

Early Outcomes and Maturation Profile of Arteriovenous Fistula Creation in a Newly Established Cardiothoracic and Vascular Surgery Unit: A Single-Surgeon Retrospective Study

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Abstract:

Background: Autogenous arteriovenous fistula (AVF) remains the preferred form of vascular access for long-term haemodialysis. Published experience from newly established vascular access services in resource-limited settings is limited. We assessed early outcomes and functional maturation after AVF creation in a newly established cardiothoracic and vascular surgery (CTVS) unit in Northeast India.

Methods: We retrospectively reviewed consecutive adults who underwent primary AVF creation between August 2024 and January 2026. A single surgeon performed all procedures using a distal-first approach. Postoperatively, rivaroxaban 2.5 mg once daily was prescribed for 45 days under the institutional protocol. Maturation was assessed clinically and by colour Doppler ultrasonography at 45 days or later. The analysis was descriptive, with categorical variables summarized as N (%).

Results: Seventy-six AVFs were created during the study period. Follow-up was adequate for 74 patients (97.4%), while 2 patients (2.6%) could not be assessed because the required follow-up was unavailable. Sixty procedures (78.9%) were radiocephalic and 16 (21.1%) were brachiocephalic. Among evaluable fistulas, 72/74 (97.3%) achieved functional maturation: 56/58 (96.6%) of the radiocephalic and 16/16 (100%) of the brachiocephalic AVFs. Two procedures (2.6%), both radiocephalic, were classified as primary failures. No early thrombosis or major complication was recorded. Minor wound complications occurred in 5/76 patients (6.6%); venous congestion occurred in 14/16 brachiocephalic AVFs (87.5%) and was managed conservatively.

Conclusions: In this newly established unit, early functional maturation was achieved in most AVFs and major complications were uncommon. The results describe the initial experience with a consistent operative approach and postoperative protocol in a resource-limited setting.

Categories: Urology, Nephrology, Cardiac/Thoracic/Vascular Surgery

Keywords: Arteriovenous Fistula, Brachiocephalic, Haemodialysis Access, Northeast India, Radiocephalic, Vascular Access.

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Introduction

For patients requiring long-term haemodialysis, an autogenous arteriovenous fistula (AVF) is usually

preferred because it generally provides durable access with fewer complications than prosthetic

grafts or central venous catheters. When anatomy permits, starting with a radiocephalic fistula preserves more proximal sites for later access. Nevertheless, early thrombosis and failure of maturation remain important clinical problems. Previous series have reported primary failure rates of about 10%–30% [1,2].

The result of AVF creation depends on several factors. Vessel calibre, coexisting conditions such as diabetes and hypertension, and the experience of the operating surgeon can all influence maturation [3,4]. Careful operative technique and consistent perioperative management may reduce early problems [3,4]. Outcomes can also differ between hospitals, particularly where vascular access services are newly developing. One Indian series reported primary failure rates between 20% and 60%, with outcomes varying according to patient and vessel characteristics [5].

Access to permanent haemodialysis vascular access can be difficult for patients with chronic kidney disease (CKD) in parts of Northeast India. In the absence of an in-house CTVS service, referral to a distant tertiary centre may be necessary. This can delay creation of definitive access, increase travel and treatment costs, and extend the period of reliance on temporary central venous catheters.

Establishing a local vascular access service may help address some of these practical difficulties. However, there are few published reports describing AVF outcomes from newly established centres in Northeast India. Experience from such centres can provide useful local information on the feasibility and safety of providing permanent dialysis access and may help guide development of comparable services in other resource-constrained settings.

We therefore reviewed the early results of AVF creation in a newly established CTVS unit at a tertiary care centre in Northeast India. The study focused on functional maturation and early complications and also described outcomes obtained with a consistent distal-first operative strategy and postoperative protocol.

Materials & Methods

Study Design and Setting: This retrospective observational study was carried out in the Department of Cardiothoracic and Vascular Surgery (CTVS), Tomo Riba Institute of Health and Medical Sciences (TRIHMS), Itanagar, a tertiary care centre in Northeast India.

