LETTER TO THE EDITOR

DOI: https://doi.org/10.5114/kitp.2026.163254

Salvage of an infected saphenofemoral arteriovenous graft complicated by thrombosis using a staged hybrid approach

Spyros Papadoulas[1], Konstantinos Nikolakopoulos[1], Chrysanthi Papageorgopoulou[1], Kate Tabaku[1], Chrysa Andrikopoulou[2], Ioannis Panagiotopoulos[3], Paraskevi Katsakiori[2], Panagiotis Kitrou[4], Francesk Mulita[2,5], Vasileios Leivaditis[6]

[1]Department of Vascular Surgery, General University Hospital of Patras, Patras Medical School, Patras, Greece
[2]Department of Surgery, Medical School, University of Patras, Greece
[3]Department of Cardiac Surgery, Ippokrateio General Hospital of Athens, Greece
[4]Department of Interventional Radiology, General University Hospital of Patras, Greece
[5]Second Department of Surgery, Medical School, Democritus University of Thrace, Alexandroupolis, Greece
[6]Department of Cardiothoracic and Vascular Surgery, Westpfalz Klinikum, Kaiserslautern, Germany

Kardiochirurgia i Torakochirurgia Polska 2026; 23 (2): 187-191

Prosthetic arteriovenous grafts for hemodialysis are associated with a higher risk of infection if placed in the lower limbs. This is usually performed when upper-arm access options have been exhausted. When graft infection is complicated by graft thrombosis, this constitutes a clinical scenario that needs a special treatment strategy.

A 62-year-old female patient on dialysis presented with an infected left saphenofemoral arteriovenous graft, placed 8 years before her current admission. Her chronic medication regimen was unremarkable for the management of vascular access, except for antiplatelet therapy with clopidogrel 75 mg once daily. She had a history of gradual loss of kidney function and subsequent end-stage kidney disease due to complications after surgical treatment for morbid obesity that was performed 17 years ago. She had failed kidney transplantation on the right side, 4 years ago, which was attributed to poor implant quality and hypotension. Vascular access history included a left brachiocephalic fistula, an early failed right brachial-axillary graft, and a left brachial-axillary graft which remained functional for 9 years before the construction of the saphenofemoral graft. Four sessions of percutaneous graft thrombectomy were performed during this interval. The saphenofemoral graft underwent eight sessions (one session per year) of percutaneous thrombectomy with stent implantation in the venous anastomosis in previous years. Our patient presented to the emergency department due to a high fever (39.1°C) after the midweek dialysis session.

Figure 1. Computed tomography angiography (CTA) revealed normal graft patency (red arrow: arterial anastomosis, blue arrow: venous anastomosis, green arrow: pus accumulation, green arrows: venous stent)

Computed tomography angiography at presentation revealed normal graft patency (Figure 1) with pus accumulation at the lateral aspect of the graft (Figure 2). No distant infectious loci were detected. A left femoral temporary hemodialysis catheter (THC) was inserted as no other options

Address for correspondence: Francesk Mulita, Second Department of Surgery, Medical School, Democritus University of Thrace, 68100 Alexandroupolis, Greece, e-mail: oknarfmulita@hotmail.com

Received: 15.05.2025, **accepted:** 25.01.2026, **online publication:** 30.06.2026.

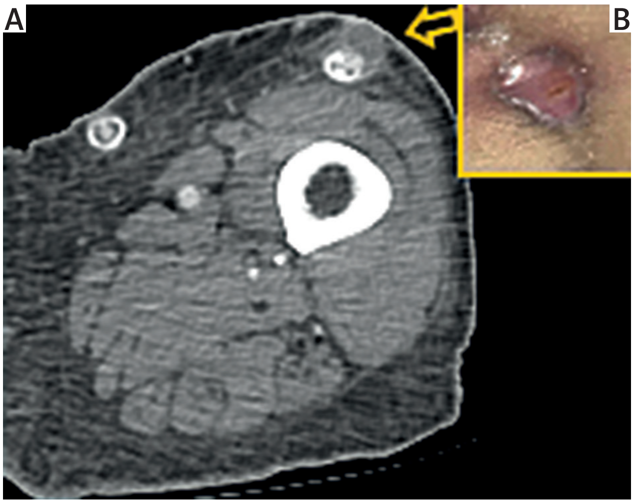

Figure 2. A – Pus accumulation was detected in the CTA around the locally destroyed graft from multiple cancellations. **B** – The locally infected graft

Figure 4. Digital subtraction phlebography revealed normal patency of the left iliac axis where the THC was inserted

for cannulation were available due to venous obstruction of the right femoral and subclavian veins, as multiple catheters had been placed in the past (Figure 3). The left iliac axis and the inferior vena cava were patent (Figure 4).

