

**A PROSPECTIVE STUDY OF COMPARISON OF DISTAL RADIOCEPHALIC  
FISTULA VS PROXIMAL RADIOCEPHALIC FISTULA**

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**Abstract:**

**Introduction:** The preferred type of vascular access (VA) for hemodialysis is arteriovenous fistulas. When cannulated effectively for dialysis, they have a longer lifespan and require fewer procedures than grafts. Autogenous fistulas outperform prosthetic grafts in terms of patency, infection rate, and postoperative morbidity. The aim of the present study was to evaluate the outcomes of proximal forearm AV fistula placed at elbow and distal forearm AV fistula placed at wrist.

**Materials and Methods:** A prospective comparative study was conducted at the Department of Cardiothoracic and Vascular Surgery, Siddhartha Medical College, Vijayawada from January 2022 to December 2022. All patients who underwent hemodialysis in the medical college were included in the study. All the patients underwent pre-operative Doppler ultrasound to determine size of radial artery, size of cephalic vein, and flow rate at wrist and elbow to determine the feasibility of distal fistula or proximal fistula.

**Results:** In proximal radiocephalic group, Mean age of the patients was 57 year ranging from 35 to 66 year. Male to female ratio was 3.12: 1. 27 patients (54%) were diabetic, 40 (80%) were hypertensive, 15 patients (30%) had cardiovascular disease. Early failure was 4 (8%) cases. Both cases were due to thrombosis. In distal radiocephalic group, Mean age of the patients was 46 year ranging from 32 year to 60 year. Male to female ratio was 3:1. 36 patients (72%) were diabetic, 26 patients (52%) hypertensive 15 (25%) had cardiovascular disease. Early failure was seen in 5 cases. Two cases were due to thrombosis and one case was due to low flow in the fistula.

**Conclusion:** With a significantly reduced primary failure rate, higher patency rate, and lower complication rate, proximal radiocephalic fistulas (PRCF) are an appealing option to brachiocephalic fistulas in failed DRCF and patients who cannot undergo a DRCF.

**Key Words:** vascular access, proximal radiocephalic fistulas, Distal radiocephalic fistulas.

## INTRODUCTION

The preferred type of vascular access (VA) for hemodialysis is arteriovenous fistulas. When cannulated effectively for dialysis, they have a longer lifespan and require fewer procedures than grafts. Autogenous fistulas outperform prosthetic grafts in terms of patency, infection rate, and postoperative morbidity.<sup>1</sup>

The distal radiocephalic arteriovenous fistula (dRCF) at the wrist is the gold standard venous access for individuals requiring long-term hemodialysis. When compared to elbow fistulas, placing the dRCF at the wrist lowers the likelihood of steal syndrome and maintains more proximal arteries for future access placement. However, dRCF at the wrist has been reported to have a high primary failure rate due to early thrombosis or failure to develop to allow sufficient dialysis.<sup>2</sup> A significant proportion (20-60%) of newly formed fistulas fail to develop. The nonmaturity rate for dRCF put at the wrist is higher than for brachiocephalic fistulas placed in the upper arm. Women and elderly individuals had a higher rate of dRCF nonmaturity. When a dRCF fails to mature or when preoperative mapping indicates there are no suitable vessels for creation of a wrist fistula, current guidelines recommend placement of upper arm brachiocephalic fistula.<sup>3</sup>

Dialysis access-associated steal syndrome (DASS) is a serious complication associated with autogenous proximal arm fistulas, reported in up to 10% of patients. Age greater than 60 years, female sex, concomitant peripheral vascular diseases, operations on the same limb, formation of proximal fistula, or use of synthetic graft have been identified as risk factors predisposing to DASS.<sup>4</sup>

The incidence of DASS is rising in direct relation to the increase in number of diabetics with autogenous fistula and the use of proximal forearm veins. Approximately 25–81% of patients with DASS have been reported to have these risk factors. An alternative option, which is used infrequently in such patients, is to create a proximal radiocephalic arteriovenous fistula (pRCF) between the proximal radial artery and the cephalic vein.<sup>5</sup>

The aim of the present study was to evaluate the outcomes of proximal forearm AV fistula placed at elbow and distal forearm AV fistula placed at wrist.

