

LONG-TERM OUTCOMES OF TRANSLUMBAR HAEMODIALYSIS CATHETERS AS SALVAGE VASCULAR ACCESS IN PATIENTS WITH EXHAUSTED CONVENTIONAL ACCESS OPTIONSShuah Ullah¹, Ammar Hussain², Nabila Khan², Shariq Bin Yousuf¹, Abdul Khalique³, Ziad Sophie⁴**How to cite this article**

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ABSTRACT**OBJECTIVES**

This study evaluated the technical success, catheter function, patency, complications, and predictors of failure of translumbar haemodialysis catheters used as salvage vascular access in patients with exhausted conventional access options.

METHODOLOGY

This record-based cohort study included 103 patients with end-stage kidney disease who underwent attempted translumbar catheter placement at the Sindh Institute of Urology and Transplantation, Karachi, from March 2025 to March 2026. We assessed consecutive eligible cases for procedural success, dialysis performance, immediate and long-term complications, catheter disposition, and access survival. We estimated patency using Kaplan–Meier analysis. Multivariable binary logistic regression identified independent predictors of catheter failure.

RESULTS

Technical success was achieved in 101/103 patients (98.1%), and 93 (90.3%) completed the first dialysis session successfully. Immediate complications occurred in 10 (9.7%) patients, without major organ injury or procedure-related mortality. Primary patency was 85.3% at three months, 75.5% at six months, and 57.6% at twelve months. Median assisted primary and secondary patency were 15.60 and 17.50 months, respectively. Catheter dysfunction occurred in 29/101 (28.7%), catheter-related bloodstream infection in 23 (22.8%), and thrombosis or occlusion in 20 (19.8%). Bloodstream infection and initial blood-flow rate below 300 mL/min independently predicted catheter failure.

CONCLUSION

Translumbar catheterisation provided high technical success and clinically meaningful patency in patients with severely limited vascular access. Rigorous infection prevention and early correction of inadequate catheter flow may improve durability and reduce access failure. These findings support translumbar access as a practical last-resort dialysis strategy.

KEYWORDS: Translumbar Catheter, Haemodialysis, Vascular Access Failure, Catheter Patency, Bloodstream Infection, End-Stage Kidney Disease

INTRODUCTION

Durable vascular access is fundamental to maintenance haemodialysis. An arteriovenous fistula or graft is generally preferred for long-term therapy because it offers better durability and lower infection risk than chronic central venous catheterisation; however, tunneled dialysis catheters remain indispensable when urgent access is required or when arteriovenous options are not feasible.^{1,2} Contemporary vascular-access planning therefore emphasises an individualised life plan that considers anatomy, comorbidity, life expectancy, previous access history, and preservation of future options.^{3,4,5} Repeated catheterisation, failed fistulas and grafts, central venous thrombosis, and prior endovascular procedures can progressively exhaust the

conventional venous routes. Occlusion of the internal jugular, brachiocephalic, or superior vena cava pathways may eventually prevent safe placement of a standard catheter and leave the patient at risk of inadequate dialysis, recurrent hospitalisation, and loss of life-sustaining access. At this stage, salvage options include translumbar or transhepatic tunneled catheterisation, arterial-arterial prosthetic access, right-atrial grafting, and other unconventional approaches.^{6,7,8,9,10,11} Selection depends on the remaining vascular anatomy, procedural expertise, expected duration of dialysis, and the risks associated with each route. The translumbar technique provides percutaneous access to the inferior vena cava through a posterior lumbar route, followed by placement of a tunneled haemodialysis catheter with the tip positioned

in the inferior vena cava or near the cavoatrial junction. Image guidance enables visualisation of the vena cava and surrounding retroperitoneal structures and can reduce the risk of hemorrhage or injury to adjacent organs. Published series from experienced centres have reported technical success rates exceeding 95%, supporting translumbar access as a feasible last-resort option when conventional central veins are no longer usable.^{8,9} Despite high technical success, translumbar catheters remain vulnerable to the complications that affect long-term dialysis catheters, including poor blood flow, thrombosis, fibrin-sheath formation, kinking, migration, dislodgement, and catheter-related bloodstream infection. Infection is particularly important because it can cause sepsis, metastatic infection, hospitalisation, catheter removal, and loss of one of the patient's final available access routes.^{7,12} Consequently, translumbar catheterisation cannot be judged by successful insertion alone; functional performance, patency, salvageability, infection burden, and catheter disposition are equally important outcomes. Most published evidence consists of retrospective series and technical reports from high-resource interventional centres, and long-term data from South Asian dialysis populations remain limited. Differences in infection-control practice, access history, patient comorbidity, and availability of catheter-salvage procedures may influence outcomes across settings. The present study therefore evaluated technical success, first-dialysis performance, primary and secondary patency, complications, final catheter status, and predictors of failure after translumbar haemodialysis catheterisation at a tertiary renal-care institution. Identifying modifiable predictors of failure may help clinicians improve surveillance and preserve access in patients with otherwise exhausted vascular options.