Under general anesthesia, she underwent a bypass procedure with a 7 mm graft around the infected area in uninfected tissue planes, using a sterile drape to cover the skin,

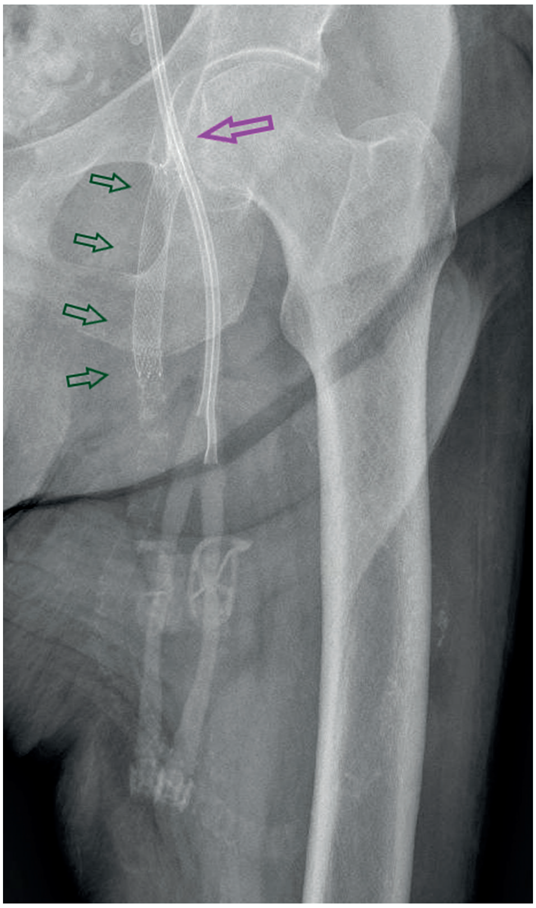

Figure 3. A left femoral temporary hemodialysis catheter (THC) was inserted (purple arrow) just proximal to a pre-existing venous stent (green arrows)

and afterward, the infected part of the graft was removed. Although the culture of the pus and the excised graft were negative, *Staphylococcus aureus* was detected in blood cultures. She received appropriate antibiotic treatment with daptomycin 750 mg q.o.d, rifampin 600 mg q.o.d., and amikacin sulfate 250 mg q.o.d. for 4 weeks. The wound was left open, and daily wound care was performed with dressings changes (Figure 5).

On the sixth postoperative day, the graft was thrombosed. The presence of an ipsilateral catheter may have contributed to graft thrombosis. Subsequently, the femoral THC was removed, and a new one was placed in the left subclavian vein after percutaneous thrombectomy of an existing venous stent. Consequently, an urgent Fogarty thrombectomy was performed in the saphenofemoral graft. Normal pulsation was achieved, but unfortunately, the graft was thrombosed again after 1 hour. We decided not to re-intervene due to the presence of infection and concerns about the presence of stenosis at the anastomosis sites or even more proximally, which may have been responsible for the re-thrombosis and thus would have made Fogarty thrombectomy impossible. We planned to recanalize the graft in the Interventional Radiology Suite (IRS) after regression of the infection and wound healing.

