



Case Series

Trauma-Induced Pseudoaneurysm of Hemodialysis Arteriovenous Fistulae: A Case Series and Surgical Management Outcomes

Dr Abdul Vakil Khan¹, Dr Sushant Nair², Dr Manjusha Sailukar³, Dr Prutha Javalekar⁴

¹MS, MCh, FMAS, FIAGES, Department of Surgery, K J Somaiya Medical College, Hospital and Research Centre, Mumbai, India

²MBBS, MS, Department of Surgery, K J Somaiya Medical College, Hospital and Research Centre, Mumbai, India

³MCh, DNB, MNAMS, Department of Surgery, K J Somaiya Medical College, Hospital and Research Centre, Mumbai, India

⁴Ms, FMAS, Department of Gen Surgery, KJ Somaiya Hospital and Research Centre

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ABSTRACT

Corresponding Author:

Dr Sushant Nair

MBBS, MS, Department of Surgery, K J Somaiya Medical College, Hospital and Research Centre, Mumbai, India.

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Background: An Arteriovenous fistula (AVF) is the preferred vascular access for patients undergoing long-term haemodialysis due to its durability and lower complication rates compared to other access modalities. However, AVFs remain susceptible to trauma-related complications. Traumatic injury to a mature AVF can result in pseudoaneurysm formation, which carries risks of rupture, infection, thrombosis, and potential loss of vascular access. Literature describing trauma-induced AVF pseudoaneurysms remains limited.

Methods: We report a case series of three patients with established upper-limb AVFs who developed pseudoaneurysms following blunt traumatic injury. Clinical presentation, fistula characteristics, surgical management, and postoperative outcomes were evaluated.

Results: All three patients presented with localized swelling over the AVF site after traumatic insult. Imaging confirmed pseudoaneurysm arising from the fistula tract. The configurations involved included brachiocephalic and brachio basilic AVFs. Given the risk of rupture and progressive enlargement, surgical exploration was undertaken in all cases. Intraoperatively, pseudoaneurysms originating from the fistula segment were identified. Excision of the pseudoaneurysm was performed, followed by ligation and closure of the affected fistula. All patients had an uneventful postoperative recovery without procedure-related morbidity.

Conclusion: Traumatic injury to hemodialysis AVFs can result in pseudoaneurysm formation, a potentially limb- and life-threatening complication. Early diagnosis and timely surgical intervention are critical to prevent catastrophic outcomes. Surgical excision with fistula ligation is a safe and effective management strategy in selected cases. This series underscores the importance of patient education regarding fistula protection and vigilance following trauma.

Keywords: Arteriovenous fistula, pseudoaneurysm, haemodialysis access, vascular trauma.

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INTRODUCTION

An arteriovenous fistula (AVF) remains the preferred vascular access for patients undergoing long-term haemodialysis because of its superior durability, lower infection rates, and better long-term patency compared with prosthetic grafts and central venous catheters. Since the first description of the surgically created AVF by Brescia and Cimino, native fistulae have become the gold standard for chronic renal replacement therapy.

Despite these advantages, AVFs are associated with several complications including thrombosis, stenosis, infection, aneurysmal dilatation, steal syndrome, venous hypertension, and pseudoaneurysm formation. Among these, pseudoaneurysm is clinically significant because it carries the risk of rapid enlargement, rupture, haemorrhage, skin necrosis, and eventual loss of vascular access. Pseudoaneurysm in haemodialysis access usually develops secondary to repeated needle puncture, infection, or anastomotic disruption; however, traumatic pseudoaneurysm occurring after blunt injury to a mature fistula is uncommon and sparsely described in available literature.

The arterialized venous wall of a mature fistula undergoes structural remodeling and may become vulnerable to injury even after minor trauma. In such cases, disruption of the vessel wall can lead to extravasation of blood into surrounding tissue, forming a contained pulsatile hematoma communicating with the fistula lumen. Because these lesions may initially present as localized swelling without active bleeding, delayed recognition can increase the risk of catastrophic rupture.

Early diagnosis using duplex ultrasonography and timely intervention are essential to prevent life-threatening complications. While endovascular techniques have been described, surgical treatment remains the definitive option in symptomatic, enlarging, or rupture-prone lesions, particularly when fistula preservation is not feasible.

