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AXILLOFEMORAL FISTULA FOR HEMODIALYSIS ACCESS

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The authors describe the technique of axillo-femoral arteriovenous prosthesis interposition and evaluate their experience with this non-conventional access for hemodialysis.

INTRODUCTION

The main current problem of hemodialysis – permanent vascular access creation – is that of a continuously increasing number of difficult patients with primarily unsuitable or secondarily exhausted vessels. That is the reason not only for prosthesis use, but also for its non-conventional connection and placement[1-7].

Axillo-femoral arteriovenous prosthesis interposition – fistula (AF AVF) is one of such less typical access creations[7,8].

METHODS

Candidates for AF AVF are patients with problematic superior vena cava outflow site – completely occluded or severely stenosed superior vena cava (SVC), bilateral brachiocephalic (BCV), jugular (JV) and subclavian (SV) veins, in case all interventional radiological options for its correction have been unsuccessful and surgical repair has been impossible (Fig. 1).

DIASTAT (GORE) ePTFE stretch prosthesis conically shaped (from 4 to 7mm) of 40 cm length with cannulation segment of 25 cm is the basis for AF AVF. It is mostly necessary to extend the DIASTAT prosthesis on both ends to get the required overall length. ePTFE stretch ringed prosthesis of adequate diameter (6mm on the inflow site, 8 mm on the outflow site) is useful for this. The prosthesis is anastomosed (ePTFE 6.0 stitch) end to side to axillary artery proximally (exposed from subclavicular incision, inflow arterial anastomosis 6mm in length) and distally to common femoral vein (exposed from groin incision, outflow venous anastomosis 18mm of length) and using a tunneler it is subcutaneously placed (cannulating segment of the prosthesis lies on the ribs) laterally on the anterior body wall (Fig. 2, 3).

PATIENTS

During the past 5 years (2000–2004) we created 5 AF AVFs in 5 patients in whom the repair of SVC outflow site completely failed. All patients had long term dialysis and previous native and bridge ePTFE fistulas creations and subclavian or jugular catheters placed a number of times to overcome complications in previous upper arm access (Tab. 1). Before the decision on AF AVF, inferior vena cava (using US doppler or phlebography) and the hemodynamic and coagulative state of the patient were evaluated. The procedure was performed under general anesthesia under common conditions for vascular surgery – antibiotic prophylaxis (wide spectrum, in three doses) and early thrombosis prevention (LMW heparin). Tensamin infusion (2–10 μg/kg/min) was used to prevent postoperative hypotension.

RESULTS

There were no severe peroperative and early postoperative complications. All the fistulas were successfully used for dialysis with an acceptable rate of thrombotic complications. The thrombotic complication repairs contribute to excellent cumulative function. One patient with a functional graft died (Tab. 2–4).

DISCUSSION

The exhaustion of SVC outflow site is related to previous central vein cannulations, catheters implantation and central bridge fistulas creations with additional procedures for maintaining their passage during the time, with consequent venous fibrosis or occlusion[9-13]. Arteriovenous fistula (AVF) is the best permanent vascular access for hemodialysis. The native fistulas and bridge fistulas (using vascular prosthesis) located in the upper limb region with SVC outflow site are the best conventional access