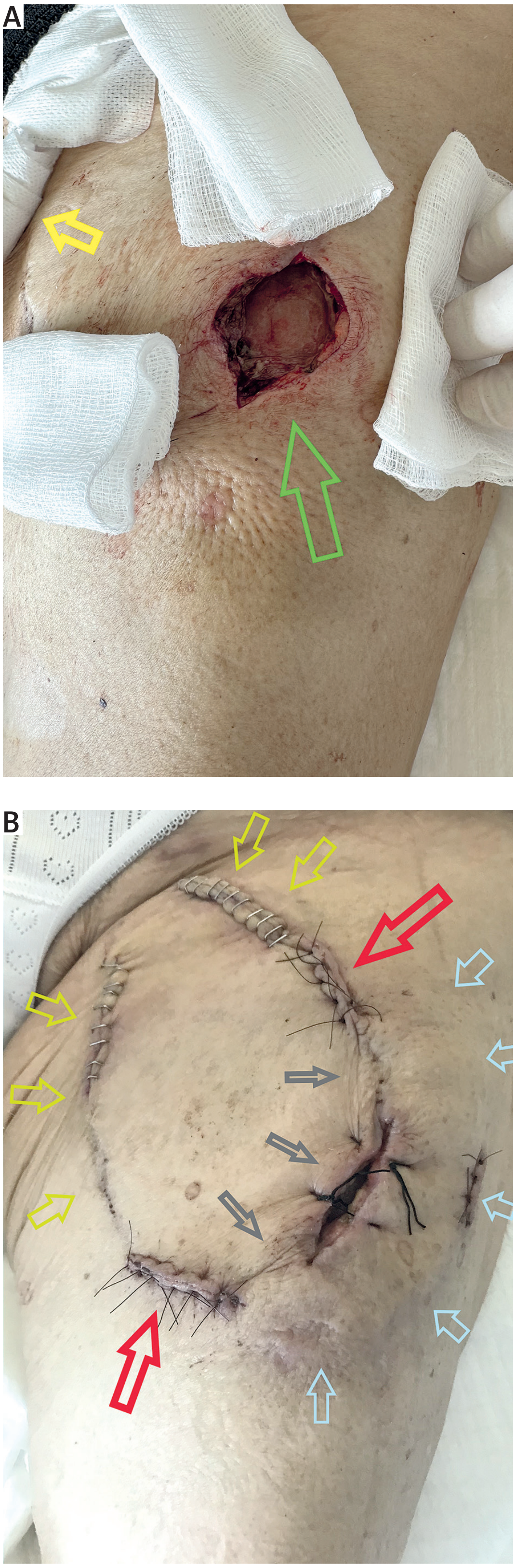

Figure 5. A – After removal of the infected segment the wound was left open (green arrow). The ipsilateral THC was seen medially (yellow arrow). B – The wound edges were approached with silk sutures 2 weeks later. After partial graft excision (gray arrows), the new graft (light blue arrows) was anastomosed (red arrows) to the old graft (light green arrows)

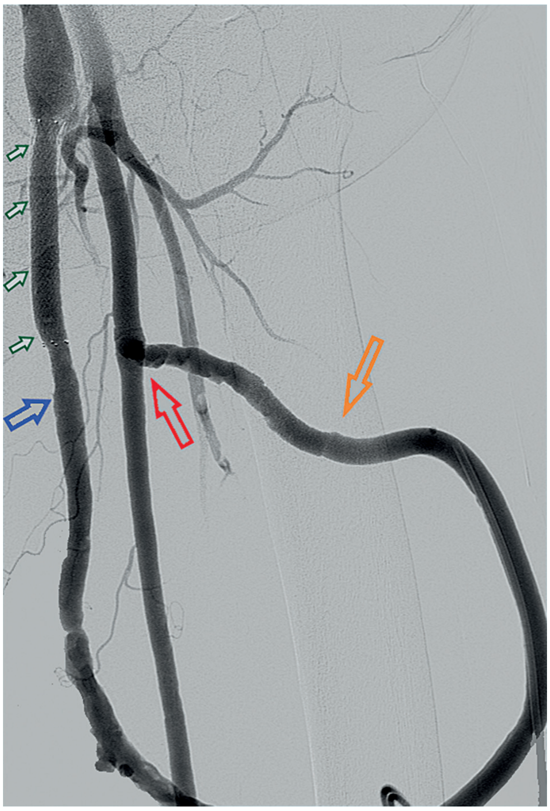

Figure 6. Completion digital subtraction angiography after the percutaneous thrombectomy (orange arrow: proximal graft-graft anastomosis, red arrow: previous arterial anastomosis, blue arrow: previous venous anastomosis with the great saphenous vein, green arrows: venous stent)

