice in 9 patients (19.1%) and three times in 6 patients (12.7%).

Snuff box arteriovenous fistula was performed in 269 patients (83.5%). Radial artery is found generally between the tendons of musculus extensor pollicis longus and brevis. Sometimes radial artery is more readily available at the distal of m. extensor pollicis longus. Side to side anastomosis was constructed in 207 patients (76.9%), while end to side anastomosis was constructed in 62 patients (23%). Radiocephalic arteriovenous fistula was performed in 29 patients (8.6%). End to side anastomosis was constructed in 14 patients (50%), while side to side anastomosis was constructed in 11 patients (39.2%). High radiocephalic side to side anastomosis was constructed in two patients. In only one patient dacron graft interposition was constructed between radial artery and basilic vein. Brachiocephalic arteriovenous fistula was performed in 24 patients (7.4%). Side to side anastomosis was constructed in 12 patients (50%), end to side anastomosis was constructed in 7 patients (29.1%). In five patients (20.8%) synthetic graft interposition was performed between brachial artery and basilic or cephalic vein [polytetrafluoroethylene (PTFE)-3, dacron-2]. In only one patient PTFE graft interposition was performed between subclavian artery and vein.

All arteriovenous fistula operations were performed on patients with chronic renal failure requiring hemodialysis at the Ondokuz Mayıs University Hospital. This included patients with new onset renal failure whose primary care was provided at our hospital.

Hemodialysis access procedures were divided into 3 groups according to the type of fistula: Group I (n=269); snuff box fistulas, Group II (n=29); radiocephalic fistulas and Group III (n=24) brachiocephalic fistulas. Immediate postoperative complications were defined as those which occurred within the first 48 hours following the procedure. Early occlusion, haemorrhage and ineffectiveness of fistula were accepted as immediate complications. Oedema for venous return dysfunction, graft infection, aneurysm and late occlusion were accepted as late complications.

RESULTS

Background analysis in primary access procedures (Table I).

Analysis of background history prior to vascular access procedures revealed a few significant difference among each group. There were more male patients in group I than groups II and III. Furthermore, patients in group I underwent a greater number of side to side procedures and had a lower incidence of hypertension and hypercholesterolemia versus patients in groups II and III.

Immediate and long term complications

Table I. Background Information for Primary Access Procedures for Hemodialysis

Parameter	Group-I (snuff-box)	Group-II (radiocephalic)	Group-III (brachiocephalic)
Patients	250	28	24
Operations	269	28	24
Access procedure			
• side to side	207 (76.%)	13 (46.4%)	12 (50%)
• end to side	62 (23%)	14 (50%)	7 (29.1%)
• graft	0	1 (3.5%)	5 (20%)
Sex (M:F)	142:108	18:10	16:08
Age (years)	41.5 (7-68)	42.9 (12-70)	40.5 (4-75)
Admission period after operation	8-28 days	10-31 days	3-12 days
Risk factors*			
• Diabetes mellitus	47 (18.8%)	8 (28.5%)	6 (25%)
• Congestive heart failure	39 (15.6%)	4 (14.2%)	0
• Myocardial infarction history	11 (4.4%)	2 (7.1%)	0
• Hypertension	105 (42.0%)	15 (53.5%)	13 (54.2%)
• Hypercholesterolemia	53 (21.2%)	9 (32.1%)	9 (37.5%)
• Pericarditis	13 (5.2%)	3 (10.7%)	1 (0.4%)
• Smoking	112 (44.8%)	16 (57.1%)	14 (58.3%)
Alcohol abuse	29 (11.6%)	2 (7.1%)	1 (0.4%)

*: One patient may have more than one risk factors

following access procedure (Table II).

In group I, there were 12 cases (10 early occlusion and 2 postoperative access bleeding) which required emergent secondary operations while 32 cases required creation of a new fistula on a non-emergency basis. In group II, there were 3 cases (2 early occlusion and one bleeding of fistula) which required emergency secondary operations while 9 cases required creation of a new fistula on a non-emergency basis. No immediate complication occured in group III. Due to venous return incompetence, arm edema developed in 4 cases of group III. Two of these patients were treated with arm elevation. In the remaining two patients closing the fistula was necessary. Graft infection developed only one patient in group III. Aneurysm developed in three patients; the fistula had to be closed in one. Remaining two patients have been followed to date with no problems.