METHODOLOGY

This retrospective cohort study was conducted in the Department of Urology at the Sindh Institute of Urology and Transplantation (SIUT), Karachi, Pakistan, from March 2025 to March 2026. The study evaluated the technical success, functional performance, catheter patency, complications and long-term clinical outcomes of translumbar haemodialysis catheters inserted in patients with exhausted conventional vascular access options. The SIUT Ethical Review Committee approved the study under approval number SIUT-ERC-2025/A-552, issued on 20 March 2025. The SIUT Institutional Review Board previously reviewed the protocol under IRB No. 609, with a certificate dated 7 February 2025, following presentation on 29 January 2025. The study followed institutional ethical requirements and the principles of the Declaration of Helsinki. We maintained patient confidentiality by

assigning anonymous identification codes, and we did not enter any personally identifiable information into the study database. The required sample size was calculated using the single-population proportion formula: Sample size (n) = $Z^2 \times p \times (1 - p) / d^2$. We selected an anticipated technical success rate of 90% as a conservative estimate, based on previous studies reporting technical success rates exceeding 95% for image-guided translumbar haemodialysis catheter placement.⁸ We used a 95% confidence level and an absolute precision of 6%. Sample size (n) = $(1.96)^2 \times 0.90 \times (1 - 0.90) / (0.06)^2$, Sample size (n) = $3.8416 \times 0.90 \times 0.10 / 0.0036$, Sample size (n) = 96.04 = 96 patients. The minimum required sample size was therefore 96 patients. After allowing for incomplete records and potential exclusions, the final sample size was increased to 103 patients. We enrolled all eligible patients who underwent attempted translumbar haemodialysis catheter insertion during the study period using consecutive sampling. The study included patients with end-stage kidney disease (ESKD) who had exhausted or were deemed to be unsuitable for conventional vascular access methods and were on maintenance haemodialysis. Indications were occlusion of the superior vena cava or brachiocephalic veins, large central venous thrombosis, failure of multiple arteriovenous fistulas or grafts, inappropriate peripheral veins for new fistulas or grafts, and unsuccessful venous recanalizations. We excluded patients with insufficient clinical and procedural information, no follow-up information, or those who received a translumbar catheter for reasons other than long-term haemodialysis access. Baseline data were obtained from hospital records and included age, sex, BMI, diabetes mellitus, hypertension, ischaemic heart disease, previous renal transplantation, duration of haemodialysis, haemoglobin, serum albumin, primary cause of end-stage kidney disease, previous renal catheterisation sites, and previous arteriovenous access procedures and the anatomical or clinical indications for the use of a translumbar catheter. The interventional team used expertise and a fluoroscopic or image-guided approach to place the translumbar catheter, and aseptic precautions were maintained. After assessing the inferior vena cava and surrounding retroperitoneal anatomy, the patient was positioned appropriately, local anaesthesia was administered with conscious sedation, and the inferior vena cava (IVC) was accessed through a posterior translumbar approach. Once the position of the guidewire had been confirmed, the tract was dilated, and a tunnelled haemodialysis catheter was advanced and the tip placed either in the inferior vena cava or at the cavoatrial junction as appropriate. The catheter was found in the correct position in the desired venous access; aspiration and flushing were satisfactory, and haemodialysis was possible, which were achieved as a

technical success. Procedural variables included procedure duration, number of puncture attempts, initial catheter blood-flow rate, success of the first dialysis session, and immediate complications such as access-site bleeding, retroperitoneal haematoma, catheter malposition, major organ injury, and procedure-related mortality. We followed patients with successful catheter placement using dialysis records, outpatient visits, hospital admissions, and interventional radiology chart review. Primary patency was defined as the time between catheter insertion and the first procedure needed to maintain catheter function or to remove it. Assisted primary patency was defined as the duration of catheter function after one or more interventions that resulted in sustained catheter patency, but not necessarily permanent catheter removal or abandonment; secondary patency was defined as the duration of catheter function following catheter insertion until the permanent removal or abandonment of the catheter. Catheter dysfunction was defined as an inadequate blood-flow rate from the external circuit for effective haemodialysis and/or the need for an intervention to restore function. Long-term complications were catheter-related bloodstream infection, exit-site infection, tunnel infection, thrombosis or occlusion, dislodgement, migration, kinking, mechanical damage or inferior vena cava thrombosis. We defined the catheter-related bloodstream infection rate as the number of infections per 1,000 catheter-days at risk, calculated as the number of infections reported divided by the number of catheter-days at risk. We also collected data on removal, indication for removal, hospital admission due to complications, and catheter mortality and function at the latest follow-up. A two-sided p -value <0.05 was considered statistically significant. We used SPSS version 26.0 for data analysis.