## MATERIALS AND METHODS

**Study design:** A prospective comparative study.

**Study duration:** January 2022 to December 2022.

**Study Location:** Department of Cardiothoracic and Vascular Surgery, Siddhartha Medical College, Vijayawada.

**Sample Size:** 100 patients.

All patients who underwent hemodialysis in the medical college were included in the study. All the patients underwent pre-operative Doppler ultrasound to determine size of radial artery, size of cephalic vein, and flow rate at wrist and elbow to determine the feasibility of distal fistula or proximal fistula.

**Pre-operative advice:** All patients were advised to preserve cephalic vein on the forearm by avoiding any venae puncture prior to fistula creation. Vein diameter was determined after tourniquet application.

#### **Inclusion criteria for DRCF**

Radial artery >2 mm at wrist, flow rate >40 ml/sec, cephalic vein >2.5 mm, absence of thrombosis in the cephalic vein.

#### **Inclusion criteria for PRCF**

Radial artery <2 mm at wrist, flow rate <40 ml/sec, cephalic vein <2.5 mm, thrombosed cephalic vein, previously failed avf (arterio venous fistula) at wrist.

All surgeries were done by local infiltration anesthesia using 2% lignocaine with adrenaline. A 4 to 5 cm longitudinal incision was made two fingers below the cubital fossa in the interval between brachioradialis and flexor carpi radialis. Brachial artery, ulnar artery and radial artery were identified. Radial artery was identified and brought upwards. Cephalic vein or median antebrachial vein were identified. If median antebrachial vein were present they were preferred. Patency of the vein was confirmed by flushing of heparin solution. If there was free flow of heparinised solution end to side anastomosis was planned. Two bulldog clamp were applied one proximally and one distally. Arteriotomy was done. Microvascular clamp was applied on the vein. End to side anastomosis was done by back wall first technique. First posterior wall was sutured continuously with prolene 7-0 suture followed by continuous suturing of the anterior wall. After anastomosis is completed papaverine or 2% Loxicard is applied and blood flow was allowed for 15 to 20 minutes. Any leak from the anastomosis was identified. Patency of fistula is confirmed by palpable thrill. Skin was closed with interrupted 3-0 polyamide.

**Statistical Analysis:** Categorical data were presented as count and proportion and was tested by Chi-square test or if applicable Fischer's exact test. Comparison between two procedures was done by Kaplan-Meier method and evaluated by the log-rank test. With the 95% of Level of significance, P value < 0.05 was consider statistically significant during analysis.

## **RESULTS**

**Proximal radiocephalic group:** Mean age of the patients was 57 year ranging from 35 to 66 year. Male to female ratio was 3.12:1. 27 patients (54%) were diabetic, 40 (80%) were

hypertensive, 15 patients (30%) had cardiovascular disease. Early failure was 4 (8%) cases. Both cases were due to thrombosis. Late failure was seen in 4 patients due to pseudo aneurysm. One patient of pseudo aneurysm was infected and ruptured which was managed by ligation of fistula. 6 patients were lost during follow up. No patient had developed steal syndrome. 6 patients had mild edema which was managed by hand elevation. Apart from that there was no case of wound infection, wound dehiscence. Out of the 50 cases of PRCF 53 cases were patency at the end of one year.

**Distal radiocephalic group:** Mean age of the patients was 46 year ranging from 32 year to 60 year. Male to female ratio was 3:1. 36 patients (72%) were diabetic, 26 patients (52%) hypertensive 15 (25%) had cardiovascular disease. Early failure was seen in 5 cases. Two cases were due to thrombosis and one case was due to low flow in the fistula. Late failure was seen in two cases due to psuedoaneurysm formation. Six patients were lost during follow up. No patient had developed steal syndrome. 3 patients had mild edema which was managed by hand elevation. 2 patients had hematoma at the operated site.

