Case Report

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Surgery Section

Surgical Management of a Chronic High-flow Arteriovenous Fistula with Pseudoaneurysm and Nerve Entrapment after Failed Percutaneous Ligation: A Case Report

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ABSTRACT

Minimally invasive flow-reduction techniques such as Minimally Invasive Limited Ligation Endoluminal-assisted Revision (MILLER) and No-Incision Limited Ligation Indwelling Needle-assisted Revision (NILLINR) have gained popularity for Arteriovenous Fistula (AVF) management. Still, their applicability in complex, long-standing, or structurally abnormal fistulas remains uncertain. We present a rare and challenging case of a young renal transplant recipient who developed multiple complications after failed percutaneous AVF ligation. A 30-year-old man, two years post-renal transplant and off dialysis, presented with palpitations, visible fistula prominence, and sensory loss in the dorsoradial hand region, 10 days after undergoing ultrasound-guided AVF ligation at another centre. Clinical examination revealed a constriction band at the ligation site, pseudoaneurysm, venous blowouts, and thrill. Intraoperatively, a large pseudoaneurysm, severely dilated and calcified veins, and a 6-7 cm remodelled radial artery segment were identified. Importantly, the superficial branch of the radial nerve was found entrapped within the ligature, explaining the sensory deficit. Surgical management included excision of the pseudoaneurysm and diseased veins, release and preservation of the trapped nerve, and secure ligation of blowouts. Given excellent collateral perfusion from the ulnar artery and palmar arch, arterial reconstruction was avoided. Postoperatively, the patient's palpitations subsided, cosmesis improved, and gradual neurological recovery was noted. This case highlights several important learning points: (i) percutaneous ligation may fail in aneurysmal or calcified vessels; (ii) high-output AVFs can cause systemic manifestations such as palpitations; and (iii) nerve entrapment is a rare but serious complication of percutaneous techniques. Surgical takedown with careful intraoperative assessment offers definitive management in such complex anatomical scenarios.

Keywords: Failed MILLER, NILLINR, Radial nerve entrapment

CASE REPORT

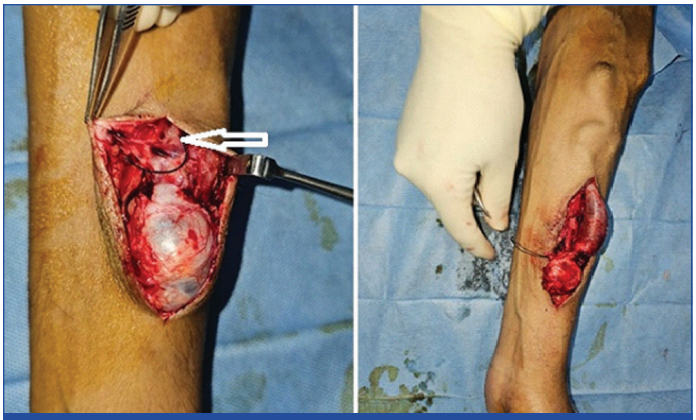
A 30-year-old man, who received a kidney transplant two and a half years back, had been off dialysis for two years, presented to the tertiary care centre, 10 days after undergoing ultrasound-guided percutaneous AVF ligation with a 2-0 silk suture performed at another hospital. The patient reported intermittent palpitations for 12 weeks, along with progressive swelling, a persistent bruit, pain, cosmetic concerns due to fistula prominence, and sensory loss over the dorsoradial aspect of the hand. He had no additional comorbidities such as diabetes, hypertension, or cardiovascular disease. Physical examination revealed a transverse constriction band at the ligation site [Table/Fig-1], a pulsatile pseudoaneurysm, tortuous dilated veins with multiple blowouts in the forearm and arm, and a persistent thrill [Table/Fig-2].

[Table/Fig-1]: Constriction at the level of the AV fistula due to suture ligation.

[Table/Fig-2]: Preoperative images showing a dilated and tortuous vein.

