

# COMPARATIVE STUDY OF PTFE, POLYURETHANE, AUTOGENOUS SAPHENOUS VEIN AND BASILIC VEIN FOR BRACHIAL ARTERIO-VEIN FISTULA

*By*

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## ABSTRACT

**Purpose :** The aim of this prospective randomized study is to compare patency and complication rates of bridge fistulas using prosthetic grafts, autogenous saphenous vein grafts and brachio basilic arteriovenous fistula in patients with unconstructable distal arteriovenous fistula.

**Patients And Methods :** this study include 34 PTFE bridge fistulas, 23 polyurethane bridge fistulas, 20 saphenous bridge fistulas and 53 brachio basilic A.V.F.

All cases were done between January 1997 and April 1998 and followed up to the end of June 1999 in Mansoura University Hospital.

Life tables analysis were used to compare the patency and complication rates for each type of the fistulas.

**Results :** The patency rates at 1 year were (86%) for brachio basilic fistulas (63.2%) for PTFE brachial bridge fistulas, (77.4%) for polyurethane brachial bridge fistulas, and (73%) for autogenous saphenous bridge fistulas. The patency rates at 2 years were (79.9%) for basilic vein group, (49%) for PTFE group, (45.9%) for polyurethane group and (38.3%) for autogenous saphenous vein group. Brachio basilic fistulas showed the lowest rate of complications.

**Conclusions :** Brachio-basilic A.V.F. provided superior patency rates and lower complication rates

compared with brachial bridge fistulas and should be considered in all patients with unconstructable radiocephalic fistula before trying bridge fistulas. The second choice should be saphenous bridge as it has lower infection rates than both polyurethane and P.T.F.E. prosthetic bridge grafts.

## INTRODUCTION

Establishing and maintaining hemodialysis access is a cornerstone of long term renal replacement therapy. Hemodialysis techniques have improved sufficiently to allow many patients to survive for as long as dialysis access can be maintained (Punch and Merion, 1995).

For the next 6 years, this ingenious device was universally adopted and regular dialysis became a standard method of treatment. Because of interference of the external appliance with normal activity and because of the risks of infection, thrombosis, and other complications, the search continued for improved techniques. Many of these disadvantages were overcome by introduction of the subcutaneous AV fistula by Brescia, Cimino, Appel and Hurwich in 1966. They surgically created a fistula between the radial artery above the wrist

and the largest available vein in close proximity. This procedure enabled them to achieve blood flow rates of 250 to 300 ml per minute. Their innovative approach remains the initial procedure of choice in patients who are candidates for long-term hemodialysis and who have suitable vessels. Unfortunately, many of these individuals have thrombosed arteries and veins as a result of repeated venipunctures and cutdowns in the distal forearm. Consequently, a number of techniques have evolved in bridging the gap between artery and vein at more proximal levels in the arm, using the saphenous vein or synthetic grafts (Gordon, 1996).

**Aim of the work :** this work is a prospective randomized study to compare patency and complication rates of bridge fistulas using prosthetic grafts, autogenous vein grafts and transposed basilic vein for construction of brachial arteriovenous fistula in patient with unconstructable radiocephalic or brachiocephalic A.V.F

## PATIENTS AND METHODS

This prospective randomized study included 130 A.V.Fs performed in 118 patients to compare patency and complication rates of bridge

A.V.F. using prosthetic grafts of PTFE, polyurethane, autogenous saphenous vein grafts and transposed basilic vein for construction of brachial A.V.F. in patients with unconstructable radiocephalic or brachiocephalic A.V.F.

They were admitted to Vascular Surgery Unit of Mansoura University Hospital with end stage renal disease (ESRD) referred from nephrology and medical departments; during the period from Jan, 1997 to April, 1998.

**Pre-operative evaluation:** Thorough history was taken from all patients that included: name, age, sex, occupation, marital status, residence, special habits, address of the hemodialysis unit, days of dialysis, associated medical diseases, diabetic or not, the possible etiology of renal failure, and the number of previous vascular accesses for hemodialysis if any.

General and Local examination of both upper limbs was done carefully to assess brachial, radial, and ulnar pulses by palpation and by doppler examination to obtain their pressures. The superficial venous system was examined in both upper limbs after application of sphygmomanometer cuff

elevated between systolic and diastolic pressure.