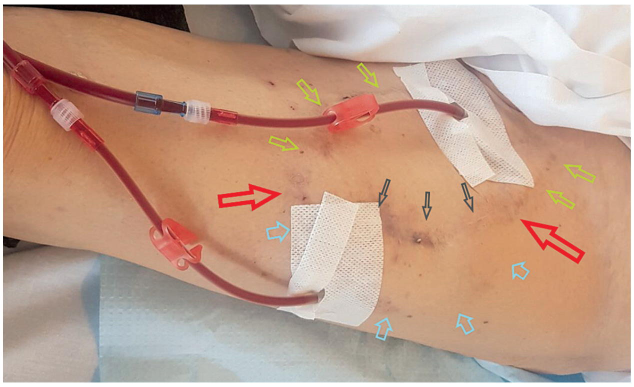

Figure 7. Successful graft cannulation. The new graft (light blue arrows) is connected (red arrows) with the old graft (light green arrows). The route of the excised part is shown (gray arrows)

Two weeks later, the wound edges came closer with the aid of two silk sutures (Figure 5).

Sixty-eight days after the re-thrombosis, complete recanalization was achieved percutaneously in the IRS (Figure 6). She continued her antiplatelet treatment with clopidogrel 75 mg q.d. The patient receives satisfactory hemodialysis through the graft at 3 months follow-up (Figure 7).

The chronological sequence of infection, surgical management, postoperative thrombosis, and delayed endovas-

Table I. Timeline of clinical events and interventions

Time point	Clinical event
Day 0	Patient presented with high fever (39.1°C) following hemodialysis; CTA demonstrated patent saphenofemoral graft with localized pus accumulation
Day 0	Placement of left femoral temporary hemodialysis catheter due to lack of alternative access options
Day 1	Surgical intervention: partial excision of infected graft segment and bypass with a new prosthetic graft in uninfected tissue planes
Days 1–28	Targeted antimicrobial therapy administered for 4 weeks; wound left open with daily wound care
Postoperative day 6	Acute thrombosis of the saphenofemoral graft
Postoperative day 6	Removal of ipsilateral femoral catheter and placement of new catheter in the left subclavian vein
Postoperative day 6	Urgent Fogarty thrombectomy performed; early re-thrombosis occurred
Weeks 2–8	Conservative management with infection control and wound healing; no further immediate intervention
Day 68	Successful percutaneous graft recanalization performed in the interventional radiology suite
3-month follow-up	Patent graft with satisfactory hemodialysis via the salvaged access

cular recanalization is summarized in Table I. Prosthetic arteriovenous grafts carry a risk of about 10% for infection in contrast to 5% of native arteriovenous fistulas [1, 2]. Diagnosis is often established based on clinical signs such as erythema, skin break, purulence, and exposed graft fabric. Lower extremity location is a risk factor for graft infection among others including poor personal hygiene, diabetes mellitus, increased age, graft duration, repeated cannulation, buttonhole technique, and number of hospitalizations [3].

Most infections are local and caused by Gram-positive bacteria, mostly by *Staphylococcus aureus*, followed by Gram-negative organisms, and to a lesser extent by polymicrobial species [4]. Lower extremity graft infections are usually due to Gram-negative bacteria and may more often spread at other sites generating a remote infection [1, 5]. Thus, whole-body imaging is usually performed with computed tomography angiography, positron emission tomography, or nuclear scintigraphy [6, 7]. Ultrasound may detect local infection and complications such as fluid collections or pseudoaneurysm formation [8].

Bacteremia may be apparent in more than 50% of infected grafts, as in our patient, and local bleeding is present in more than 30% of cases [9]. Broad-spectrum antibiotics are regularly used followed by targeted antibiotic treatment after culture results [1].

