Section: CVTS

Original Research Article

ARTERIOVENOUS ACCESS: OUR EXPERIENCE OVER A SPAN OF 3 YEARS

Shyam Singh[1], I A Mir[1], Mohit Arora[1], Vivek Gandotra[1], Prabdeep Singh Sudan[1], Rouf Gul[1], Anirudh[1]

[1]*Department of Cardiovascular and Thoracic Surgery (CVTS) Super-Specialty Hospital, Government Medical College, Jammu, and Kashmir, India.*

Received *: 05/02/2026*
Received in revised form *: 20/03/2026*
Accepted *: 09/04/2026*

Corresponding Author:
Dr. Shyam Singh,
Department of Cardiovascular and Thoracic Surgery (CVTS) Super-Specialty Hospital, Government Medical College, Jammu, and Kashmir, India.
Email: ishtyak_mir@rediffmail.com

DOI: 10.70034/ijmedph.2026.2.244

Source of Support: Nil,
Conflict of Interest: None declared

Int J Med Pub Health
2026; 16 (2); 1466-1470

ABSTRACT

Background: Chronic kidney disease (CKD) and End-Stage Renal Disease (ESRD) necessitate reliable vascular access for hemodialysis. While various modalities exist, the native arteriovenous fistula (AVF) remains the gold standard. However, primary failure rates can be significant, ranging from 20% to 60%. The objective is to evaluate institutional experience with AV access creation and analyze the impact of demographics, comorbidities, and vessel characteristics on clinical outcomes.

Materials and Methods: This retrospective, single-center study analyzed 509 patients who underwent primary AV access creation from November 2022 to October 2025 at the Dept of CVTS, Govt Medical College, Jammu. Parameters included demographics, comorbidities (Diabetes Mellitus, Peripheral Arterial Disease), occupation, and preoperative vessel diameters measured by Doppler ultrasound. The surgical protocol emphasized a "distal-first" strategy using end-to-side radio-cephalic anastomosis.

Results: The cohort was 70% male (n=355) and 30% female (n=154), with an average age of 53.1 years. Radio-cephalic anastomosis was performed in 96% of cases (n=490). Successful outcomes were achieved in 443 patients (87%), with a 6-week primary patency rate of 89%. Preoperative vein diameter was the most significant predictor of success (2.3 □0.6 mm in successful vs. 1.8 □0.4 mm in unsuccessful cases; $p < 0.0001$). Artery diameter ($p = 0.8941$), age ($p = 0.923$), occupation ($p = 0.156$), and comorbidities ($p = 0.6024$) were not statistically significant predictors of failure. The overall complication rate was 8.2%, with thrombosis (n=13) being the most common adverse event.

Conclusion: Our experience confirms that autologous AV access is the preferred choice for hemodialysis. Success is strongly correlated with adequate preoperative vein diameter rather than patient age or systemic comorbidities. A "fistula first," "distal-first" approach supported by vessel mapping yields favorable long-term results and high early patency rates.

Keywords: AV Fistula, Hemodialysis, Radio-cephalic AV fistula.

INTRODUCTION

Chronic kidney disease (CKD) and End-Stage Renal Disease (ESRD) impose a growing burden on healthcare systems, necessitating reliable vascular access (VA) for maintenance hemodialysis (HD).[1,2] While central venous catheters are often used for immediate access, they are associated with high complication rates, including infection and thrombosis.[3,4] Consequently, the native arteriovenous access remains the gold standard due to superior long-term patency and lower morbidity. Despite initiatives advocating for native access as the primary choice, primary failure and non-maturation rates remain high, reported between 20% to 60% in literature.[4,5] This retrospective study summarizes our institutional experience with 509 cases over three years. We evaluated the impact of demographic factors, comorbidities (such as diabetes, PAD, etc.,), and vessel characteristics on arteriovenous access outcomes, comparing our findings with recent literature.

MATERIALS AND METHODS

Study Design: This study was a single-center, retrospective evaluation of 509 patients who underwent arteriovenous access creation for maintenance hemodialysis from November 2022 to October 2025.

Data Collection: Data was extracted from hospital medical records and operative notes. The following parameters were analyzed:

Demographics: Age, Gender, and Occupation.

Comorbidities: History of diabetes mellitus, hypertension, and peripheral arterial disease.

Surgical Details:

- Type of anastomosis (end-to-side vs. side-to-side), site of access (radio-cephalic,
- Brachio-cephalic, brachio-basilic).
- Intraoperative findings(presence of thrill/bruit).