If there was a suspicion of peripheral vascular disease and in cases with previous thrombosed AVF photoplethysmographic examination of the digital circulation was performed.

**Duplex examination :** Pre-operative duplex examination of both upper limb veins was done to all patient to evaluate:

- Patency, Diameter and Length of basilic vein in the arm .

- Patency and absence of stenosis in the axillary, and the subclavian vein specially in cases with history of subclavian catheter placement.

- Patients who were randomized to do saphenous bridge fistulas underwent duplex examination for the saphenous vein in the thigh for its diameter and patency .

**Randomization and grouping of patients :** Patients included in our study were randomized into two main groups:

**Group 1 :** included 51 patients to whom (53) brachio-basilic A.V.F. were done .

**Group 2 :** included 67 patients to

whom (77) brachioaxillary bridge fistulas were done .

Patients of group 2 were further randomized into 3 subgroups:

2a. (20) patients to whom (23) polyurethane bridge fistulas were done.

2b. (29) patients to whom (34) PTFE bridge fistulas were done .

2c. (18) patients to whom (20) saphenous bridge fistulas were done.

**Surgical techniques :** Group (1): brachio basilic (Fig 3 A and B).

The cases of brachio basilic fistula with superficialisation of the basilic vein were done by the technique described by Dagher et al., in (1976) The basilic vein was located anterior to the medial epicondyle of the humerus, and an incision was made along the course of the vein from the elbow to the level of the pectoralis muscle . The cutaneous nerve of the forearm lies close to the vein, and usually there are multiple branches from it that cross the vein. Tributaries were ligated and divided, after which the vein was divided distally and mobilized deep to the cutaneous nerve. Its patency was established either by the passage of an umbilical catheter or by injection of heparinized saline. Exposure of the brachial artery was carried out either through distal part of

the wound or through further incision made in the antecubital fossa (Fig. 25). A subcutaneous tunnel was created between the artery and the axilla either anterior to the anterior wound edge or more anterior on the arm by performing long loop .

**Group (2) :** bridge Fisteulea: 2A: polyurethane (Fig 5 A,B),

2B: PTFE (Fig 6 ). 2C: Saphenous vein (Fig 4 A, B, C, D).

The grafts in bridge fistula were interposed in straight manner between brachial artery at the elbow and the axillary vein . We used the technique described by (Santaro and Cambria, 1997) .

A longitudinal incision was made originating at the superior aspect of the anterior axillary fold and extending distally along the groove between biceps and triceps muscles.

A second incision was made over the distal brachial artery just superior to the antecubital fossa medial to the biceps. This incision was carried down to the vascular sheath. The sheath was incised and the brachial artery was freed for a length of 2 to 3 cm in preparation for arterial anastomosis . Vascular control of the axil-

lary vein was obtained proximally and distally with vascular clamps or loops. A longitudinal venotomy was made as far distally as possible to allow for future revision to a higher position on the axillary vein if necessary. Heparinized saline solution was infused and the anastomosis was performed between the vein and a beveled 6-mm graft. Either ePTFE, polyurethane, or autogenous saphenous vein. The length of the anastomosis was about 2 cm. The graft was then passed through a subcutaneous tunnel, curving laterally, to the brachial wound. Once controlled, the artery was opened, local heparin was infused proximally and distally, and 6mm arterial anastomosis was constructed.

In cases of saphenous bridge fistulas we started first by harvesting the saphenous vein in the thigh through multiple separate incisions to obtain a length of the vein about 25 cm, Then proceeding into the same steps as previously mentioned.

The synthetic grafts used in our study for creation of bridge fistulas are expanded polytetra fluoroethylene 6mm diameter of WL Gore & Associates, Inc. and the three layered polyurethane of thoratec

(VAG) 6mm diameter.

Operative measures to deal with the complications in order to extend the patency of AVFs were attempted :

- a- Trials to deal with thrombosis by thrombolytic therapy and by thrombectomy ( dilatation, angioplasty or bypass were done but there were no attempt at thromboectomy for thrombosed brachioasilic or saphenous bridge A.V.F. as our previous experience showed no successful trial of thrombectomy in such thrombosed fistulas .
- b- Infected A.V.Fs. : Were dealt with by conservative treatment and operative procedures like local rhomboidal flap or bypass to deal with infected or exposed grafts (Fig 7 A & B).
- c- Trials to exclude the segments that showed true aneurysmal dilatation
- d- Trials for narrowing the anastomosis or banding to deal with steal syndrome .