Study Population

Inclusion criteria: All consecutive adult patients (≥ 18 years) with CKD requiring haemodialysis who underwent primary autogenous AVF creation (radiocephalic or brachiocephalic) between August 2024 and January 2026.

Exclusion criteria: Patients with a previous AVF in the same limb, patients receiving a prosthetic graft, patients whose index vascular access procedure was a central venous catheter, and patients without follow-up information at ≥ 45 days after surgery.

All operations were performed by the same surgeon. Radiocephalic AVF creation was attempted first when clinical examination and preoperative ultrasound vein mapping showed suitable forearm vessels. A brachiocephalic AVF was used when the forearm vessels were considered unsuitable.

Perioperative Protocol: After surgery, rivaroxaban 2.5 mg once daily was prescribed for 45 days in accordance with the institutional postoperative protocol.

Outcome Definitions

1. Primary outcome — Functional maturation: The fistula was considered clinically ready for cannulation when a palpable thrill and audible bruit were present. Colour Doppler ultrasonography performed at ≥ 45 days was used for confirmation. Maturation criteria included flow ≥ 500 mL/min and vein diameter ≥ 6 mm, appropriate for the prescribed haemodialysis blood-flow requirements.
2. Secondary outcome — Primary failure: Failure to reach functional maturation within 3 months or inability to use the fistula for dialysis.
3. Secondary outcome — Early thrombosis: Thrombosis developing within 30 days of AVF creation.
4. Secondary outcomes — Other complications: Minor wound problems, such as surgical-site infection or a small haematoma not requiring intervention, and clinically documented venous congestion presenting as forearm or limb swelling.

Ethical Considerations: The study was reviewed by the Institutional Ethics Committee (IEC) of TRIHMS and was conducted in accordance with the ICMR National Ethical Guidelines for Biomedical and Health Research Involving Human Participants (2017) and the Declaration of Helsinki. Because the study used retrospective, de-identified clinical information and posed minimal risk, the IEC waived the requirement for individual written informed consent. Consent for treatment and open-access publication had been obtained during the patients' original clinical care.

Statistical Analysis: The analysis was descriptive. Age and other continuous variables are reported as mean $\pm$ standard deviation, while categorical variables are given as frequency and percentage, N (%). Radiocephalic and brachiocephalic AVFs were compared descriptively; no formal hypothesis

testing was undertaken because of the retrospective design and sample size. Analyses were performed using Microsoft Excel or SPSS.

Results

Patient Demographics: Of the 76 patients who underwent AVF creation, 74 (97.4%) had the required follow-up for outcome assessment. Two patients (2.6%) were not included in the outcome analysis because follow-up at ≥ 45 days was unavailable (Table 1). Mean age was 41.8 years. There were 41 males (53.9%) and 35 females (46.1%). Diabetes mellitus was recorded in 32

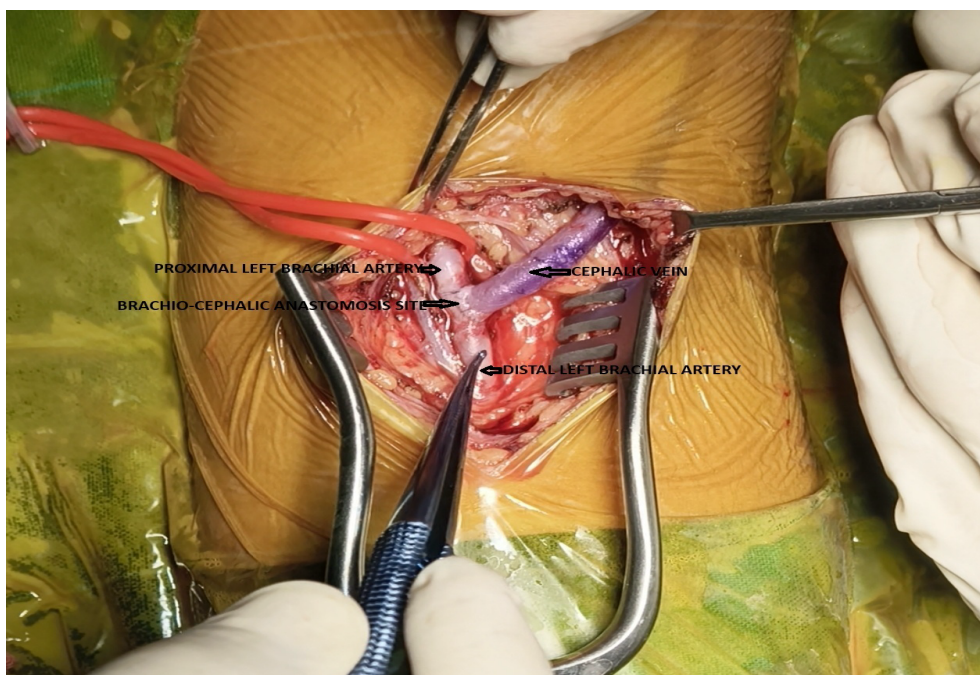
patients (42.1%), while hypertension was present in 56 (73.7%).