Doppler ultrasound demonstrated markedly elevated flows, with an AVF flow of 2,990 mL/min (PSV: 300 cm/s). The radial artery measured 5 mm in diameter with a flow of 1,777 mL/min, while the cephalic vein measured 9.2 mm in diameter with a flow of 1,477 mL/min.

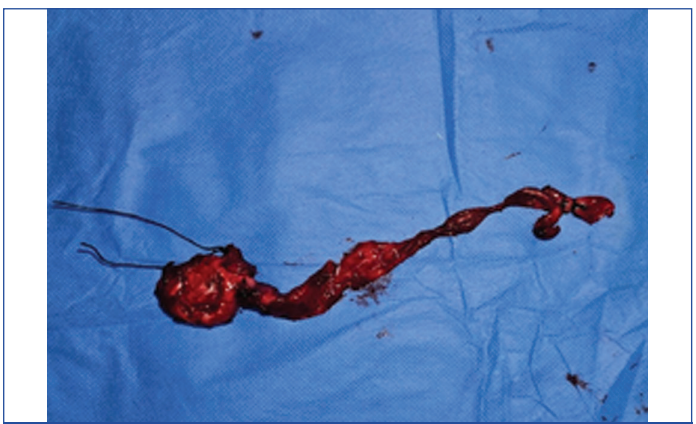
Under regional block, a curvilinear incision facilitated removal of the retained suture, excision of the pseudoaneurysm, resection of the calcified and dilated vein up to the elbow, and ligation of superficial blowouts [Table/Fig-3,4]. The superficial branch of the radial nerve was identified within the fibrous band at the site of percutaneous ligation, likely causing the sensory deficit. The nerve was meticulously released and preserved during the excision. Postoperatively, palpitations subsided, and sensory function began to recover.



[Table/Fig-3]: Intraoperative images showing the pseudoaneurysm at the fistula site and dilated vein proximally. White arrow pointing towards the silk thread used for percutaneous ligation.

[Table/Fig-4]: Intraoperative image showing ligation and division of the distal end of the fistula.

Following excision of the pseudoaneurysm [Table/Fig-5], we noted a 6-7 cm discontinuity in the radial artery that was tightly adherent to the aneurysm sac. Notably, the proximal radial artery segment was 2-3 times larger in diameter than the distal segment, consistent with chronic flow-induced remodelling. Hand perfusion was well maintained, confirmed both clinically and by Doppler, due to robust ulnar artery contribution and an intact palmar arch. Given the significant calibre mismatch, length of the arterial gap, and adequate collateral circulation, we elected not to proceed with radial artery reconstruction. The patient recovered uneventfully after surgery. Palpitations subsided immediately, swelling reduced, and cosmesis improved. Neurological symptoms showed gradual recovery, with partial return of sensation in the dorsoradial aspect of the hand during follow-up. No anticoagulation therapy was administered, as arterial reconstruction or grafting was not performed. Postoperative care included routine wound management and physiotherapy to support hand function in view of the radial nerve involvement. At follow-up at the end of 3 months, the surgical site had healed well, there was no residual thrill, and the patient remained symptom-free [Table/Fig-6].



[Table/Fig-5]: Image showing the excised specimen consisting of a pseudoaneurysm and a dilated vein segment.

[Table/Fig-6]: Postoperative image showing resolved symptoms.

DISCUSSION

Autologous AVFs remain the preferred vascular access for haemodialysis, offering superior long-term patency and lower infection risk compared to grafts or catheters [1]. In renal transplant recipients, however, persistent AVFs may become problematic, leading to complications such as high-output cardiac failure, venous hypertension, aneurysm formation, or cosmetic concerns, thereby necessitating intervention [2].

Traditionally, open surgical ligation or excision has been the standard approach. In recent years, less-invasive techniques such as MILLER and NILLINR have been introduced. The MILLER technique uses a balloon to standardise vein diameter before suture placement and has demonstrated technical success rates exceeding 98% with durable outcomes [3]. The NILLINR approach, performed with needle-guided sutures without skin incision, also shows significant and sustained flow reduction (~2200 to ~700 mL/min) in clinical series [4]. Similarly, percutaneous banding techniques have shown encouraging patency results [5].