**Follow up sheet :** Cases included in this study were followed up to the end of June 1999 to assess patency and complication rates. Patients were examined and followed up once weekly for one

month post operatively. After start of usage of A.V.F. patients were examined once monthly for the 1st 3 months then once every 3 months up to the end of two years post-operative.

**Statistical Methods :** Patency rates were calculated after construction of life table analysis figures and comparison were made between patency rates of each group using logrank test. Also complication rates were calculated for each group and comparison was made between them.

## RESULTS

Table (1) show demographic data of the studied groups:

There was no significant variability in the demographic presentation of the studied groups.

Table (2) Represent mean operative time of the surgical procedures: This table showed significant prolonged operative time for saphenous bridge fistula

Data obtained from dialysis centers: The time needed to control puncture site bleeding was less with

polyurethane (about 5 minutes) grafts than with PTFE grafts (about 9 minutes).

Table (3) and Fig (1 & 2) show life table analysis of cumulative patency rate at 1- year and at 2- years: group 1 (brachio basilic AVFs), Showad 1-year patency rate was 86.19% and 2-years patency rate was 71.14% while cumulative primary and extended patency rates of group 2a (polyurethane bridge fistulas) showed primary patency rate at 1-year was 67.74% and at 2-years was 35.77%, extended patency rate at 1-year was 77.34% and at 2-years was 52.89% and cumulative primary and extended patency rates of group 2b (PTFE bridge fistulas) showed notice that primary patency rate at 1-year was 57.21% and at 2-years was 39.61% extended patency rate at 1-year was 63.23% and at 2-years was 48.97% and cumulative patency rate of group 2c (autogenous saphenous vein bridge fistulas), from which we can notice that patency rate at 1-year was 73.17% and at 2-years was 37.97%. Ther was significant high patency rate in brachio-basilic A.V.F. followed by autogenous saphenous bridge fistula,

Table (4) show the incidence of complications in the studied groups: there where significant difference between brachiobasilic AVF 18 (34%) and Brachioaxillary bridge fistulas44 (57.1%)

**Table 1 :** Demographic data of the studied groups .

	group 2a Polyurethane	group 2b PTFE	group 2c Saphenous	group 1 Basilic vein
<b>Total fistulas</b>	23	34	20	53
<b>Age</b>				
Range	23-65	18-65	30-65	15-65
Mean	42±14.3	50.8±13.2	47.1±13.6	48.3±13.2
<b>Sex :</b>				
Male	10 (43.5%)	14 (42.4%)	13 (72.2%)	25 (49%)
Female	13 (56.5%)	19 (57.6%)	5 (27.8%)	26 (51%)
<b>Number of diabetic patients</b>	4 (17.4%)	3 (8.8%)	2 (10%)	13 (24.5%)

**Table 2 :** The mean oper ative time for different groups .

<b>Group 1:</b>	Brachiobasilic AVFs :	103.2 min ± 6
<b>Group 2a :</b>	Polyurethane bridge fistulas :	106.5 min ± 7.2
<b>Group 2b :</b>	Saphenous bridge fistulas :	102.6 min ± 3.2
<b>Group 2c :</b>	Saphenous bridge fistulas :	133.8 min ± 3.8

Table 3 : Patency rates at 1-year and at 2-years .

	group (1)	group (2)					
	Brachio-basilic	total	Polyurethane		PTFE		Saphenous
			1 ry	2 ry	1 ry	2 ry	
1- Year patency rate	86.2%	70%	67.7%	77.3%	57.2%	63.2%	73.2%
1- Year patency rate	71.1%	46.4%	35.8%	52.9%	39.6%	49%	38%

Table 4 : The incidence of complications in the studied groups .