Figure 1 shows an intraoperative view of a brachiocephalic AVF, and baseline demographic and clinical characteristics of the study cohort are summarized in Table 1.

FIGURE 1: Intraoperative view of a left brachiocephalic arteriovenous fistula (AVF). The proximal and distal portions of the left brachial artery and the cephalic vein are identified, together with the site of the brachiocephalic end-to-side anastomosis. AVF: arteriovenous fistula.

Table 1: Baseline characteristics of the study cohort (N = 76).

Variable	Value
Total patients	76
Evaluable for outcome analysis	74 (97.4%)
Mean age	41.8 years
Male	41 (53.9%)
Female	35 (46.1%)
Diabetes mellitus	32 (42.1%)
Hypertension	56 (73.7%)



AVF Characteristics: Radiocephalic AVF creation was undertaken in 60 patients (78.9%), and 16 patients (21.1%) received a brachiocephalic AVF.

The left upper limb was used for 73 of the 76 procedures (96.1%). An intraoperative view of a left brachiocephalic AVF is shown in Figure 2.

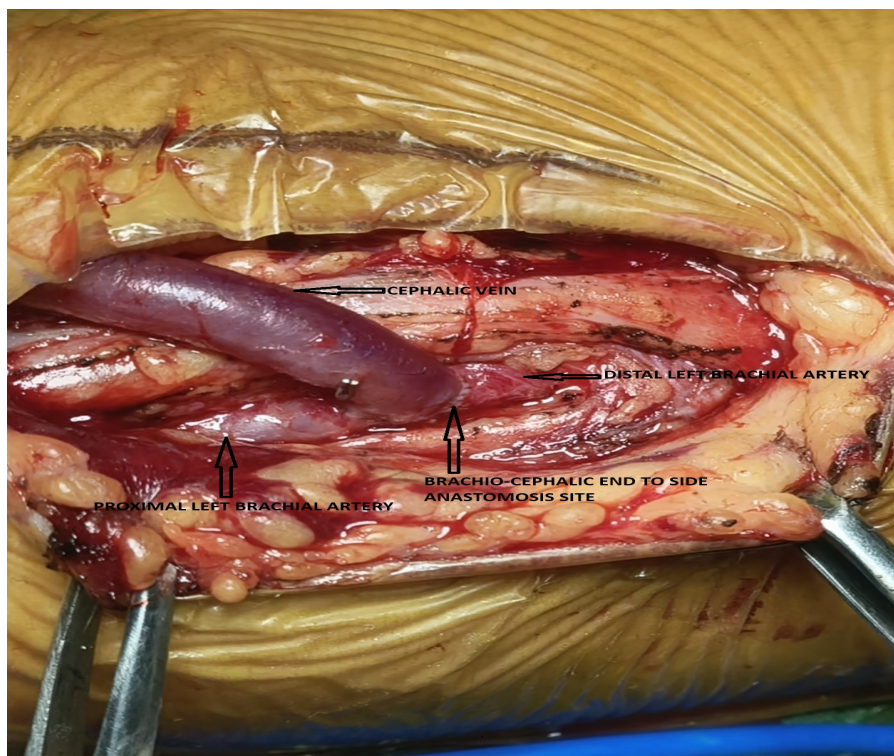


Figure 2: Left brachiocephalic AV fistula showing the anastomosis. The intraoperative photograph identifies the cephalic vein, distal left brachial artery and the brachiocephalic end-to-side anastomosis. AVF: arteriovenous fistula.