Vessel Characteristics: Preoperative arterial and venous diameters recorded by Doppler ultrasound.

Inclusion and Exclusion Criteria

All patients referred for primary arteriovenous access creation were included. Patients with incomplete follow-up data or those who underwent grafting without an attempt at native access were excluded from the analysis.

Surgical Technique: The standard surgical protocol involved identifying the cephalic or basilic vein and the corresponding artery. An end-to-side anastomosis was the preferred technique to minimize turbulence and maximize flow. Operative success was defined by the presence of a palpable thrill and audible bruit on the operating table.

RESULTS

In our retrospective study, 520 cases underwent AV access creation during the study period. Out of these cases, 11 cases were excluded from study due to inadequate data.

So a total of 509 cases were included in the study who underwent AV access creation. Out of them, males accounted for 70%(355 cases) and females were 30% (154 cases).

Patient Characteristics: The average age at presentation was 53.1 years. Average age for males was 49.8 years and 46.1 years for females.

Out of 509 cases, 214 cases had co-morbidities other than ESRD with 163 cases, 26 cases and 25 cases having DM, PAD and other co-morbidities respectively.

Abandoned Cases: 3 cases were abandoned intraoperatively as the quality of the vessel was poor.

Following type of fistulas were performed for our cases,

- Radio-cephalic anastomosis- 490 cases
- Brachio-cephalic anastomosis- 17 cases
- Brachio-basilic anastomosis- 02 cases

Out of the 509 cases, 443 patients(87%) cases had successful outcomes while 66 cases(13%) had unsuccessful outcomes.

The difference in mean age between the successful and unsuccessful groups in both males and females was not statistically significant. (p value of 0.923).

The success rate and the occupation of the patients were correlated using a chi square test and it was not found to be statistically significant with a p value of 0.156.

However, when we correlated outcomes of the AV access creation and co-morbidities, it was not statistically significant with a p value of 0.6024.

Vessel Diameter: The mean venous diameter in the successful group (2.3 ± 0.6) was significantly larger than that in the unsuccessful group(1.8 ± 0.4). This correlation was statistically significant with p value of < 0.0001. This aligns with findings in the literature stating that vein diameter is the most important predictive factor for a successful outcome.

However, the mean artery diameter in successful and unsuccessful group was 2.3 ± 0.4 and 2.2 ± 0.3 respectively; and the p value was 0.8941 and was not statistically significant.

Occupation and Anatomy: The distal arterial and vein diameter was higher in both males and females of the laborer group compared to the clerical group; however, the outcomes were comparable.

Patency and Complications:

Patency: We had a primary patency rate of 89% at the end of six weeks.

Failure: The primary failure rate was 13%.

Complications: The overall complication rate was 8.2%.

Table 1: Timeline of Legal Evolution of Consumer Protection in Healthcare

Complications	No. of cases
Aneurysm	2
Bleed	7
Edema	10
Hematoma formation	10
Thrombosis	13
No complication	467

Table 2: Table showing the type of surgery in our institution.

Type of Surgery	Number of patients
Radio-cephalic anastomosis	490
Brachio-cephalic anastomosis	17
Barchio-basilic anastomosis	2