	Brachio-basilic AVF	group (2)			
			Polyurethane	PTFE	Saphenous
Total Number of fistulas	53	77	23	34	20
Infection	7 (13.2%)	20 (26%)	7 (30.4%)	10 (29.4%)	3 (15%)
Thrombosis	5 (9.4%)	19 (24.7%)	4 (17.4%)	10 (29.4%)	5 (25%)
Aneurysm	3 (5.7%)	2 (2.6%)	-	-	2 (10%)
Steal	3 (5.7%)	3 (3.9%)	1 (4.3%)	2 (5.9%)	p= 0.047
Total	18 (34%)	44 (57.1%)	12 (52.2%)	22 (64.7%)	10 (50%)

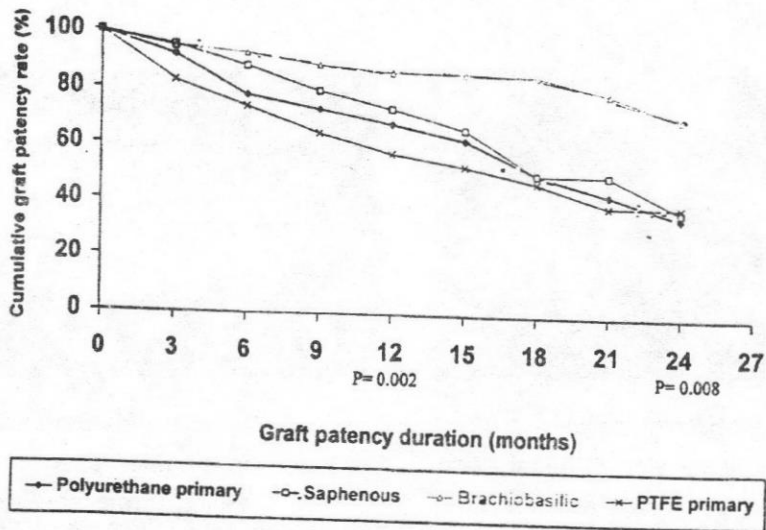


Figure (1) : Cumulative primary patency rate in studied groups .

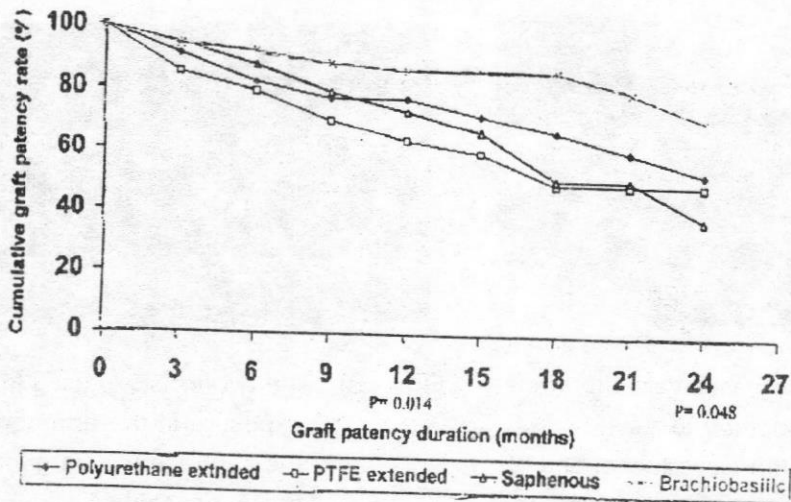
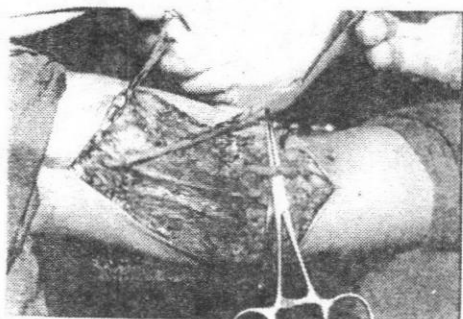
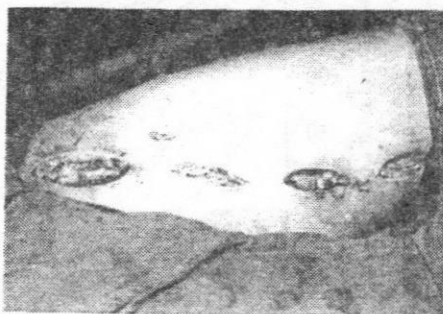


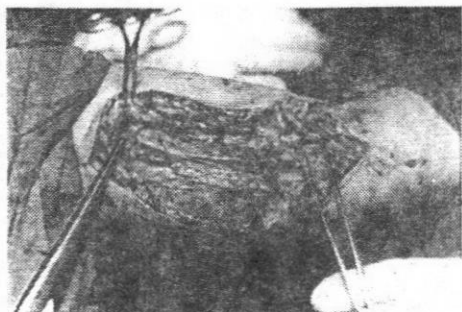
Figure (2) : Cumulative extended patency rate in studied groups .



