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Original Research Article

Dual Channel Brachial AVF- A Case Series of Six Patients

Aandrei J Jha[1], Tushar Kumar[2], Madhav Kumar[3], Sheil Avaneesh[4], Ruchi Singh[5]

[1]Assistant Professor, Department of Cardiothoracic and Vascular Surgery, Indira Gandhi Institute of Medical Sciences, Sheikhpura, Patna, Bihar, India.

[2]Assistant Professor, Department of Cardiothoracic and Vascular Surgery, Indira Gandhi Institute of Medical Sciences, Sheikhpura, Patna, Bihar, India.

[3]Assistant Professor, Department of Cardiothoracic and Vascular Surgery, Indira Gandhi Institute of Medical Sciences, Sheikhpura, Patna, Bihar, India.

[4]Additional Professor and Head, Department of Cardiothoracic and Vascular Surgery, Indira Gandhi Institute of Medical Sciences, Sheikhpura, Patna, Bihar, India.

[5]Senior Resident, Department of Cardiothoracic and Vascular Surgery, Indira Gandhi Institute of Medical Sciences, Sheikhpura, Patna, Bihar, India

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Corresponding author: Dr. Tushar Kumar
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Abstract

Background: Vascular access for Hemodialysis is the commonest mode of renal replacement therapy for end stage renal failure patients. Such fistulae have significant access related complications that translate to reduced durability. This paper reviews a new technique of a "dual channel" brachial arteriovenous fistula creation that provides used both basilic and cephalic veins thereby providing greater area for access and potentially reduced complications. **Objectives:** To study technical feasibility of creation and immediate patency of "dual channel" arteriovenous fistula in patients of end stage renal disease. **Materials and Methods:** All patients found anatomically suitable for creation of "dual channel arteriovenous fistula" were included in the study. **Results and conclusions:** The "dual channel" arteriovenous fistula is an acceptable alternative to the traditional single channel variant in anatomically suitable patients and provides excellent immediate patency. **Summary:** An arteriovenous fistula is by far, the commonest and the most durable vascular access for hemodialysis in patients with End stage renal disease. Antecubital fossa has been long recognized as an alternative site for AVF construction but local complication at this site is higher than the classical Bresica- Cimino fistula at radial or forearm location. This case series describes a new technique of making a forearm fistula where two venous channels are available for hemodialysis access instead of one.

Keywords: Dual channel brachial arteriovenous fistula, new technique, vascular access, hemodialysis.

Introduction

The current incidence of chronic kidney disease is currently estimated at 9.1 % which translates to 700 million cases worldwide [1] and continues to increase as are ESRD (CKD- V) patients. To sustain life, these ESRD patients (2%) must undergo some kind of renal replacement therapy. The dismal fact that less than twenty percent [1] of the ESRD patients in 2018 were able to get a renal transplant compels the vast majority of the remaining patients to continue with AVF for HD access. For reasons pertaining to patient comfort, cost and durability, a surgically created AVF is the best access for HD. The first such fistula was made by Bresica and Cimino (1966) [2] using radial artery and cephalic vein. An AVF can also be made in antecubital fossa using brachial artery and either cephalic or basilic vein. Using brachial artery leads to higher flows and hence more chances of distal steal when compared to an AVF at the wrist. This can translate into faster maturation and lesser failures for Brachial AV fistulae [3]. A significant technical issue with a brachial AVF is the short length of the cephalic or basilica vein that is available for HD access. The first mention of the antecubital or brachial AVF is available no earlier than 1976 [4], which is a decade later than the first reported radio cephalic AVF by Bresica and Cimino. The basilic vein, in particular, has an unfavorable anatomy for needle puncture as it goes posteriorly and backwards. In anterior transposition technique [5], the basilic vein is brought anteriorly, improving accessibility without effecting the length. The short segment of vein available for HD access in a brachial AVF is inevitably subject to frequent needle trauma and local complications like hematoma and aneurysm are therefore more common with brachial than with radial AVFs. The novel technique described in this paper makes both cephalic and basilic veins available for HD. This could lead to a decrease in local complications related to needle puncture for HD as more healing time is allowed between successive needle pricks as two veins are now available instead on one.