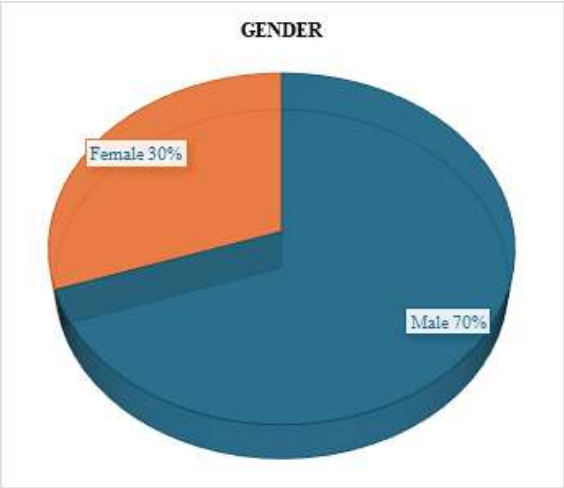

Figure 1: Gender distribution in the study

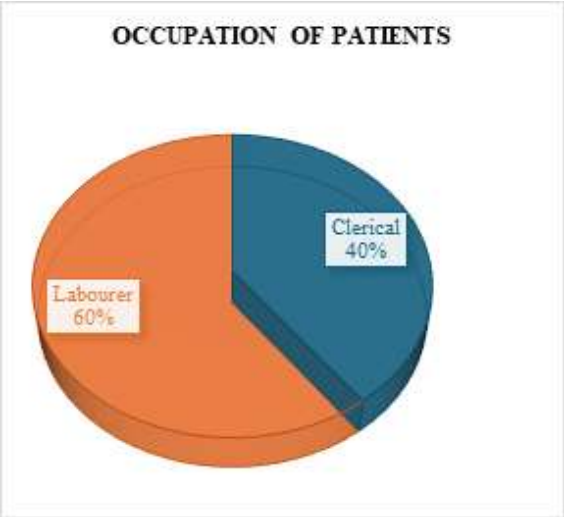

Figure 2: Occupation of patients.

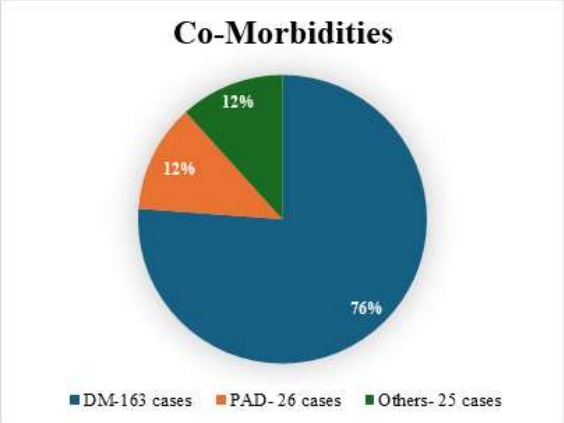

Figure 3: Co-morbidities in patients

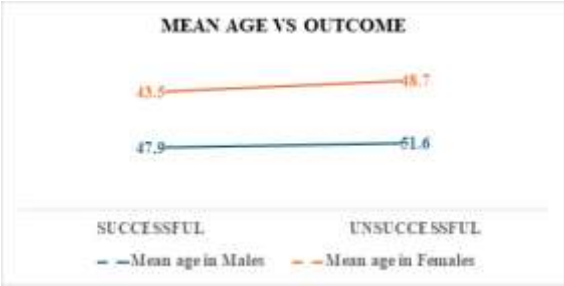

Figure 4: Comparison of Mean age in both males and females, and Outcome of surgery

- The chi-square statistic is 0.0091. The p-value is .923802. Not significant at $p < .05$.
- The chi-square statistic with Yates correction is 0.0024. The p-value is 0.961262. Not significant at $p < .05$.

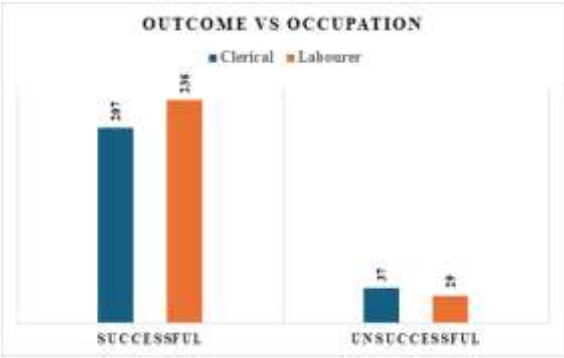

Figure 5: Comparison of Occupation and Outcome of surgery

- The chi-square statistic is 2.0051. The p-value is .156768. Not significant at $p < .05$.
- The chi-square statistic with Yates correction is 1.6486. The p-value is 0.199153. Not significant at $p < .05$.

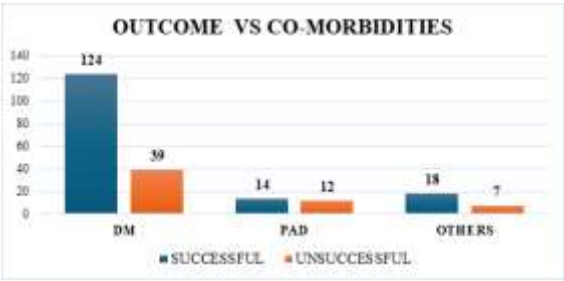

Figure 6: Comparison of Co-morbidities and Outcome of surgery

The chi-square statistics is 5.6188. The p-value is. 06024. The result is not significant at $p < .05$.