Graft salvage is normally feasible when the infected part is remote to anastomoses and the treatment strategy involves a stepwise approach like the one we described concerning our patient [10]. If it involves the anastomoses, total graft excision is required with venous patch angioplasty of the femoral artery or extra-anatomic bypass after arterial ligation. In cases with mild infections, solely medical management could be sufficient [11, 12]. A lateral approach has been described to avoid groin infection with promising results [13]. Negative pressure wound therapy may be used to improve healing after debridement [14]. On the other hand, dysfunctional fistulas and grafts, as well as graft thrombosis, are nowadays treated by endovascular means [15, 16]. Thrombectomy devices may be used, or alternative techniques such as lysis-assisted balloon (LAB) thrombectomy, as we used in our patient [16]. This procedure includes initial lysis with 5 mg of recombinant tissue plasminogen activator (rt-PA) followed by thrombectomy with a high-pressure balloon to macerate the thrombus. The “facing sheaths” technique is employed [16].

Although pharmacological thrombolysis is generally considered ineffective in chronic thrombosis due to thrombus organization and fibrosis, the use of rt-PA in this case was not intended to achieve standalone chemical thrombolysis. Instead, rt-PA was administered as part of a LAB thrombectomy strategy, aiming to soften and partially fragment the organized thrombus and to facilitate subsequent mechanical disruption by high-pressure balloon angioplasty. In addition, local thrombolytic administration may reduce residual thrombotic burden and decrease the risk of early re-thrombosis following endovascular recanalization. Therefore, rt-PA was used as an adjunct to mechanical intervention rather than as a primary thrombolytic therapy, which is consistent with contemporary endovascular practice in chronically thrombosed arteriovenous grafts. A stent graft is electively used if stenosis persists [17, 18].

When graft infection is complicated with postoperative thrombosis a special problem arises, and a particular strategy is required. Open and percutaneous thrombectomy carries the risk of spreading the infection in the sterile graft segments, the bloodstream, and remote organs. A stepwise approach which includes treatment of the infection first and treating thrombosis at a later stage is feasible. Although early graft decluttering is preferable, the latter procedures may also be successful based on the current equipment and expertise. In our patient, we tried initially an open thrombectomy to avoid later endovascular techniques, but we finally chose to delay treatment until complete wound healing was achieved. Moreover, we realized that Fogarty thrombectomy would be insufficient as inaccessible proximal lesions would be apparent, amenable only to endovascular techniques. Another option would be to act earlier, but after the establishment of sterile blood and wound cultures and open wound, granulation was ongoing. This case highlights the process to salvage an infected and failed arteriovenous access when the patient does not have other access options. A staged approach and hybrid treatment with open surgery and percutaneous techniques may prove valuable.

Acknowledgments

We gratefully acknowledge the Department of Vascular Surgery at the University Hospital of Patras and the University of Patras for providing the facilities and resources necessary for this research.

Funding

No external funding.

Ethical approval

Approval number: 15590-12/2/2025.

Disclosures

The authors report no conflict of interest.