Aim: To examine the early patency of a surgically created Dual Channel AV Fistula for hemodialysis.

Inclusion criteria: All patients presenting to the department of Cardiothoracic and Vascular Surgery at IGIMS, Patna for creation of AVF for HD access with suitable anatomy for Dual Channel AV Fistula creation.

Exclusion criteria:

1.Patients with unsuitable anatomy 2. Non-Ambulatory patients with multiple and poorly controlled comorbidities and other medical conditions. 3. Radiocephalic AVF patients were also excluded from this study.

Materials & methods:

Twenty consecutive patients were admitted for surgical creation of brachial AVF for HD access during the month of May 2021. All patients underwent Ultrasound Doppler exam of left upper extremity artery and veins in which the sizes and flows of ante-cubital vessles was ascertained. Intraoperatively, veins in the ante-cubital fossa were dissected out and the anatomy assessed. A suitable anatomy was defined as adequate caliber basilic, and cephalic veins connected by an ante-cubital vein so that dual channel venous outflow could be achieved thereby creating a DC- AVF. Only six patients were intra-operatively found to satisfy these criteria and underwent the creation of DC- AVF, the technique of which is described subsequently. Duly informed and written consent was taken from these patients. The endpoint was taken as presence of palpable thrill over both cephalic and basilic veins after completion of AVF construction. On the Photo plate, the left and right columns show the completed anastomoses of patients S. No 1 through 3 and 4 through 6 respectively.

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Creation of DC- AVF- The Technique

Taking all aseptic precautions, under local anesthesia, skin crease incision was given in ante-cubital fossa and superficial fascia was explored for veins. The basilic vein was isolated first and traced caudally to visualize the ante-cubital vein communication with cephalic vein. After assessing all the veins for caliber and ensuring adequate "H connection" (Fig.1) between the basilic and cephalic veins (Fig 1) the brachial artery was exposed by dividing the left margin of biccipital aponeurosis for varying lengths. The AVF was constructed between brachial artery and basilic vein in a side-to side fashion, as distally as possible using continuous 6-0 prolene suture. Upon completion of the anastomosis and usual hemostasis, fistula flow was documented by palpating for thrill over both cephalic and basilic veins. Patient no 6, however, had a particular tailor-made anatomy where the ante cubital vein was of sufficient length and caliber. This vein continuing caudally at elbow was anastomosed end to side with brachial artery, thereby achieving a complete "Y" configuration with inflow at the lower and vertical stem of the 'Y". The remaining five patients had the same venous "Y "configuration but the inflow (anastomosis) was at a more proximal level i.e side to side between the basilic vein and the brachial artery.

Results:

Table 1: Patient demographics were as follows

S. No.	Age/Sex	Co-morbidities	Brachial Artery (mm)	Cephalic vein (mm)	Basilic Vein
1.	25/M	HTN	4.0	3.5	3.0
2.	37/M	HTN	3.0	3.0	4.5
3.	45/M	HTN, DM	4.0	3.5	2.0
4.	60/M	HTN, DM	5.0	4.0	4.0
5.	30/M	HTN, DM	4.0	3.0	3.0
6.	28/M	HTN	4.0	3.0	3.5