**Fig. (3A) :** Mobilized basilic vein after division of its distal end. The brachial artery is also exposed and is shown elevated on the forceps .



**Fig. (4A) :** Multiple separate incisions in the thigh used for harvesting the saphenous vein .



**Fig. (3B) :** The basilic vein after transposition to its new subcutaneous tunnel and after completion of the anastomosis .



**Fig. (4B) :** The two incisions used for exposure in the arm and the saphenous vein graft before anastomosis .

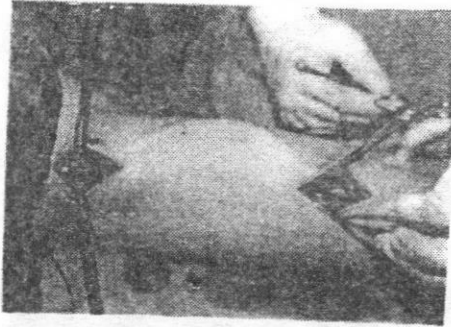


Fig. (4C) : The saphenous vein graft after completion of the two anastomosis .

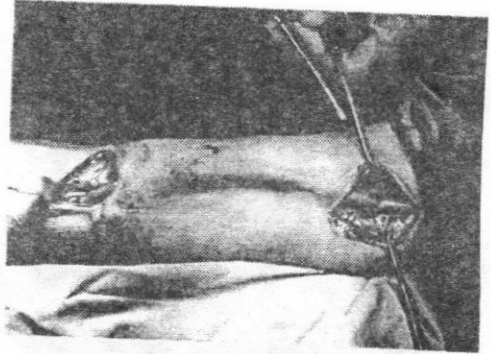


Fig. (5B) : Polyurethane graft 6 mm completion of the two anastomosis.

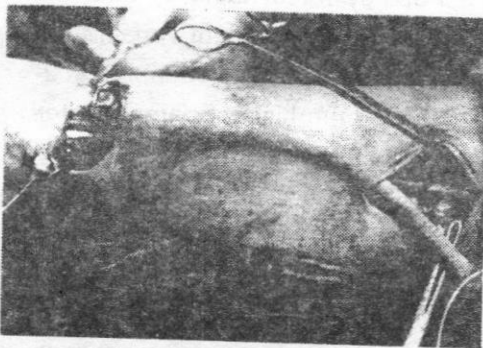


Fig. (5A) : Polyurethane graft 6 mm after completion of the arterial anastomosis.

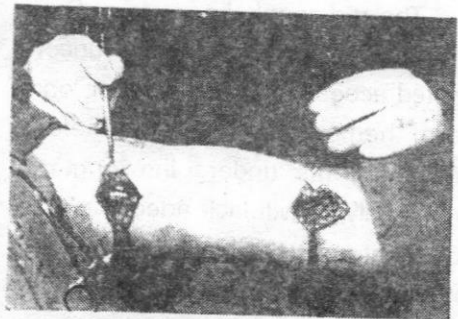


Fig. (6) : PTFE graft 6mm stretched between the two wounds used for exposure of the brachial artery and the axillary vein.



**Fig. (7A) :** Exposed segment of PTEF graft due to perigraft hematoma and the design for local rhomboidal flap .



**Fig. (7B) :** The same patient after excision of the unhealthy area and coverage by local rhomboidal flap .

## DISCUSSION

The radiocephalic fistula of Brescia and Cimino remains the uncontested access of first choice for long-term hemodialysis . Nevertheless most patients undergoing longterm hemodialysis will lack adequate vein for construction or have development of unsalvageable thrombosis of such a fistula. Hence an alternative access site is required, this alternation has typically invoked the use of bridge fistula using autogenous vein and prosthetic materials (Bennion and Wilson, 1993) .