References

1. Sidawy AP, Perler BA. Rutherford's Vascular Surgery and Endovascular Therapy. 10th Edition. Elsevier, 2022.
2. Ravani P, Quinn R, Oliver M, Robinson B, Pisoni R, Pannu N, MacRae J, Manns B, Hemmelgarn B, James M, Tonelli M, Gillespie B. Examining the association between hemodialysis access type and mortality: the role of access complications. Clin J Am Soc Nephrol 2017; 12: 955-964.
3. Antoniou GA, Lazarides MK, Georgiadis GS, Sfyroeras GS, Nikolopoulos ES, Giannoukas AD. Lower-extremity arteriovenous access for haemodialysis: a systematic review. Eur J Vasc Endovasc Surg 2009; 38: 365-372.
4. Nguyen DB, Shugart A, Lines C, Shah AB, Edwards J, Pollock D, Sievert D, Patel PR. National Healthcare Safety Network (NHSN) Dialysis Event Surveillance Report for 2014. Clin J Am Soc Nephrol 2017; 12: 1139-1146.
5. Natarajan S, Jagan Sebastian J. Upper thigh loop prosthetic arterio-venous grafts (AVG) for dialysis access: an Indian perspective. J Vasc Access 2023; 24: 786-791.
6. Lok CE, Huber TS, Lee T, Shenoy S, Yevzlin AS, Abreo K, Allon M, Asif A, Astor BC, Glickman MH, Janet Graham, Moist LM, Rajan DK, Roberts C, Vachharajani TJ, Valentini RP; KDOQI Vascular Access Guideline Work Group. KDOQI clinical practice guideline for vascular access: 2019 update. Am J Kidney Dis 2020; 75 (4 Suppl 2): S1-S164.
7. Rahimi M, Adlouni M, Ahmed AI, Alnabelsi T, Chinnadurai P, Al-Mallah MH. Diagnostic accuracy of FDG PET for the identification of vascular graft infection. Ann Vasc Surg 2022; 87: 422-429.
8. Meola M, Marciello A, Di Salle G, Petrucci I. Ultrasound evaluation of access complications: thrombosis, aneurysms, pseudoaneurysms and infections. J Vasc Access 2021; 22 (1 Suppl): 71-83.
9. Cheng TW, Farber A, Eslami MH, Kalish JA, Jones DW, Rybin D, Siracuse JJ. Removal of infected arteriovenous grafts is morbid and many patients do not receive a new access within 1 year. J Vasc Surg 2019; 70: 193-198.
10. Sgroi MD, Kirkpatrick VE, Resnick KA, Williams RA, Wilson SE, Gordon IL. Less than total excision of infected prosthetic PTFE graft does not increase the risk of reinfection. Vasc Endovascular Surg 2015; 49: 12-15.
11. Chow BJ, Chowdary P, Khurram M, Mohamed IH. Management of infected arteriovenous grafts for haemodialysis: outcomes and strategies using a novel objective scoring system. J Vasc Access 2024; 25: 1293-1300.
12. Alnahhal KI, Williams DB, Kirksey L. Surgical creation of lower extremity fistula and grafts. Cardiovasc Diagn Ther 2023; 13: 156-161.
13. Yuan F, De Grijs D, Goudreau B, Robinson WP. Technique for a lateral approach to a superficial femoral artery-femoral vein thigh loop arteriovenous graft placement in avoidance of a traditional groin incision. J Vasc Access 2023; 24: 1185-1189.
14. Morimoto N, Tanabe M, Imono A, Otani M, Shioji S, Hirasawa S, Aki S, Aoyagi M, Tanaka H. The utility of portable negative pressure wound therapy in the management of prosthetic dialysis arteriovenous graft infection. J Vasc Access 2021; 22: 673-676.
15. Kitrou PM, Katsanos K, Spyridonidis I, Theofanis M, Papachristou E, Papadoulas S, Karnabatidis D. Use of drug-coated balloons in dysfunctional arteriovenous dialysis access treatment: the effect of consecutive treatments on lesion patency. J Vasc Interv Radiol 2019; 30: 212-216.
16. Kitrou PM, Papadimatos P, Spiliopoulos S, Christeas N, Katsanos K, Karnabatidis D. Lysis-assisted balloon (LAB) thrombectomy. A declotting technique for the treatment of thrombosed arteriovenous dialysis grafts. 5-year experience of 241 endovascular procedures. Cardiovasc Intervent Radiol 2018; 41: 245-252.
17. Schmidli J, Widmer MK, Basile C, de Donato G, Gallieni M, Gibbons CP, Haage P, Hamilton G, Hedin U, Kamper L, Lazarides MK, Lindsey B, Mestres G, Pegoraro M, Roy J, Setacci C, Shemesh D, Tordoir JHM, van Loon M, Esvs Guidelines Committee, Kolh P, de Borst GJ, Chakfe N, Debus S, Hinchliffe R, Kakkos S, Koncar I, Lindholt J, Naylor R, Vega de Ceniga M, Vermassen F, Verzini F, Esvs Guidelines Reviewers, Mohaupt M, Ricco JB, Roca-Tey R. Editor's Choice - Vascular Access: 2018 Clinical Practice Guidelines of the European Society for Vascular Surgery (ESVS). Eur J Vasc Endovasc Surg 2018; 55: 757-818.
18. Lok CE, Huber TS, Lee T, Shenoy S, Yevzlin AS, Abreo K, Allon M, Asif A, Astor BC, Glickman MH, Graham J, Moist LM, Rajan DK, Roberts C, Vachharajani TJ, Valentini RP; National Kidney Foundation. KDOQI Clinical Practice Guideline for Vascular Access: 2019 Update. Am J Kidney Dis 2020; 75 (4 Suppl 2): S1-S164. Erratum in: Am J Kidney Dis 2021; 77: 551.