RESULTS

We analysed 103 attempted translumbar catheter placements for baseline and immediate procedural outcomes; we evaluated long-term outcomes among the 101 technically successful placements. The mean age was 53.85 ± 12.62 years, 58 (56.3%) patients were male, and the median haemodialysis duration was 7.1 years (Q1–Q3 5.3–9.2). Hypertension (71.8%) and diabetes mellitus (47.6%) were common. The cohort had extensive prior access exhaustion: 90.3% had previous internal-jugular catheterisation, 86.4% had undergone arteriovenous fistula formation, 67.0% had superior vena cava or brachiocephalic vein occlusion, and 57.3% had at least two failed fistulas or grafts.

Technical success was achieved in 101/103 procedures (98.1%), and 93/103 patients (90.3%) completed the first dialysis session successfully. Immediate complications occurred in 10 patients (9.7%): five minor access-site bleeds, three small retroperitoneal haematomas, and two malpositions requiring repositioning. No major organ injury or procedure-related mortality occurred. During a median follow-up of 7.0 months, primary patency was 85.3% at three months, 75.5% at six months, and 57.6% at twelve months. Median primary patency was not reached; estimated mean primary patency was 15.62 months. Median assisted-primary and secondary patency were 15.60 and 17.50 months, respectively. Catheter dysfunction occurred in 29/101 patients and was successfully restored in 18/29. CRBSI occurred in 23/101 (22.8%), equivalent to 0.87 episodes per 1,000 catheter-days, and thrombosis/occlusion occurred in 20/101 (19.8%). At final follow-up, 58/101 catheters (57.4%) remained functional. In adjusted analysis, CRBSI (AOR 10.95, 95% CI 3.33–36.00; $p<0.001$) and initial blood-flow rate <300 mL/min (AOR 4.14, 95% CI 1.23–13.97; $p=0.022$) independently predicted catheter failure.

Table 1: Baseline Characteristics, Previous Access History, and Indications for Translumbar Catheterisation

Panel A: Demographic and Clinical Characteristics		
Variable		Result
Age, years		53.85 ± 12.62
Sex	Male	58 (56.3%)
	Female	45 (43.7%)
BMI, kg/m ²		23.81 ± 3.91
Diabetes mellitus		49 (47.6%)
Hypertension		74 (71.8%)
Ischaemic heart disease		21 (20.4%)
Previous renal transplantation		11 (10.7%)
Dialysis duration, years		7.1 (5.3–9.2)
Haemoglobin, g/dL		9.52 ± 1.61
Serum albumin, g/dL		3.27 ± 0.62
Primary cause of end-stage kidney disease	Diabetic kidney disease	39 (37.9%)
	Hypertensive nephropathy	27 (26.2%)
	Chronic glomerulonephritis	18 (17.5%)
	Polycystic kidney disease	7 (6.8%)
	Other or undetermined cause	12 (11.7%)
Panel B: Previous Vascular Access History and Indications		
Variable		n (%)
Previous internal jugular catheter		93 (90.3%)
Previous femoral catheter		65 (63.1%)
Previous subclavian catheter		29 (28.2%)
Previous arteriovenous fistula		89 (86.4%)
Previous arteriovenous graft		27 (26.2%)
Two or more failed fistulas/grafts		59 (57.3%)
Superior vena cava or brachiocephalic vein occlusion		69 (67.0%)
Extensive central venous thrombosis		48 (46.6%)
Unsuitable peripheral vessels for new fistula		44 (42.7%)
Failed previous recanalisation attempt		31 (30.1%)

Table 2: Procedural Characteristics and Immediate Outcomes

Variable	Result
Technical success	101 (98.1%)
Procedure duration, minutes	60.22 ± 16.22
Puncture attempts	
One attempt	75 (72.8%)
Two attempts	24 (23.3%)
Three attempts	4 (3.9%)
Initial blood-flow rate, mL/min	315.99 ± 40.37
Successful first dialysis session	93 (90.3%)
Immediate complication	10 (9.7%)
Minor access-site bleeding	05 (4.9%)
Small retroperitoneal haematoma	03 (2.9%)
Catheter malposition requiring repositioning	02 (1.9%)
Major organ injury	0 (0.0%)
Procedure-related mortality	0 (0.0%)