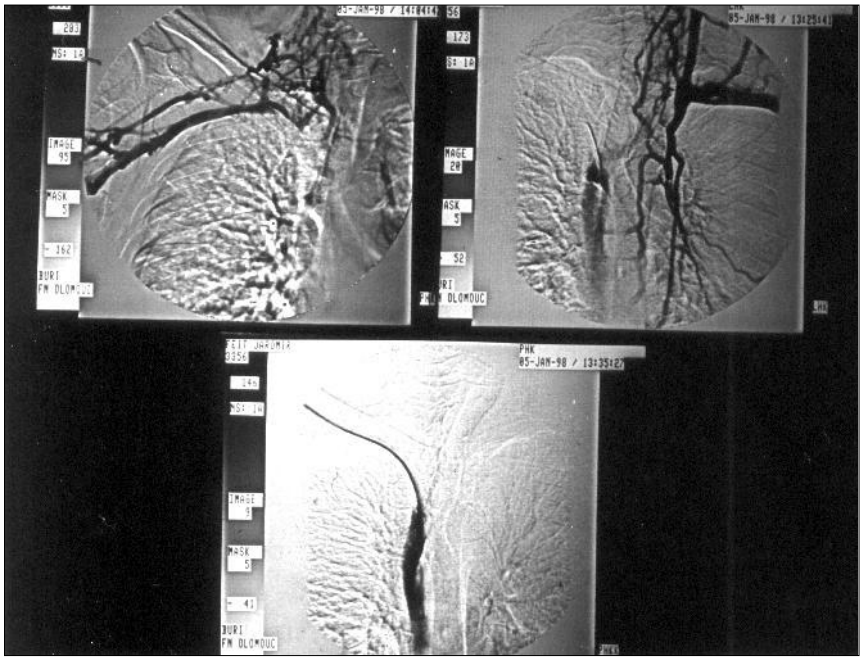

Fig. 1. Superior vena cava outflow site occlusion (bilateral brachiocephalic vein occlussion).

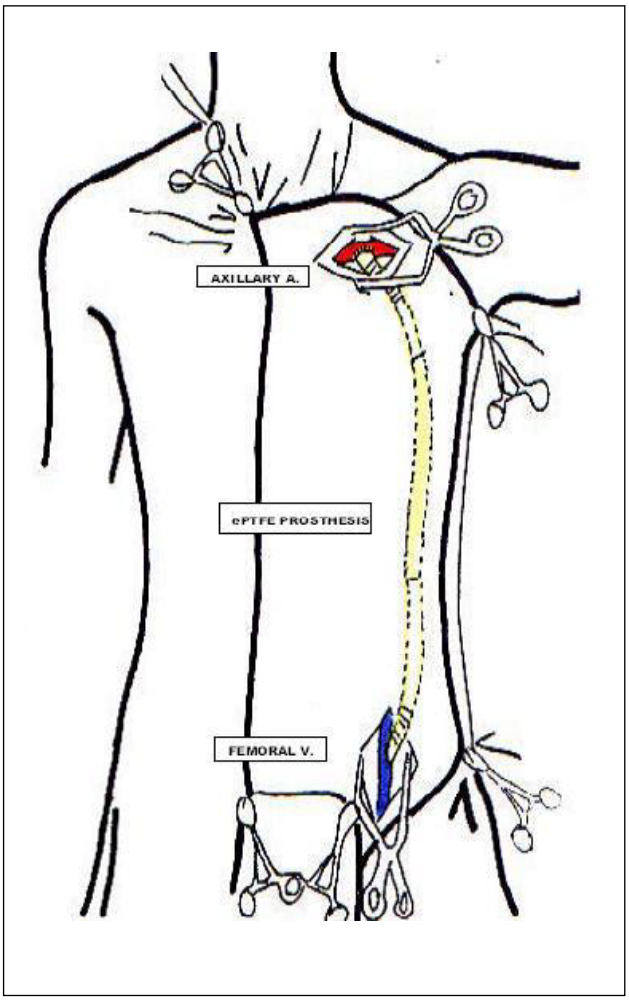

Fig. 2. Schema of AF AVF.