Patency rates (table 3) and (Fig 1&2) showed significant variability at 1- year and significant variability at 2- years with the highest patency rates for brachiobasilic AVF which were significantly higher than those of autogenous saphenous, PTFE, and polyurethane bridge fistulas, not only the primary but also the secondary patency rates. Also comparison between brachiobasilic AVFs and the three groups of bridge fistulas collectively showed significantly higher patency rates of the brachiobasilic group than the group of bridge fistula (86.2% Vs

70.0%) at 1-year  $P=0.018$ , (71.1% Vs 46.4) at 2-years  $P=0.005$ .

In addition, the use of basilic vein offers advantages over bridge fistulas:

1) Only one anastomosis is required and the distal venous anastomosis, which is the most common site for stenosis in bridge fistula is avoided, (2) the development of local infection doesn't mandate removal of a native vein fistula.

Patency rates of brachiobasilic AVF in our study correlate with the experience of Coburn and Carney 1994 (90% 1 year patency rate and 86% 2 years patency rate) and Marx et al. 1990 (78% 1 year patency rate and 74% 2 years patency rate).

One year patency rate of autogenous saphenous bridge fistulas was higher than primary patency rates of PTFE and polyurethane but without statistical significance ( $P = 0.22$ ,  $P = 0.65$  respectively). Also, it was higher than 1-year 2ry patency rate of PTFE and slightly lower than that of polyurethane without statistical significance ( $P= 0.43$ ,  $P = 0.86$  respectively).

The results of saphenous bridge fistulas from the United States dem-

onstrated lower patency rates than those from Australia and Europe. For example Haimov et al. 1980 noted patency rates of 51%, 20% and 10% at 1,2,3 years, respectively.

The patency rates of synthetic bridge fistulas in our study were much lower than those in review of literature by Winsett and Wolma 1985 (70% 2ry patients rate at 3 years) and Coburn and Carney 1994 (64% 2ry patients at 2 years). This is due to the higher infection rates of our grafts which approached (30%)

Polyurethane bridge fistulas showed higher 1ry and extended patency rates at 1 -year than those of PTFE but without statistical significance ( $P = 0.44$ ,  $P=0.32$  respectively), while 1ry and extended 2-years patency rates of polyurethane and PTFE were similar (Table 10) (Fig.38,39).

The patency rates of polyurethane (Thoratec VAG) in our study were similar to those in review of literature but the infection rates in our study were higher Allen et al., 1996 reported secondary patency rate of 64.5% at 1-year with 11% infection rate in Australian multicenter study including

145 polyurethan AVFs. Also Nakagaw et al. (1995) reported patency rate of 53.2% at 1-year for polyurethan bridge fistula in a study including 34 polyurethan AVFs.

Infection was the main cause of graft failure in PTFE and polyurethane bridge fistulas while thrombosis was the main cause of graft failure in saphenous and brachiobasilic AVFs in this study (table 4,5) but the infection rates in brachiobasilic and saphenous groups are higher than those in review of literature (May et al., 1980; Jenkins et al., 1980 and Coburn and Carney, 1994).

Allen et al. 1996 reported that infection was less in bridge AFVs with antibiotic prophylaxis that included vancomycin. Also, Albers, 1996, reported that, medical therapy for infected vascular access must be directed primarily against staphylococcus aureus, with vancomycin being used most frequently.

Ten trials of thrombectomy 2 thrombectomy alone, 2 failed, 2 with dilatation, 2 with patch angioplasty, and 2 thrombectomy with bypass to a proximal site on the vein to overcome narrowing at the venous end. All have

its advantages and disadvantages. Dilatation is the simplest manoeuvre and the easiest to perform but has the disadvantages of early recurrence. While patch angioplasty has longer patency rate than balloon dilatation and it preserves the proximal part of the vein for future bypass but it is difficult to perform and carries the hazards of injury to the axillary vessels and nerves, on the other hand, bypass to a new proximal site on the vein has the longest patency rate but potentially limiting further access sites.