Despite their minimally invasive nature, these methods depend on uniform vessel compliance. Anatomical abnormalities such as aneurysmal dilation, calcification, tortuosity, or arterial remodelling may compromise suture effectiveness, resulting in procedural failure, pseudoaneurysm formation, or venous blowouts [6].

In our patient, percutaneous ligation failed because of marked aneurysmal dilatation, venous calcification, and tortuous anatomy that prevented uniform compression of the vessel. These factors led to persistent high flow, pseudoaneurysm formation, and repeated blowouts. Chronic high-output flow had also triggered significant radial artery remodelling, further complicating effective flow reduction.

Vascular calcification is a recognised predictor of AVF failure. Jankovic A et al., reported that calcified vessels carried a significantly increased risk of failure over five years {Hazard Ratio (HR) ~3.4} [7]. Similarly, Yap YS et al., demonstrated that aortic arch calcification strongly correlated with loss of AVF patency in end-stage renal disease [8]. These findings highlight the need for thorough vascular assessment before considering percutaneous banding or ligation.

Surgical excision offers definitive management by directly removing aneurysmal or calcified segments and controlling flow. This approach is particularly indicated in cases of pseudoaneurysm or failed endovascular procedures. Aguirre-Flores K et al., reported successful surgical resection of a giant AVF pseudoaneurysm, emphasising that definitive surgery is often required in complex, high-flow fistulas [9]. Maeba T et al., reported a case of iatrogenic pseudoaneurysm with AVF after transradial coronary intervention, which was managed

successfully by microsurgical resection and arterial repair, further demonstrating that anatomically challenging fistulas may necessitate open surgery when minimally invasive options are unsuitable [10]. These reports align with our case, where surgical takedown provided a durable resolution after percutaneous failure.

Chronic high-flow AVFs often induce arterial remodelling: sustained shear stress causes proximal radial artery dilation frequently more than twofold, while the distal segment remains small due to reduced flow [11]. In our case, this resulted in a threefold diameter mismatch and a 6-7 cm arterial gap, making interposition grafting unfeasible. Reconstruction is generally reserved for patients with impaired hand perfusion, where the ulnar artery and palmar arch provide adequate collateral supply; radial artery ligation is usually well tolerated [12]. Attempting a graft across a significant diameter mismatch increases the risk of turbulence, thrombosis, and graft failure.

Our case also illustrates uncommon systemic and neurological sequelae. Palpitations were likely secondary to chronic high-output cardiac physiology, consistent with reports that AVF flows exceeding 2 L/min can strain cardiac function [13]. Additionally, entrapment of the superficial radial nerve within the ligature produced sensory loss, a rare but plausible complication given the close anatomical relationship between the cephalic vein and radial nerve at the wrist.

This case reinforces the principle that while percutaneous AVF ligation can be effective in compliant, non-aneurysmal vessels, surgical takedown is the safer and definitive option in complex anatomical scenarios. Pre-procedure imaging, awareness of vascular remodelling, and vigilance for neurological complications are essential when planning management.

CONCLUSION(S)

Percutaneous ligation suits flow reduction in compliant, non-aneurysmal AVFs but often fails with aneurysm, tortuosity, calcification, or venous damage. Surgical takedown is definitive in such cases. Intraoperative findings of a long arterial gap and calibre mismatch, with adequate ulnar flow, negated the need for reconstruction. This case underscores the need for individualised planning, Doppler assessment, awareness of arterial remodelling, and vigilance for nerve injury and systemic signs during complex AVF takedown.

REFERENCES

[1] Lok CE, Huber TS, Lee T, Shenoy S, Yevzlin AS, Abreo K, et al. National Kidney Foundation. KDOQI Clinical Practice Guideline for Vascular Access: 2019 Update. Am J Kidney Dis. 2020;75(4 Suppl 2): S1-S164. Epub 2020 Mar 12. Doi: 10.1053/j.ajkd.2019.12.001. Erratum in: Am J Kidney Dis. 2021;77(4):551. Doi: 10.1053/j.ajkd.2021.02.002. PMID: 32778223.

