

Arteriovenous Fistula in the First Interosseous Space of the Hand for Renal Dialysis

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Abstract

Background: Brescia-cimino fistula between the radial artery and cephalic vein is the most distal arteriovenous (A.V.) fistula in the upper limb used for renal dialysis. It may be end-to-end or side to side anastomosis. It is still widely used, with long patency rate and minor complications.

Aim of Study: To report our experience in AV fistula in the first interosseous space as regards results, complications and factors affecting its patency.

Patients and Methods: The study was done between January 2016 and January 2019, 60 A.V. fistulae were created in 55 patients with end-stage renal failure (22 females and 33 males) with a mean age of 45 years (range 20-75) years. All fistulas were done by the same technique. All patients were assessed preoperatively and the A.V. fistula was done in the first interosseous space of the non-dominant hand. If (a) The vein is absent, thrombosed or very small (less than 3 mm in diameter). (b) The radial artery is smaller than 1.5 mm or the pulse is not palpable, A.V. fistula was created proximally at the anatomical snuff-pox or at the wrist.

Results: 8 cases (13%) of 60 fistulae failed within 24 hours. A further 4 cases (2.5%) failed within 6 weeks (3.5%) not mature enough for haemodialysis and were therefore classified as failure at 6 weeks. The remaining 42 fistulae (81%) matured and were ready for haemodialysis within 6 weeks of construction. Among those, there were 10 cases (17%) late failure between 2 and 24 months. Two patients underwent successful fistula thrombectomy following occlusion after one year and one and half year and were able to continue haemodialysis using the same fistula which were patent till the end of our research. 2 cases (3%) lost follow-up; 4 cases (6.5%) underwent renal transplantation with functioning A-V fistula. The remaining 21 cases were alive and maintained on haemodialysis using fistula in the first interosseous space till the end of our study in January 2019.

Conclusion: Fistula in the first interosseous space should be considered the first option of A.V. fistula for renal dialysis if the artery and vein having suitable size for surgery which is 1.5mm. for the artery and 3mm. for the vein.

Key Words: Arteriovenous fistula – Interosseous space – Haemodialysis – End-stage renal failure.

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Introduction

BRESCIA-CIMINO fistula between the radial artery and cephalic vein is the most distal arteriovenous (A.V.) fistula in the upper limb used for renal dialysis. It may be end-to-end or side to side anastomosis. It is still widely used, with long patency rate and minor complications [1,2].

Alternative sites of A. V. fistula is:

- a- Fistula in the first interosseous space.
- b- Fistula in the anatomical snuff pox.
- c- Fistula in the cubital fossa between the brachial artery and cephalic vein.
- d- Brachio basilic A.V. at the lower part of the arm which need superficialization [3].

For many patients, arteriovenous fistula is the life of the patient and loss of venous accesses means loss of life; so it is good to the patient to do A.V. fistula as distal as possible to give long segment of arterialized vein for repeated venipuncture and reanastomosis proximally in cases of occlusion of the fistula [3].

Fistula in the first interosseous space was designed in 1969 by Rassat et al., [4]. It is of uncommon use in the United Kingdom [4].

The present study was to report our experience in AV fistula in the first interosseous space as regards results, complications and factors affecting its patency.

Patients and Methods

Our study was done between January 2016 and January 2019, 60 A.V. fistulae were created in 55 patients with end-stage renal failure (22 females and 33 males) with a mean age of 45 years (range

20-75) years. All fistulas were done by the same technique. All patients were assessed preoperatively and the A.V fistula was done in the first interosseous space of the non-dominant hand. If (a) The vein is absent, thrombosed or very small (less than 3mm in diameter). (b) The radial artery is smaller than 1.5mm or the pulse is not palpable, A.V. fistula was created proximally at the anatomical snuff-pox or at the wrist.