Subclavian arteriovenous fistula constructed with PTFE graft. Graft extended over major pectoral muscles. Ineffective snuff box, radiocephalic fistula and brachiocephalic graft fistula had been previously constructed. In the early postoperative period the first and the second fistulas had been occluded by thrombosis. The third operation had failed too because of late thrombosis associated with graft infection. In the pectoral region, hematoma developed after subclavian arteriovenous fistula and resolved spontaneously. The patient admitted for

Table II. Immediate and Late Complications After Primary access Procedures

Complications	Group-I (n=269)	Group-II (n = 28)	Group-III (n = 24)
Immediate complications			
• early occlusion or ineffectiveness	52 (19.3%)	5 (17.8%)	0
• hemorrhage	2 (0.7%)	1 (3.5%)	0
Late complications			
• edema	0	0	4 (16.6%)
• infection	0	0	1 '4.1%)
• aneurysm	0	0	3 (12.5%)
• late occlusion	4 (1.4%)	1 (3.5%)	1 (4.1%)
Total	**58 (21.6%)**	**7 (25%)**	**9 (37.5%)**

hemodialysis on the postoperative twentyth day and the fistula is still being used effectively for 15 months.

DISCUSSION AND CONCLUSIONS

Maintenance dialysis is currently a universally accepted method of treatment for patients with end stage renal disease. The peripheral arteriovenous fistula (AVF) as originally described by Brescia et al.[1] is the vascular access of choice for patients on chronic hemodialysis. A fistula should be created for the patient to undergo hemodialysis three times in a week for a prolonged period and its complications rates should be little. The researches on this subject have develop more than 20 technique and modifications[3]. The A-V fistula performed to ulnar artery is less successful and more difficult. Basilic vein wall which is thicker and more spastic, is not very agreeable for hemodialysis[4]. Arteriovenous access procedures using saphenous vein grafts are more difficult and saphenous vein dilatation occurs later, so becomes harder to puncture for dialysis. In addition, it provides an alternative for patients with after unsuccessful fistula application[5,6]. In vascular applications human umbilical vein [7], bovin heterograft[8], dacron[9], PTFE[10,11] are used and may be considered when the autogenous veins are not available. There is no need to discuss the preference of Brescia Cimino radiocephalic fistula (BCRF) then others. But later current snuff box AVF procedure has been accepted by many surgeons. We think the same on this. If there is suitable artery and vein, if we think that the fistula can be successful, we primarily prefer snuff box fistula, because the other veins which are important for patient can be used for other operations. There is always possible to perform BCRS and brachiocephalic A-V fistula[12,13,14]. When snuff box and radio cephalic fistula on wrist are not successful, brachiocephalic fistula should be preferred[15]. This location is more suitable for artery and vein and it can be worked better and successful rates are higher. But it must not be forgotten that in such cases, complications like cardiac failure, venous return function disfunction in arm and aneurysm are more frequent and anastomotic area is narrower.

Our study showed that while the rates of early and late occlusion and haemorrhage

developed more frequently in arteriovenous fistula performed on wrist and dorsal hand, the patency rates were found approximately one hundred percent in the early and the late postoperative period in arteriovenous fistula performed in the antecubital region. Major problems such as venous return dysfunction, aneurysm and graft infection appeared only in brachiocephalic arteriovenous fistula and required a second corrective operation. Because of infection we had to remove the graft from one of the six patients. According to us, firstly it should be used autogeneus arteries and veins of the patients in the some locations and it should be preferred to start from the distal portions of the upper extremities for vascular access procedures. If it is necessary, the other locations can be used later snuff box, radiocephalic and brachiocephalic should be sequentially preferred. When autogenous veins are not effective, synthetic grafts should be used. So antecubital, axillary locations can be used. If they are not effective, subclavian artery-vein can be used extending the graft on pectoral muscle.

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