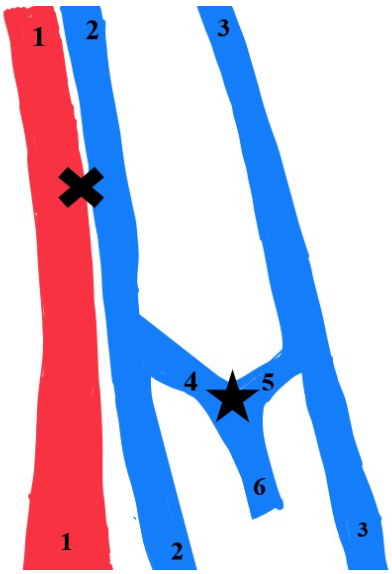


Figure 1: Patient's nos, 1-5

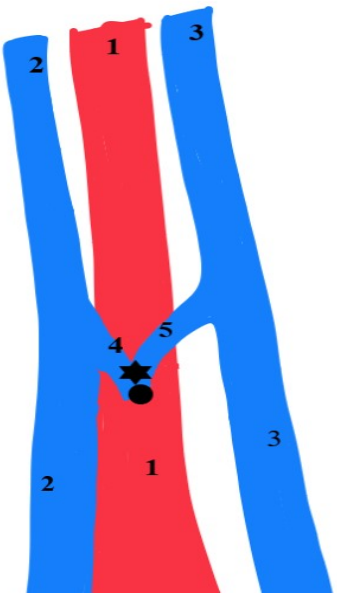
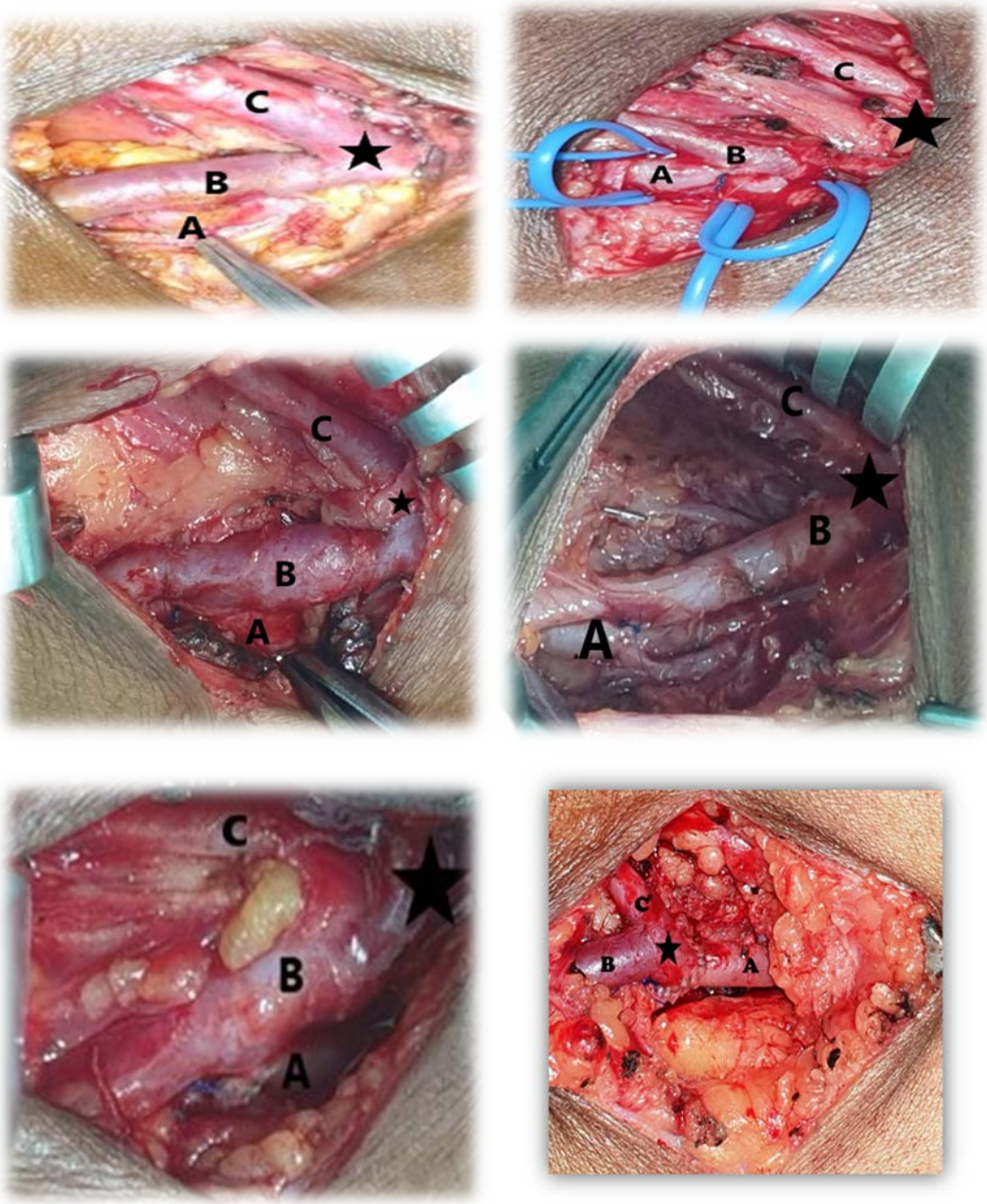