An intraoperative view of a left radiocephalic AVF is shown in Figure 3.

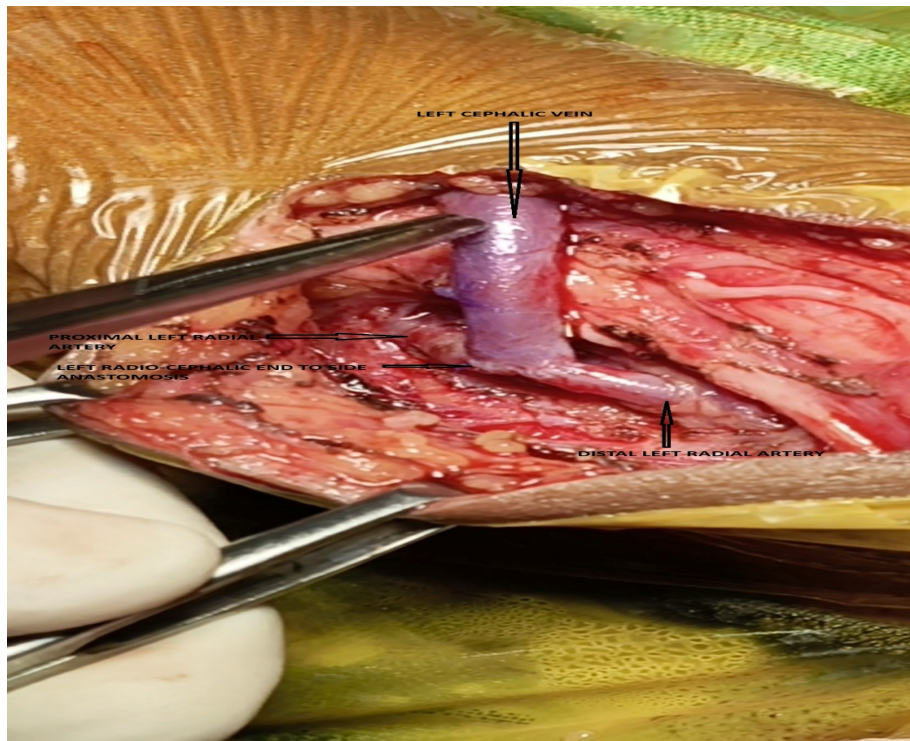


Figure 3: Left radiocephalic AV fistula. The intraoperative photograph shows the left cephalic vein, the proximal and distal portions of the left radial artery and the radiocephalic end-to-side anastomosis. AVF: arteriovenous fistula.

Maturation Outcomes: Among the 74 evaluable AVFs, 72 (97.3%) met the criteria for functional maturation. Maturation was recorded in 56/58 radiocephalic AVFs (96.6%) and in all 16 brachiocephalic AVFs (100%). Two of the 76 procedures (2.6%) were classified as primary failures, and both were radiocephalic.

Complications: No early thrombosis, clinically significant haematoma, major bleeding, steal syndrome or need for re-exploration was recorded. Minor wound complications occurred in 5/76 patients (6.6%). Venous congestion was documented in 14/16 brachiocephalic AVFs (87.5%); these patients developed forearm swelling

and were managed conservatively. No apparent adverse effect on maturation was noted. The subgroup results are summarized in Table 2.

Table 2: Early outcomes and maturation rates of radiocephalic and brachiocephalic arteriovenous fistulae. RC AVF: radiocephalic arteriovenous fistula; BC AVF: brachiocephalic arteriovenous fistula. Wound complications and primary failure are reported as a percentage of the total cohort (N = 76); venous congestion is reported as a percentage of brachiocephalic AVFs only (N = 16), as this complication was specific to the brachiocephalic subgroup.