Table 3: Catheter Patency and Functional Outcomes among Technically Successful Placements

Outcome	Result
Follow-up duration, months	7.0 (3.0–14.0)
Three-month primary patency	85.3%
Six-month primary patency	75.5%
Twelve-month primary patency	57.6%
Median primary patency	Not reached
Mean primary patency, months	15.62 (95% CI: 13.49–17.75)
Median assisted primary patency, months	15.60 (95% CI: 11.64–19.56)
Median secondary patency, month	17.50 (95% CI: 14.19–20.81)
Catheter dysfunction	29/101 (28.7%)
Successful restoration of catheter function	18/29 (62.1%)
Mean dialysis blood-flow rate during follow-up, mL/min	300.50 ± 51.95
Mean delivered Kt/V	1.27 ± 0.18

Table 4: Long-term Catheter Complications, Disposition, and Clinical Outcomes

Long-term Catheter-Related Complications	
Complication	n (%age)
Catheter-related bloodstream infection	23 (22.8%)
Exit-site infection	13 (12.9%)
Tunnel infection	07 (6.9%)
Catheter thrombosis or occlusion	20 (19.8%)
Catheter dislodgement	06 (5.9%)
Catheter migration	05 (5.0%)
Catheter kinking or mechanical damage	08 (7.9%)
Inferior vena cava thrombosis	03 (3.0%)
Catheter-related bloodstream infection rate	0.87 per 1,000 catheter-days
Catheter Disposition and Clinical Outcomes	
Outcome	n (%age)
Permanent catheter removal	31 (30.7%)
Removal due to dysfunction or thrombosis	12/31 (38.7%)
Removal due to infection	10/31 (32.3%)
Removal due to dislodgement or mechanical damage	4/31 (12.9%)
Alternative vascular access established	3/31 (9.7%)
Renal transplantation	2/31 (6.5%)
Hospital admission due to catheter complication	27 (26.7%)
All-cause mortality	18 (17.8%)
Catheter infection-related mortality	03 (3.0%)
Catheter functional at last follow-up	58 (57.4%)

Table 5: Multivariable Analysis of Factors Associated with Catheter Failure

Predictor	Adjusted odds ratio	95% confidence interval	p-value
Age ≥60 years	3.19	1.00–10.26	0.051
Diabetes mellitus	1.25	0.41–3.80	0.699
Dialysis duration ≥7 years	1.42	0.48–4.16	0.526
Five or more previous access procedures	0.46	0.15–1.38	0.168
Serum albumin <3.0 g/dL	1.47	0.45–4.80	0.528
Catheter-related bloodstream infection	10.95	3.33–36.00	<0.001
Initial blood-flow rate <300mL/min	4.14	1.23–13.97	0.022

DISCUSSION

This study showed that translumbar haemodialysis catheterisation is a feasible and potentially life-sustaining vascular-access strategy for patients with exhausted conventional access options. Technical success was achieved in 98.1% of procedures, 90.3% of patients completed their first dialysis session successfully, and no procedure-related mortality or major organ injury occurred. These findings matter because the participants represented a particularly difficult population: 67.0% had superior vena cava or brachiocephalic vein occlusion, 57.3% had at least two failed arteriovenous accesses, and 46.6% had extensive central venous thrombosis. The technical success observed in our study is comparable to the 97.4% reported by Jonszta et al. in their 10-year experience with computed tomography-guided translumbar catheter placement.⁹ Similarly, Leś et al. reported only one major early complication among 34 translumbar procedures, supporting the procedural safety of this approach when performed by an experienced team.⁸ The KDOQI guideline recommends individualised access selection according to the patient's end-stage kidney disease life plan.¹⁰ At the same time, Inston et al. and Sharma et al. identified translumbar catheterisation as an appropriate salvage option when conventional venous access cannot be established.^{10,5} Catheter patency and functional results were also clinically acceptable. Primary patency was 85.3% at three months, 75.5% at six months and 57.6% at twelve months, while median assisted primary and secondary patency were 15.60 and 17.50 months, respectively. At the last follow-up, 57.4% of the catheters were still working. Jonszta et al. reported 88.7% primary assisted patency at 1 year and 72.0% at 3 years after translumbar catheter placement performed under the guidance of computed tomography (CT).⁹ Their higher 1-year estimate may reflect differences in catheter