As only one case with narrowing at the venous end is encountered during thrombectomy in polyurethan group and 6 cases are encountered in PTFE group, accordingly incidence of hyperplasia with polyurethan was less than that with PTFE. This correlates with many studies which reported that polyurethane grafts are more compliant than PTFE and with better endothelial cell attachment and less incidence of neointimal hyperplasia (Stansby et al. 1994; Jensen et al., 1996; Guidiceandrea et al., 1998; Jeschke et al., 1999).

The average operative time for polyurethane bridge fistula, PTFE

bridge fistula and brachio basilic fistula were not significantly different from each other, while average operative time for saphenous bridge fistula was longer than the other three groups by about 28-31 minutes, that time was needed for harvesting the saphenous vein. This time can be saved if the work is done by team work. The increased cost of anaesthesia and expenditures required for saphenous bridge fistulas are still beyond the cost of synthetic grafts in our locality .

Pre operative duplex examination played an important role in excluding those patients who have unsuitable basilic vein and also those with unsuitable saphenous vein. In our study 8% of patients had unsuitable Basilic and 9% unsuitable Saphenous vein in comparison with Corney 1997 who reported 5% unsuitable Basilic vein. Also preoperative duplex examination helped so much in diagnosing patients with venous outflow stenosis or obstruction and also in evaluating those with major arterial diseases .

Also, Robert B. Rutherford in 1997 stated that "vein mapping, using aduplex scan, is valuable in any patient in whom the superficial veins

are not easily visible and distend nicely with tourniquet application . Patients who have previously had chronic cannulation of the subclavian or jugular veins for hemodialysis or other reasons, should have proximal venous outflow obstruction ruled out by a duplex study".

### Conclusion and Recommendations

Preoperative duplex examination is a very valuable tool in evaluating patients who are unsuitable to do radiocephalic or brachiocephalic AVFs. Preoperative duplex ex. in those patients is necessary for arterial assessment, vein mapping for the basilic vein in the arm as regard its diameter, patency, length and for venous outflow assessment . Also patients in need for bridge fistula, should be suspected to preoperative duplex examination of their saphenous vein in the thigh to decide whether its suitable or not .

As brachio basilic AVF has a higher patency rate and a lower complication rates than all varieties of bridge fistulas, so if the basilic vein is suitable, brachio basilic AVF should be the access of choice before trying bridge fistulas in those patients.

Autogenous saphenous vein is

considered suitable if its preoperative diameter by duplex examination is 5mm or more and by adopting this concept in selecting patients who are suitable for autogenous saphenous bridge fistula, the patency rate is suspected to be much higher than those in our study .

Autogenous saphenous vein bridge fistula has the following advantages when compared with synthetic grafts in our study :

- Autogenous saphenous vein bridge fistula has a lower complication rates than synthetic graft bridge fistulas, especially the infection which is the main cause of graft failure in our locality .

- The cost of autogenous saphenous vein bridge fistula is lower than that of synthetic graft bridge fistulas .

Polyurethane grafts were found to have patency and complication rates similar to those of ePTFE, but they have some advantages like, less suture line bleeding, possibility of early cannulation, earlier hemostasis for puncture site bleeding and they are more compliant than PTFE with less incidence of neointimal hyperplasia.

So, polyurethane is a good alternative for ePTFE in construction of bridge AVF.

The high infection rates for synthetic grafts AVF in our locality arouses the importance of increasing the awareness of the dialysis staff and nurses about the sanitary measures required on dealing with AVF specially synthetic graft fistulas .

We recommend to exhaust all measures to extend the patency of a given bridge fistula before trying creation of a new one .

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## دراسة مقارنة للوصلة الشريانية الوريدية مع الشريان العضدى باستخدام الشرايين الصناعية من مادة البولى تترافلور وإيثلين ومادة البولى يوريثان والوريد الصافن الذاتى والوريد القاعدى المشتركون فى البحث

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فى هذا البحث قمنا بدراسة مقارنة مستقبلية عشوائية لبعض طرق الوصلة الشريانية الوريدية مع الشريان العضدى وذلك باستخدام بدائل الشرايين المصنعة من مادة البولى يوريثان وباستخدام الوريد الصافن الذاتى باستخدام الوريد القاعدى وذلك لتقييم لفضل الاختيارات لعمل الوصلات الشريانية الوريدية لمرضى الفشل الكلوى المستمر الذين لا يمكن إجراء وصلات لهم بين الشريان الكعبرى أو العضدى مع الوريد القفالى.