Surgical technique:

The fistula was created under local anaesthesia (0.5% bupivacaine mixed with 0.5% lidocaine) and mild sedation (by midazolam 5-10mg. IV) followed by preoperative antibiotic (Fortazidim 1gm I.V.). Longitudinal skin incision was done over the first interosseous space, 2-3cm long. This is enough to give good exposure to the artery and vein. An end to side anastomosis was done between the cephalic vein and the radial artery by continuous polypropylene sutures (6/0 prolene, ethicon) (Figs. 1-6); the wound was closed in layers and good palpable thrill was palpated used as an indicator for success.

In some cases of immediate failure, the patency of the fistula was restored by embolectomy using fogarty catheter No. 2 or 3.

Any failure was detected after leaving the operating theater, a proximal fistula was done. The fistula is allowed to mature by time about 6-8 weeks until the cephalic vein is sufficient for haemodialysis and the blood flow per minute was more than 350ml/min. Most of the patients were given aspirin 75mg once per day for 2-3 days postoperative to prevent early thrombosis.



Fig. (1): Sterilisation by betadine.

Outcome:

Classification of outcome was done as the follow: Fig. (1).

a- Patients with failed A.V. fistula were classified into two subgroups:

- 1- Early failure within 6 weeks before the use of the fistula for dialysis and this due to thrombosis.
- 2- Late failure, patent fistula with palpable thrill but with low blood flow less than 250ml/min.

b- Patient died with functioning A.V. fistula.

c- Patient underwent renal transplantation with functioning A.V. fistula.

d- Functioning fistula till the end of our research in January 2019.

Results

8 cases (13%) of 60 fistulae failed within 24 hours. A further 4 cases (2.5%) failed within 6 weeks (3.5%) not mature enough for haemodialysis and were therefore classified as failure at 6 weeks. The remaining 42 fistulae (81%) matured and were ready for haemodialysis within 6 weeks of construction. Among those, there were 10 cases (17%) late failure between 2 and 24 months. Two patients underwent successful fistula thrombectomy following occlusion after one year and one and half year and were able to continue haemodialysis using the same fistula which were patent till the end of our research. 2 cases (3%) lost followup; 4 cases (6.5%) underwent renal transplantation with functioning A-V fistula. The remaining 21 cases were alive and maintained on haemodialysis using fistula in the first interosseous space till the end of our study in January 2019.



Fig. (2): Cephalic vein.



Fig. (3): Cephalic vein and distal ligation.



Fig. (4): Anastomosis between the radial artery and cephalic vein.



Fig. (5): Closure of the wound.



Fig. (6): Arterialised vein after six months.

Complications:

Early thrombosis which is managed by redo of proximal fistula is the main complication otherwise, complications are minimal in the form of superficial infections which was improved by the use of antibiotics, aneurysmal formation at the site of anastomosis in one case managed by ligation of the fistula, steal phenomenon in one case affecting the digits managed also by shunt ligation and 2 cases of bleeding at the site of puncture due to increased bleeding tendency managed by blood and plasma transfusion.

There were no deaths related to the fistula procedure: After failure of 13% (8 cases) distal interosseus cephalic fistula, 6 cases need proximal radiocephalic A.V. fistula, 1 case needs proximal brachiocephalic A.V. fistula and the other one needs A.V. graft.

Discussion

Our distal first interosseus A.V. fistulas were done to 50% of the patients as a primary vascular

access and in few patients as a secondary vascular access after failure of access in the other limb.

The distal first interosseus A. V. fistula have the following superiorities:

- It is the most distal upper limb fistula giving the longest length of vein used for needle puncture.
- Easy performance due to presence of the vein and artery over each other; so, there is no need for vein mobilization and transposition.
- Peripairing already arterialized vein for easy proximal redo in cases of late failure.
- The incidence of steal phenomena and hyperdynamic circulation is very minimal due to small vessel size.
- The immediate failure rate was 11 %, in these patients, proximal AV fistulae was done but in others, continuous amputating peritoneal dialysis (CAPD) or jugular venous catheter, were inserted at 6 weeks, 2% were lost in the first year, similarly, 10% were lost in the second year. With rate of loss of the fistula equal to 7% per year.
- First interoseus distal A.V. fistula.