Table 3: Comparison of Mean vessel diameter(vein and artery) and Outcome of Surgery

Outcome	Vein diameter*	Artery diameter**
Successful	2.3+/-0.6	2.3+/-0.4
Unsuccessful	1.8+/-0.4	2.2+/-0.3

- *The two-tailed P value is less than 0.0001. By conventional criteria, this difference is considered to be extremely statistically significant.

* Confidence interval: The mean of vein diameter with successful outcomes minus unsuccessful outcomes equals 0.500.

* 95% confidence interval of this difference: From 0.384 to 0.616.
* Intermediate values used in calculations:
  - t = 8.4667
  - df = 507
  - standard error of difference = 0.059

** The two-tailed P value equals 0.8941. By conventional criteria, this difference is considered to be not statistically significant.

** Confidence interval: The mean of vein diameter with successful outcomes minus unsuccessful outcomes equals 0.100.
** 95% confidence interval of this difference: From 1.375 to 1.575.
** Intermediate values used in calculations:
  - t = 0.1332
  - df = 507
  - standard error of difference = 0.751.

Table 4: Complications associated with procedure

Complications	No. of cases
Aneurysm	02
Bleed	07
Edema	10
Hematoma formation	10
Thrombosis	13
No complication	467
Total	509

DISCUSSION

This retrospective analysis of 509 cases over a three-year period provides a comprehensive look at the factors influencing the success of autologous arteriovenous (AV) access creation. Our findings align with the global "Fistula First" initiative while offering specific insights into the Indian clinical context.[1]

Surgical Strategy and the "Distal-First" Principle

The study reflects a strong institutional adherence to a "distal-first" surgical strategy, evidenced by the fact that 490 cases (96%) involved radio-cephalic anastomosis.

- **Vessel Preservation:** By prioritizing the wrist for primary access, we ensure that more proximal vessels remain available for future interventions, which is critical for the long-term management of ESRD patients.
- **Technical Technique:** The preference for an end-to-side anastomosis was utilized to minimize turbulence and optimize flow, contributing to an overall technical success rate of 87%.
- **Intraoperative Judgment:** The decision to abandon 3 cases intraoperatively due to poor vessel quality underscores the necessity of real-time clinical assessment. Identifying non-viable vessels on the operating table prevents the creation of "doomed" accesses and helps maintain high institutional patency rates.

Anatomical Predictors: Vein vs. Artery

Our data confirms that preoperative vein diameter is the single most significant predictor of fistula maturation and success.

- **Venous Significance:** Successful outcomes were associated with a significantly larger mean venous diameter. This aligns with findings by Gupta et al.,(2) Mendes et al., (5) and Min Jun Kim et al.,(6) who identified vein diameter as the most significant independent predictor of success ($p < 0.05$).
- **Arterial Resilience:** In contrast, arterial diameter ($p = 0.8941$) did not significantly impact the outcome. This resilience is consistent with literature stating that while inflow is necessary, the venous outflow capacity is often the primary limiting factor.
- **Occupational Influence:** Although laborers exhibited larger vessel diameters compared to the clerical group, this anatomical advantage did not translate into a statistically superior success rate ($p = 0.156$), suggesting that once a minimum "threshold" diameter is reached, further size increases do not necessarily improve maturation.

Resilience Against Comorbidities and Age

One of the most encouraging findings is that age and systemic comorbidities did not act as barriers to successful AV access creation.

- **Demographics:** There was no statistically significant difference in mean age between the successful and unsuccessful groups ($p = 0.923$). This mirrors findings by Allon et al, and Lok et al, where age was not a primary predictive factor.[1,3]
- Medical Profile: Despite the prevalence of Diabetes Mellitus (163 cases) and Peripheral Arterial Disease (26 cases), these factors did not significantly correlate with failure ($p = 0.6024$). This indicates that a native fistula should remain the primary choice even in patients with complex medical histories.

Safety and Patency Milestones

The study observed a primary patency rate of 89% at six weeks, which compares favourably to international literature that often reports rates between 70% and 80%.

- **Low Complication Profile:** The overall complication rate was 8.2%.
- **Specific Complications:** Thrombosis was the most frequent complication observed in 13 cases, a finding consistent with other institutional experiences where outflow occlusion is a primary cause of early failure.

- **Major Events:** Serious complications like aneurysms (2 cases) and significant bleeding (7 cases) were rare, validating the safety of our surgical protocols.

Limitations: As a retrospective study, this analysis is limited by the quality of historical record-keeping and the inability to control for unrecorded variables such as patient adherence to postoperative exercise protocols.