Parameter	RC AVF	BC AVF	Overall
Total	60	16	76
Evaluable	58	16	74
Matured	56 (96.6%)	16 (100%)	72 (97.3%)
Maturation rate	96.6% (56/58)	100% (16/16)	97.3% (72/74)
Primary failure	2 (3.3%, 2/60)	0 (0%, 0/16)	2 (2.6%, 2/76)
Wound complications	—	—	5 (6.6%, 5/76)
Venous congestion	—	14 (87.5%, 14/16)	—

Discussion

This series represents the first reported experience of the newly established CTVS unit. Of the 74 fistulas available for assessment, 72 matured (97.3%), while 2 of the 76 procedures (2.6%) were classified as primary failures. Published results vary considerably, and differences in patient characteristics, vessel quality and local surgical experience can affect both maturation and failure [1,2,6]. A systematic review of forearm AVFs also found wide variation in maturation outcomes [7]. The figures from the present series should therefore be interpreted as an account of the unit's early experience, rather than as a direct comparison with other centres.

Radiocephalic access was used in 60 of the 76 procedures (78.9%). In practical terms, this reflects the decision to use the forearm site when the vessels were suitable and to retain more proximal sites for possible future access. Such a distal-first approach is consistent with the KDOQI recommendation [6]. Fifty-six of the 58 evaluable radiocephalic fistulas matured (96.6%). The finding is encouraging, but the number of patients was small and all procedures were performed by one surgeon; these factors limit how broadly the result can be applied.

The 16 brachiocephalic AVFs that could be evaluated all reached maturation. Larger vessels and the higher flow associated with a proximal fistula may have contributed to this result. Patient selection and the surgeon's consistent technique may also have influenced the outcome. Proximal access has its own pattern of complications, however, and

problems such as venous hypertension and steal have been described [2,4].

There were no cases of early thrombosis among the evaluable fistulas. All patients had received rivaroxaban 2.5 mg once daily for 45 days because this was the postoperative protocol used at the centre. Earlier studies have investigated antithrombotic treatment after AVF creation, although the drugs, treatment schedules and outcomes have differed [8–10]. Routine postoperative anticoagulation is not recommended universally [6,11]. More importantly, this study did not include a group that did not receive rivaroxaban. It is therefore not possible to say that the absence of thrombosis resulted from the drug. At present, the finding is simply part of the observed experience and would need confirmation in a comparative prospective study.

Major complications were not encountered. Five patients (6.6%) developed a minor wound complication, and these cases were managed without major intervention. There were no episodes of major bleeding, steal syndrome or re-exploration. Because only 76 procedures were included, the study is too small to draw firm conclusions about uncommon adverse events.

Forearm swelling attributed to venous congestion was seen after 14 of the 16 brachiocephalic procedures (87.5%). The affected patients were treated with compression and hand exercises. No clear delay in maturation was noted. This result should be viewed carefully, since the brachiocephalic group contained only 16 patients

and there was no separate assessment of the natural course of postoperative swelling.

Having one surgeon perform all procedures reduced variation in the operative technique. The postoperative management was also kept the same across patients. In addition, maturation was checked with colour Doppler ultrasonography at 45 days or later. These features made the assessment reasonably consistent within the study, although they do not remove the limitations of a retrospective review.

The study also describes what happened after a dedicated vascular access service was introduced in this centre in Northeast India. Previously, patients could need referral to another centre for definitive access, which could add delay. The present experience shows that AVF creation can be incorporated into a newly developed local service using a defined operative and follow-up pathway. Whether similar results can be reproduced elsewhere remains uncertain because this was a single-centre series with a relatively small number of patients.

There are several limitations to consider. The retrospective design means that selection and information bias cannot be excluded. The overall sample was modest, and the brachiocephalic subgroup was particularly small, so comparisons between access types should be interpreted cautiously. There was also no control group with which to examine the effect of postoperative antithrombotic treatment. Finally, the study was concerned with early maturation; it did not provide information on longer-term fistula patency or access survival.

Conclusion

In this newly established CTVS unit, AVF creation was followed by a high rate of early functional maturation and few major complications. These findings represent the unit's initial experience with a distal-first surgical strategy and a standardized postoperative protocol. Prospective studies with larger cohorts and longer follow-up are needed to determine longer-term access durability and to clarify the effects of postoperative antithrombotic therapy.

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