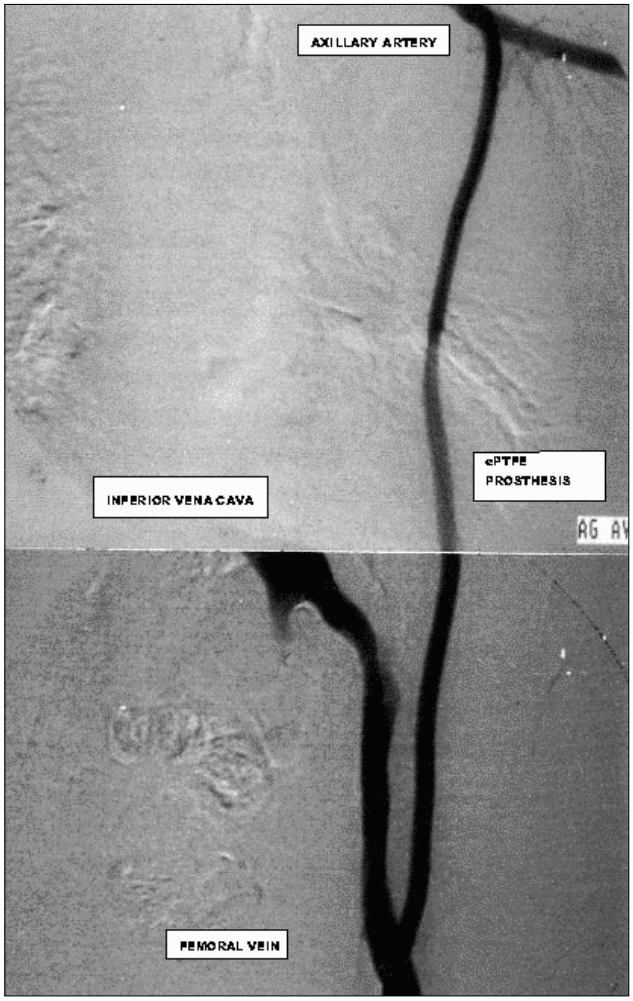

Fig. 3. Angiography of AF AVF.

Table 1. Dates of the patient receiving AF AVF.

PATIENT		PREVIOUS ACCESSES					SVC OUTFLOW SITE	AXILLO-FEMORAL GRAFT			
		PRIMARY	NATIVE	ePTFE	CENTRAL CATHETERS			CREATION DATE	FUNCTION		No OF REPAIR
					SVC	FV			CURRENT	DURATION MONTHS	
1	✳1938	1993	4	1	4	2	SVC OCCLUSION	9/00	+	52	4
2	✳1947	1996	2	3	3	1	BCVv OCCLUSION	3/01	-	✝ 23	2
3	✳1935	1999	2	0	5	1	BCVv OCCLUSION	4/01	+	36	6
4	✳1952	1997	4	2	8	-	SV+JVv dx OCCLUSION BCVsin STENOSIS	12/03	+	16	3
5	✳1941	2001	1	3	3	-	BCVv STENOSIS	10/04	+	6	1

creations[3,4,7,14–15]. Central venous occlusion of the upper limbs (SVC outflow site) makes the AVF creation in this location impossible. Therefore we have to utilize all the interventional radiological methods for SVC outflow site repair before the decision on its unfitness. Surgical repairs in SVC central veins region are usually not possible due to extreme operating and complication rate risk[16–19]. Thorough preoperative vessel evaluation and the stable hemodynamic and coagulative condition of the patient are the basic prerequisites to prevent fistula failure[7,20,21]. Therefore the patients have to be evaluated thoroughly in connection with its creation, especially in the AF AVF type of fistula[7,21]. Patients with pathological findings are contraindicated for AF AVF. Prosthesis interposition between a high blood flow axillary artery and a femoral vein of large diameter provides excellent flow for high flux dialysis. Prosthesis length gives a wide choice of sites for cannulations and increases potential viability of the prosthesis. The prosthesis placement laterally on the anterior body wall is cosmetically acceptable for patients. The thick, less sensitive and infection resistant skin in this region enables easy and well tolerated cannulation. The construction of the DIASTAT prosthesis cannulating segment allows us to stop puncture bleeding using a small brief compression (Fig. 4).Therefore this type of prosthesis is an advantage in places problematic in terms of prosthesis compression such as the anterior body wall. Owing to this construction, cannulation is possible immediately after fistula creation when necessary. The stretch type of e PTFE prosthesis reduces the risk of intimal hyperplasia stenotic complications, especialy on the venous outflow site[6,22–25]. The main disadvantage of AF AVF is the prosthesis length increasing the risk of thrombosis. Therefore care should be taken to avoid periods of low blood pressure in patients with these fistulas7. Another disadvantage is the outflow anastomosis in the inguinal region, with the risk of prosthesis kinking and with high infection complication rate. In order to avoid these complications, outflow anastomosis creation on iliac vein from the suprainguinal access is possible. Combined approach seems to be the option for AF AVF thrombotic – stenotic complications solution. Surgical thrombectomy (using Fogarty baloon catheter) of ePTFE prosthesis is easy and interventional radiological anastomotic stenoses repair (baloon angioplasty) produces good results[19,26–29]. Only local anesthesia and one incision as repair accesss are needed. The use of Fogarty wire catheter and direct surgery are other options for stenoses repair. When the outflow site complications (iliac vein stenoses or occlusion) repair is not successful,