[2] Rao NN, Stokes MB, Rajwani A, Lawton PD, Barber IG, Francis L, et al. Effects of arteriovenous fistula ligation on cardiac structure and function in kidney transplant recipients. Circulation. 2019;139(24):2809-18. Doi: 10.1161/CIRCULATIONAHA.118.038505. PMID: 30998386.

[3] Shukla PA, Kolber MK, Nwoke F, Kumar A, Shams JN, Silberzweig JE. The MILLER banding procedure as a treatment alternative for dialysis access steal syndrome: A single institutional experience. Clin Imaging. 2016;40(3):569-72. Epub 2015 Oct 3. Doi: 10.1016/j.clinimag.2015.09.019. PMID: 26615898.

[4] Wang Y, Li J, Liu W, Zhang Y, Li Q, He F. An ultrasound-guided no incision banding method for the treatment of arteriovenous fistula high-flow in hemodialysis. Ren Fail. 2023;45(1):2222853. Doi: 10.1080/0886022X.2023.2222853. PMID: 37340954; PMCID: PMC10286689.

[5] Kok HK, Maingard J, Asadi H, Ryan E, Sheehan M, Given MF, et al. Percutaneous dialysis arteriovenous fistula banding for flow reduction - A case series. CVIR Endovasc. 2018;1(1):27. Epub 2018 Nov 3. Doi: 10.1186/s42155-018-0035-z. PMID: 30652158; PMCID: PMC6319522.

[6] Malovrh M. Non-invasive evaluation of vessels by duplex sonography prior to construction of arteriovenous fistulas for haemodialysis. Nephrol Dial Transplant. 1998;13(1):125-29. Doi: 10.1093/ndt/13.1.125. PMID: 9481727.

[7] Jankovic A, Damjanovic T, Djuric Z, Dimkovic N, Jovanovic D, Djuric P, et al. Calcification in AVF vessels predicts AVF failure: 5-year follow-up. Int Urol Nephrol. 2017;49(5):881-87. Doi:10.1007/s11255-017-1515-0. PMID: 28185042.

[8] Yap YS, Ting KT, Chi WC, Lin CH, Liu YC, Chuang WL. Aortic arch calcification predicts patency loss of arteriovenous fistula in end-stage renal disease patients. Sci Rep. 2016;6:24943. Doi: 10.1038/srep24943. PMID: 27101807; PMCID: PMC4840307.

[9] Aguirre-Flores K, Mazariegos-Gutiérrez UE, Audiffred-Guzmán RA. Giant arteriovenous fistula pseudoaneurysm resection: Case report. MOJ Surg. 2022;10(3):67-69. Doi: 10.15406/mojs.2022.10.00207.

[10] Maeba T, Urata H, Nagata K, Haishi S, Sugihara K, Shiozawa K, Nishimura G. Pseudoaneurysm and Arteriovenous Fistula in the Radial Artery after Cardiac Catheterization: A Case Report. Plast Reconstr Surg Glob Open. 2022;10(1):e4022. Doi: 10.1097/GOX.0000000000004022. PMID: 35036245; PMCID: PMC8754177.

[11] Girerd X, London G, Boutouyrie P, Mourad JJ, Safar M, Laurent S. Remodeling of the radial artery in response to a chronic increase in shear stress. Hypertension. 1996;27(3 Pt 2):799-803. Doi: 10.1161/01.hyp.27.3.799. PMID: 8613243.

[12] Tolba M, Maresch M, Kamal D. Distal radial artery ligation for treatment of steal syndrome associated with radiocephalic arteriovenous fistula. J Surg Case Rep. 2020;2020(9):rjaa314. Doi: 10.1093/jscr/rjaa314. PMID: 32963762; PMCID: PMC7490220.

[13] Basile C, Lomonte C. The complex relationship among arteriovenous access, heart, and circulation. Semin Dial. 2018;31(1):15-20. Doi: 10.1111/sdi.12652. Epub 2017 Oct 9. PMID: 28990213.

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