Table (1): Comparison of patency rate of our study (%) with other studies.

References	Patency (%) immediate failure	1 month	6 months	1 year	2 years
Bornalumi et al., [7]	10.2	—	83.1	—	—
Harder, landmann [5]	—	—	85	—	—
Bartova et al., [9]	—	84	75	—	—
Marx, landmann [10]	—	—	74	65	60
Sakar, Mnams [13]	—	94.8	—	—	—
Semoni et al., [8,14]	—	—	—	77	70
Our study	11	82	65	60	55

- The patency rate in our study was slightly lower than that reported in some other studies (Table 1). This is due to more use of borderline suitable vessels and less number of patients in our study compared to other studies. However, creation of large number of such distal fistula reducing the need of more complicated A.V. fistula such as synthetic graft.
- Preoperative assessment may be difficult in obese patients; so, some studies exclude such patient and also diabetics [4,12,16].
- This increase the patency rate of the fistula as it is low in obese and diabetics but this has not confirmed in our study.
- Another reason for lower patency rate, in other studies is higher mean age of patient used, [7,14] compared with our study.
- We and some studies, [6,9,10] used end-to-side anastomosis to decrease the risk of steal phenomenon and venous hypertension, which can occur with end-to-end and side-to-side anastomosis [8,10,15].
- Early occlusion and thrombosis of A.V fistula was due to technical error, [7,8] proximal venous obstructions, [17], or small vessels used, [7,8].
- In our study and some series [11,12,17,18], of female gender was a significant factor of decreasing the patency rate due to relatively smaller vessels. The use of secondary or tertiary procedures were suitable and increasing the patency rate [4,13].
- After maturation of A.V. fistula, the blood flow and easy needle puncture is similar to the classic distal radiocephalic A.V. fistula (Brescia-Cimino fistula) but the difference was the longer length of vein suitable for dialysis in our study which was extended along the whole forearm.

Conclusion:

- Fistula in the first interosseous space should be considered the first option of A.V. fistula for renal dialysis if the artery and vein having suitable size for surgery which is 1.5mm. for the artery and 3mm. for the vein.

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الناصور الشرياني الوريدي في أول مساحة بين العظام في اليد المستخدم للغسيل الكلوي

تمت هذه الدراسة في الفترة ما بين يناير ٢٠١٦ إلى يناير ٢٠١٩ في مستشفى الحسين وسيد جلال الجامعيين بجامعة الأزهر على ٥٥ مريضاً، وتم عمل ٦٠ وصلة شريانية وريدية (٢٢ امرأة و٣٨ رجلاً). وكان التوصيل بين الشريان العضدي والوريد الرأسي في أول مساحة بين العظام باليد بغرض استخدامها للغسيل الكلوي. ويُعد هذا المكان أبعد مكان عن القلب في الطرف العلوي يمكن فيه عمل عمليات الناصور الشرياني الوريدي. وقد ثبت من هذه الدراسة أن هذا المكان يُعتبر مكاناً جيداً لعمل مثل تلك العمليات بشرط أن يكون الشريان والوريد صالحين للجراحة، ولذلك لماله من فوائد كثيرة وهي:

أولاً : أنه يعطى أطول مسافة صالحة للغسيل من الوريد .

ثانياً : لو حدث انسداد لهذا الناصور واحتاج المريض لعمل عملية أخرى يكون هذا الوريد جاهزاً للغسيل بعد الجراحة الثانية بمدة قليلة.

ثالثاً : سهولة التوصيل الشرياني الوريدي لوجود الوريد فوق الشريان مباشرة.

رابعاً : فرصة حدوث قصور الدم الشريان باليد بعد عملية التوصيل تكاد تكون معدومة.