وأجريت هذا الدراسات على مرضى الفشل الكلوى الذين يحتاجون للإعاشة على الغسيل الكلوى المستمر الذين أدخلوا لوحدة جراحة الأوعية الدموية بكلية طب المنصورة لعمل الوصلة الشريانية الوريدية فى الفترة من يناير ١٩٩٧ إلى إبريل ١٩٩٨ وتمت متابعتهم حتى يونيو ١٩٩٨ وشملت الدراسة عدد ١٣٠ وصلة شريانية وريدية أجريت لعدد ١١٨ مريض فشل كلوى تتراوح أعمارهم بين ١٥ ، ٦٥ سنة .

وقد تم تقسيم المرضى عشوائياً إلى مجموعتين المجموعة الأولى عدد ٥١ مريضاً أجريت لهم ٥٣ وصلة شريانية وريدية بين الشريان العضدى والوريد القاعدى مع تسطيق الوريد القاعدى وضمت المجزومة الثانية ٦٧ مريضاً أجريت لهم ٧٧ عملية توصيل غير مباشر بين الشريان العضدى والوريد الأبطى بواسطة جسر أنبوى وحسب طبيعة الجسر تم تقسيم مرضى المجموعة الثانية إلى ثلاث مجموعات فرعية :

أ٢ : ٢٣ عملية توصيل باستخدام جسر أنبوى من مادة البولى يوريثان

٣ب: ٣٤ عملية توصيل باستخدام مادة البولي تترافلور إيثيلين (ب.ت.أف.إي) .

### وكانت النتائج كما يلي :

نسبة العمليات التي ظلت تعمل بكفاءة في المجموعة الأولى (التوصيل المباشر بين الشريان العضدي والوريد القاعدي) كانت ٨٦,٢٪ في نهاية العام الأول و ٧١,١٪ في نهاية العام الثاني .

نسبة العمليات التي ظلت تعمل بكفاءة في المجموعة الثانية كانت كما يلي :

١٢ أ : لتوصيل غير المباشر بين الشريان العضدي والوريد الأبطى بواسطة جسر أنبوى من مادة البولى يورثان كانت نسبة الكفاءة الأولية لها فى العام الأول ٦٧,٧٪ وفى نهاية العام الثانى ٣٥,٨٪ أما نسبة الكفاءة الثانوية لها نهاية العام الأول ٧٧,٣٪ وفى نهاية العام الثانى ٥٢,٩٪ .

٢ب : التوصيل غير المباشر بين الشريان العضدي والوريد الأبطى بواسطة جسر أنبوى من مادة البولى تتر أفلور إيثيلين كانت نسبة الكفاءة الثانوية فكانت فى نهاية العام ٦٣,٢٪ وفى نهاية العام الثانى ٤٩٪ .

٣ج : التوصيل غير المباشر بين الشريان العضدي والوريد الأبطى بواسطة الوريد الصافى الذاتى للمريض كانت نسبة الكفاءة الأولية فى نهاية العام ٧٣,٢٪ وفى نهاية العام الثانى ٣٨٪ .

### الاستنتاجات والنصائح :

لما كانت كفاءة وصلات التوصيل المباشر بين الشريان العضدي والوريد القاعدي مع تسطیح الوريد القاعدي أعلى من نسبة كفاءة التوصيل غير المباشر بين الشريان العضدي والوريد الأبطى سواء باستخدام شرايين صناعية أو باستخدام الوريد الصافن الذاتى وكذلك نسبة حدوث المضاعفات أقل بشكل ملحوظ فى وصلات المجموعة الأولى عن المجموعة الثانية فإننا على ضوء ذلك نرى أنه يجب اللجوء للوصلة الشريانية بين الشريان العضدي والوريد القاعدي إذا كان قطرة مناسباً إما إذا كان اللجوء لعمليات التوصيل غير مباشرة حتمياً فى حالة عدم ملائمة الوريد القاعدي فإننا ننصح باستخدام الوريد الصافن الذاتى للمريض أولاً قبل اللجوء للشرايين الصناعية من مادتى البولى يورثان والبولى تترافلور إيثيلين (ب.ت.أف.إي) .

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