Fig. 4. Schema of Diastat ePTFE prosthesis (GORE) cannulating segment.

Table 2. Complications of AF AVF.

COMPLICATIONS

PEROPERATIVE
NO

EARLY POSTOPERATIVE
NO CARDIAC FAILURE
INFECTION
1 GRAFT THROMBOSIS
1 TUNNEL HEMATOMA

LATE
NO HYPERFUNCTION
PERIPHERY ISCHEMIA
CARDIAC FAILURE
VENOUS HYPERTENSION
SKIP LEASION
INFECTION
FALS ANEURYSM
1 PERIGRAFT SEROMA

GRAFT THROMBOSIS

16 GRAFT THROMBOSIS
IN 5 FISTULAS

MEAN NUMBER 3.2 RANGE 1-6

CAUSES OF THROMBOSIS

HYPOTENSION	7
HYPECOAGULATION	2
VENOUS ANASTOMOSIS STENOSIS INTIMAL HYPERPLASIA	5
GRAFT STENOSIS	2

Table 3. Reoperations of AF AVF.

REOPERATIONS

THROMBECTOMY	16	SIMPLE	9
VENOUS ANASTOMOSIS REPAIR	5		
		DIRECT SURGERY	2
		SPIRAL FOGARTY	1
		PTA	2
GRAFT STENOSIS	2	SPIRAL FOGARTY	2

ALL FISTULAS NEEDED ADDITIONAL PROCEDURES TO MAINTAIN PATENCY

MEAN NUMBER OF REOPERATIONS 3.2 RANGE 1 - 6

cross over new outflow creation on the opposite femoral or iliac vein is possible . Longterm antiaggregant or anticoagulant therapy is recommended in case of repeated thrombotic complications[7]. There are AF AVF alternatives. Double-lumen tunneled cuffed catheter in inferior vena cava outflow region placement is an easy option, but not a more durable one[30-31]. Peritoneal dialysis may be another possibility[32-33]. Urgent kidney transplantation seems to be the option in some patients with missing vascular access for hemodialysis, especially in young patients[34].

CONCLUSION

Axillary artery to common femoral vein ePTFE bridge fistula seems to be an excellent and durable hemodialysis access strategy with acceptable thrombosis and infection rate.

In the dialysis access algorithm it is recommended for patients with exhausted superior vena cava outflow site before resorting to lower limb fistulas or permanent venous catheter[35].

Table 4. Results of AF AVF.

RESULTS

MORTALITY
NOBODY DIED PEROPERATIVELY OR LATER DUE TO FISTULA COMPLICATIONS

ALL FISTULAS HAVE BEEN USED FOR DIALYSIS

THE MEAN DURATION OF USE 26.6 MONTHS RANGE 6-52

PATENCY

THE MEAN PRIMARY PATENCY TIME 8.7 MONTHS RANGE 3-13

CUMULATIVE FUNCTION 100%

THE LONGEST CUMULATIVE FUNCTION 52 MONTHS
WITH NEED OF 4 REPAIRS

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