CONCLUSION

Our experience with 509 cases confirms that the autologous arteriovenous access remains the preferred access for hemodialysis. Success is strongly correlated with adequate preoperative vein diameter rather than patient age. A "fistula first" approach, supported by careful vessel mapping and immediate intraoperative assessment, yields favorable long-term results, with a high six-week patency rate of 89%.

REFERENCES

1. Lok CE, Huber TS, Lee T, et al.: KDOQI clinical practice guideline for vascular access: 2019 update . Am J Kidney Dis. 2020, 75:S1-164.
2. Gupta A, Kumar V, Peswani A R, et al. (January 04, 2022) Outcomes of Arteriovenous Fistula Creation in Patients Undergoing Hemodialysis: An Indian Experience. Cureus 14(1): e20921. DOI 10.7759/cureus.20921
3. Allon M, Litovsky S, Young CJ, Deierhoi MH, Goodman J, Hanaway M, et al. Medial fibrosis, vascular calcification, intimal hyperplasia, and arteriovenous fistula maturation. Am J Kidney Dis Off J Natl Kidney Found 2011;58:437e43.
4. Lauvao LS, Ihnat DM, Goshima KR, Chavez L, Gruessner AC, Mills Sr JL. Vein diameter is the major predictor of fistula maturation. J Vasc Surg 2009;49:1499e504.
5. Mendes RR, Farber MA, Marston WA, Dinwiddie LC, Keagy BA, Burnham SJ. Prediction of wrist arteriovenous fistula maturation with preoperative vein mapping with ultrasonography. J Vasc Surg 2002;36:460e3.
6. Kim M.J., Ko H. and Kim S.M. (2024) 'Predicting factors for early failure of vascular access in hemodialysis patients', Annals of Surgical Treatment and Research, 106(5), p. 255. doi:10.4174/astr.2024.106.5.255.
7. Basavanthappa RP, Anandasu RK, Gangadharan AN, Luthra L, Vardhan JP, Ramswamy CA, et al. Arteriovenous graft patency outcomes and prognostic factors: A single-center study. Indian J Vasc Endovasc Surg 2020;7:222-4.
8. Al-Shameri, I., KhudaBux, G., & Al-Ganadi, A. (2021). Prospective Evaluation of Factors Associated with Arteriovenous Fistula Primary Failure and Complications in Hemodialysis Patients: A Single Center-Study. Cardiology & Vascular Research, 5. https://doi.org/10.33425/2639-8486.1103
9. Barbosa, W. M., Franco, R. P., & Rodrigues, A. T. (2023). Arteriovenous fistulas maturation: predictors of maturation and use of ultrasound. Brazilian Journal of Nephrology, 45(3), 272–273. https://doi.org/10.1590/2175-8239-jbn-2023-e011en
10. Feng, R., Wang, S., Yu, J., Zheng, X., Chen, W., Wang, X., & Chang, G. (2023). The feasibility and efficiency for constructing arteriovenous fistula with <2 mm vein—a systematic review and meta-analysis. Frontiers in Cardiovascular Medicine, 10. https://doi.org/10.3389/fcvm.2023.1226136
11. Kim, M. J., Ko, H., & Kim, S. M. (2024). Predicting factors for early failure of vascular access in hemodialysis patients. Annals of Surgical Treatment and Research, 106(5), 255. https://doi.org/10.4174/astr.2024.106.5.255
12. Mendes, R. R., Farber, M. A., Marston, W. A., Dinwiddie, L. C., Keagy, B. A., & Burnham, S. J. (2002). Prediction of wrist arteriovenous fistula maturation with preoperative vein mapping with ultrasonography. Journal of Vascular Surgery, 36(3), 460–463. https://doi.org/10.1067/mva.2002.126544
13. Oprea, A., Molnar, A., Vlăduțiu, D., Scridon, T., Trifan, C., Săcui, D., Săsărman, V., & Mircea, P. A. (2018). Correlation between preoperative vein and artery diameters and arteriovenous fistula outcome in patients with end-stage renal disease. Medicine and Pharmacy Reports, 91(4), 399–407. https://doi.org/10.15386/cjmed-1080
14. Siddiqui, M. A., Ashraff, S., & Carline, T. (2017). Maturation of arteriovenous fistula: Analysis of key factors. Kidney Research and Clinical Practice, 36(4), 318–328. https://doi.org/10.23876/j.krcp.2017.36.4.318.