Characteristics	PRCV	DRCV
Age year (Mean)	57	46
<b>Gender</b>		
Male	35 (70%)	36 (72%)
Female	15 (30%)	14 (28%)
<b>Diabetes Mellitus</b>		
Yes	27 (54%)	26 (52%)
No	23 (46%)	24 (48%)
<b>Hypertension</b>		
Yes	40 (80%)	45 (90%)
No	10 (20%)	5 (10%)

**Table 1: Patient demographics**

Type of fistula	Mean	Number of patients	SD
Distal forearm	2.21	50	0.25
Proximal forearm	3.70	50	0.65
Total	3.10	100	0.96

**Table 2: Mean diameter of artery in distal and proximal fistula**

Type of fistula	Mean	Number of patients	SD
Distal forearm	2.67	50	0.32
Proximal forearm	4.35	50	0.70
Total	3.50	100	1.02

**Table 3: Mean diameter of vein in distal and proximal fistula**

Type of fistula	Mean	Number of	SD
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		patients	
Distal forearm	1.90	50	0.60
Proximal forearm	2.30	50	0.70
Total	2.21	100	0.70

**Table 4: Mean diameter of the narrowest part of fistula**

## DISCUSSION

Tordoir et al. reported symptomatic ischemia 10-20% cases BCF and brachiobasilic fistula, 4.3-6% of forearm prosthetic AVF, 1-1.8% of radiocephalic AVF. Incidence of dialysis associated steal syndrome is extremely rare following proximal RCF. Burns and Jennings in 2003 found Proximal forearm fistula to be safe and reliable with no incidence of steal after 42 months.<sup>6</sup> Studies have reported low incidence of steal syndrome (0- 3%) for PRCF group compared with higher (20%) in BCF. In our study there was no case of steal syndrome in either PRCF group or DRCF group. When radial artery is used as inflow artery ulnar artery is still available for vascular supply and prevents steal syndrome.<sup>7</sup>

In our series thrombosis and failure of maturation are cause of early failure (6.06%). Kumar et al. reported early failure rate in 16 (5%) patients whereas eight (2.5%) fistulas failed at a later date. Rate of thrombosis in our series was seen in 6.06% cases in PRCF group and 15% case in DRCF group.<sup>8</sup> Early cause of thrombosis is mostly technical. It was decreased in our series by use of finer suture material (6-0 for PRCF, 7-0 for DRCF), use of magnification loupe, pre operative screening of healthy vein, and use of clopidogrel in the post operative period. Prevention of early thrombosis maintains flow across the fistula site and favours maturation.<sup>9</sup>

Late cause of thrombosis occurs due to intimal hyperplasia. Thrombosis can be managed by thrombectomy. But in our series all cases presented late with sign of thrombophlebitis. So thrombectomy was not tried in any of the cases. After initiation of hemodialysis by fistula repeated needle insertion can lead to pseudo aneurysm formation which can get infected and rupture.<sup>10</sup>

Follow up period range from 6 month to 1 year depends on the post operative period duration. 1st follow up was 1 week after discharge from hospital, suture removal done as protocol on 10th post op day. then when patient come to dialysis after one month of post operative period after maturity of fistula regularly done post op color Doppler to all patients, then after every 2 months from post maturity patients were followed up for describe findings.

## CONCLUSION

Early detection and treatment of Arteriovenous fistula-related problems is critical for optimizing operation success. It is critical for health-care practitioners to constantly monitor patients for indicators of problems and to take necessary treatment as soon as possible. This can help to reduce the severity of the problems and increase the likelihood of successful fistula use.

With a significantly reduced primary failure rate, higher patency rate, and lower complication rate, proximal radiocephalic fistulas (PRCF) are an appealing option to brachiocephalic fistulas in failed DRCF and patients who cannot undergo a DRCF.

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