definition of patency, patient selection, catheter maintenance, and intervention frequency. However, both studies show that translumbar access effectively sustains dialysis for a clinically relevant time. Raskin et al. also found that translumbar access was technically successful and maintained vascular access patency for a long time in patients with end-stage vascular access failure.² Sood et al. described translumbar access as one of the most useful unconventional routes because it allows catheter exchange over a guidewire and may reduce migration compared with transhepatic access.¹² Most importantly, a 2026 systematic review and meta-analysis of 18 observational studies with 649 catheters found that rates of irreversible infection, irreversible dysfunction, thrombosis, and catheter displacement were significantly lower with translumbar than with transhepatic catheters.¹³ These results further reinforce the importance of translumbar access for TEE when the IVC is available, and patient anatomy is favorable. The overall success rate was acceptable, but in 28.7% of successful placements, catheters were dysfunctional, and in 19.8% of placements, thrombosis or catheter occlusion occurred. In 62.1% of the dysfunctional catheters, their function was restored, highlighting the crucial role of early radiological assessment and catheter-salvage interventions. Blood-flow rate (mean during follow-up) was around 300 mL/min and mean delivered Kt/V was 1.27, which is generally acceptable dialysis delivery. Adjusted odds of catheter failure were more than four-fold higher with an initial blood-flow rate < 300 mL/min. If flow is poor initially, the catheter tip may be malpositioned, kinked, or in contact with the vessel wall, or the catheter may develop an early fibrin sheath and/or thrombus. The technique was developed to enhance anatomical visualisation and reduce the risk of malposition, vascular injury, and injury to neighboring retroperitoneally located structures.¹⁴ Contemporary reviews also emphasise that appropriate catheter length and tip placement near the cavoatrial region are essential to achieve adequate flow and reduce recirculation and dysfunction.^{12,13} Therefore, a catheter with an initial flow rate below 300 mL/min should not be considered technically adequate and should be promptly assessed by imaging and corrected. The most significant late complication was catheter-related bloodstream infection (CRBSI), which occurred at 0.87 per 1,000 catheter-days, or 22.8% of patients. The overall rate of 0.40 per 1,000 catheter-days was higher than the rate reported by Almenara-Tejedoras et al. (0.40 per 1,000 catheter-days), but much lower than the rate reported by Hajji et al. (3.7 per 1,000 catheter-days).^{7,15} In a similar study, Shahar et al. found that bloodstream infection was an important complication in haemodialysis catheter users and associated it with longer catheter use and other patient-related risks.¹⁶

Variations in catheter infection rates across studies may reflect differences in catheter-care methods, comorbidities, catheter duration, definitions of catheter-associated infection, and surveillance regimes. The current study found that adjusted odds of catheter failure were nearly elevenfold higher with bloodstream infection, indicating that infection poses a serious risk to patient safety and catheter access. In haemodialysis patients, screening and targeted decolonisation in selected high-risk groups may be beneficial, as Vanegas et al. showed that bacteraemia is significantly associated with *S. aureus* colonisation.¹⁷ Fujimoto et al. reported that sutureless securement was significantly associated with reduced CBI risk compared with conventional suturing, but they analysed non-tunnelled catheters.¹⁸ These findings highlight the importance of strict hand hygiene, chlorhexidine skin antisepsis, standardised hub disinfection, sterile dressing changes, regular exit-site assessment, and prompt treatment based on culture.

LIMITATIONS

This study has several limitations. Its record-based, single-centre design is susceptible to selection bias, incomplete documentation, and variation in follow-up. Median follow-up was seven months, which reduces precision of longer-term patency estimates. The study included no direct comparator group using transhepatic access, surgical bypass, right-atrial grafting, or another unconventional route. The number of catheter-failure events was limited relative to the number of predictors included in the regression model, resulting in wide confidence intervals and possible residual confounding. The analysis did not capture infecting organisms, antimicrobial-resistance profiles, catheter-lock solutions, detailed salvage interventions, patient-reported quality of life, or competing-risk methods for transplantation and death. Prospective multicentre comparisons should address these issues with standardised patency definitions and catheter-care protocols.

CONCLUSIONS

Translumbar haemodialysis catheterisation achieved high technical success, acceptable dialysis performance, and clinically meaningful medium- to long-term patency in patients with exhausted conventional access. CRBSI and an initial blood-flow rate below 300 mL/min were independent predictors of failure. When conventional routes are no longer feasible, translumbar access is a valuable salvage option provided that placement is image guided, catheter function is monitored closely, and rigorous infection-prevention practices are maintained.

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The authors accept responsibility for all aspects of the work and will ensure that any concerns regarding the accuracy or integrity of any part are properly investigated and resolved.



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