In this case series, we present three patients with established upper-limb haemodialysis AVFs who developed pseudoaneurysm following blunt trauma to the fistula site and were successfully managed by surgical exploration, pseudoaneurysm excision, and fistula ligation. This series highlights the clinical presentation, operative findings, and outcomes of this uncommon but important vascular access complication.

RESULTS

Case no	Site	Cause	Symptom	Diagnosis	Management	Post-op course
1	Brachiocephalic AV fistula	Trauma to fistula site	Painful swelling over fistula	Pseudoaneurysm of AV fistula	Surgical exploration and excision of pseudoaneurysm with surgical ligation and closure of fistula	Uneventful recovery
2	Brachiobasilic AV fistula	Trauma to fistula site	Expanding swelling over fistula	Pseudoaneurysm of AV fistula	Surgical exploration and excision of pseudoaneurysm with surgical ligation and closure of fistula	Uneventful recovery
3	Brachiobasilic AV fistula	Trauma to fistula site	Localised swelling over fistula	Pseudoaneurysm of AV fistula	Surgical exploration and excision of pseudoaneurysm with surgical ligation and closure of fistula	Uneventful recovery

CASE 1



CASE 2



CASE 3



DISCUSSION

An Arteriovenous fistula (AVF) remains the gold standard vascular access for long-term haemodialysis due to its superior patency rates and lower infection risk compared with grafts and central venous catheters. Despite these advantages, AVFs are not exempt from complications. Commonly reported issues include thrombosis, stenosis, aneurysm formation, infection, steal syndrome, and high-output cardiac failure. Among these, pseudoaneurysm formation is relatively uncommon but potentially catastrophic, particularly when precipitated by trauma.

A pseudoaneurysm represents a contained vascular rupture in which blood extravasates through a defect in the vessel wall but remains confined by surrounding soft tissue. In the context of haemodialysis access, pseudoaneurysms more frequently result from repeated cannulation, infection, or technical failure at the anastomotic site. Trauma-induced pseudoaneurysm, however, is infrequently reported and may occur following blunt injury, fall, compression, or direct impact to the limb containing the fistula. In mature high-flow fistulae, even minor trauma may lead to disruption of the arterialized venous wall due to chronic structural changes such as intimal hyperplasia and medial thinning.

Clinically, patients typically present with localized swelling, pain, pulsatility, rapid increase in fistula size, skin thinning, or discoloration. In some cases, sentinel bleeding may precede rupture. Prompt evaluation is critical because rupture can result in life-threatening hemorrhage. Duplex ultrasonography serves as the first-line imaging modality, demonstrating the characteristic “yin-yang” sign and to-and-fro flow pattern at the neck of the pseudoaneurysm. Cross-sectional imaging such as CT angiography may be reserved for complex anatomy or operative planning.

Management depends on pseudoaneurysm size, symptoms, overlying skin integrity, and presence of infection. Small, asymptomatic pseudoaneurysms may occasionally be observed. Endovascular options, including covered stent placement or thrombin injection, have been described; however, these may compromise future cannulation sites and are less favored in contaminated or large lesions. Surgical intervention remains the definitive treatment in cases of rapid enlargement, skin compromise, bleeding, infection, or high rupture risk.

In our series, all patients presented following traumatic insult and demonstrated progressive swelling over established upper-limb AVFs, including brachiocephalic and brachio basilic configurations. Given the risk of rupture and absence of salvageable fistula segments, surgical exploration with excision of the pseudoaneurysm and ligation of the involved fistula was undertaken. All patients had favorable postoperative outcomes without complications. While fistula preservation is ideal, patient safety remains paramount; therefore, ligation is justified when reconstruction is not feasible or when tissue viability is compromised.

This case series highlights several important considerations. First, trauma—even seemingly minor—can precipitate pseudoaneurysm formation in mature AVFs. Second, early diagnosis and timely referral are essential to prevent catastrophic hemorrhage. Third, patient education plays a critical preventive role. Patients undergoing haemodialysis must be counseled regarding limb protection, avoidance of heavy lifting, prevention of direct impact, and immediate reporting of swelling or bleeding.

Although limited by small sample size, this series adds to the sparse literature on trauma-induced AVF pseudoaneurysms and reinforces surgical ligation as a safe and effective management strategy in selected cases. Larger studies are needed to better define optimal management algorithms and long-term outcomes following traumatic vascular access injury.

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