Figure 2: Patient no. 6

1. Brachial Artery
2. Basilic Vein
3. Cephalic Vein
4. Median Branch of Basilic Vein
5. Median Brach of Cephalic Vein
6. Median Antecubital Vein

★ The "H" Connection
✖ The Anastomosis site Patients no. 1-5
● The Anastomosis site patient no 6



A= Brachial Artery
B= Basillic Vein
C= Cephalic Vein
*= Median /Antecubital Vein

Table 2: Intraoperative details are summarized as follows:

S. No.	Brachial artery	Length of anastomosis (mm)	Thrill over Basilic vein	Thrill over Cephalic vein
1.	Healthy	3.0	+	+
2.	Healthy	4.0	+	+
3.	Healthy	3.0	+	+
4.	Atheroma	4.0	+	+
5.	Healthy	4.0	+	+
6.	Healthy	5.0	+	+

As can be inferred above, all six patients who underwent construction of the Dual Channel AVF had a palpable thrill over both Basilic and Cephalic veins at the end of the procedure.

Discussion:

An AVF is the most common means of HD access for ESRD patients today. Despite the common use they are cumbersome local problems like bleeding, hematoma, aneurysm formation and very importantly, patency issues. These patients often have other coexisting medical conditions and some workers have shown that patency rates of these AVFs have a significant effect on mortality and morbidity of these patients [6]. Many of the local complications can be attributed to the compulsion of repeated needle punctures for HD. The approach described in our work here gives the patient the benefit of two veins to puncture for HD access. This technique is easy to reproduce and can be done in patients with the favourble “H Connection” venous anatomy on the antecubital fossa. AVF construction using median antecubital vein has been described by workers from CHU Yaunde’ (Guifo et al) [7] and Elamurugan et al [8]. Like most other workers, one major vein, including perforating veins was also ligated with intention of increasing reverse flow and decreasing distal ischemia and venous hypertension. Brachial AVF per se, has its own issues that include a shorter length of accessible vein, higher chances of limb edema and ischemia and distal venous hypertension. Brachio-basilic AVF, in particular is more difficult to access as the vein here runs posteriorly and cranially in the arm when compared to a Brachio – Cephalic AVF. Surgeons over last several decades have been trying to address these issues. One of the most popular approaches to improve accessibility of a brachio-basilic AVF is the anterior transposition of Basilic vein. Venous hypertension in the effected limb would also be lesser in a dual channel AVF as the arterial flow is now dissipated over a larger run off area that include two veins as compared to one.

Limitations of the study:

We present an original new technique case series of brachial AVF creation that we hope will increase longevity and reduce local access complications. The major limitation here is a small number of patients and the fact that not all patients have a suitable venous anatomy for creation of the Dual channel AVF. Also, longer follow up is needed using Doppler studies and the same is already underway in a larger series.

Summary:

AVF is the commonest means of HD access for patients with ESRD. This original article describes a new technique of creating a brachial AVF where instead of a single vein, both veins i.e the basilic and the cephalic are available for access. This could potentially obviate local complications attributable to frequent needle punctures for HD and thereby increase longevity of the AVF.

Conclusion:

Dual channel Brachial AVF is a safe, effective reproducible technique and possibly an improved alternative to tradition brachial AVFs.

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