

Percutaneous Thrombin Injection for Post-Stab Wound Induced Upper Extremity Pseudoaneurysm: Case Report

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AUTHORS' CONTRIBUTIONS

Mohammad Al Mutarid: Participated in the interventional procedure and provided critical technical input.

Sulaiman AlRajeh: Collected clinical data, gathered imaging studies, and drafted the initial manuscript.

Abdulaziz Altaweel: Collected clinical data, reviewed imaging studies, and reviewed the initial manuscript.

Basil Alzahrani: Reviewed the literature and assisted with manuscript editing.

Yosouf AlZahrani: Participated in the interventional procedure and provided critical technical input.

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None

DISCLOSURES

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

CONSENT

We confirm that written, informed consent was obtained from the patient for the publication of this case report. The patient has reviewed the case details and images and has provided permission for the information to be shared for educational and research purposes.

HUMAN AND ANIMAL RIGHTS

All procedures performed were in accordance with institutional ethical standards and the Helsinki Declaration.

ABSTRACT

Percutaneous thrombin injection is a well-known minimally invasive treatment option of pseudoaneurysm. This minimally invasive procedure offers high success rates, rapid symptom relief, and low rates of complications, making it an attractive option for patients with pseudoaneurysms. This case describes a 51-year-old man with a medical history of Non-ischemic Cardiomyopathy, Dyslipidemia, peripheral vascular ischemia being treated with warfarin. Patient presented to the emergency department with a stab wound to the right upper arm, the wound was treated using thrombin injection.

CASE REPORT

BACKGROUND

Pseudoaneurysms are a recognized complication of penetrating trauma and may result in serious hemorrhagic outcomes if not promptly treated. Percutaneous thrombin injection is a minimally invasive technique with high success rates in achieving pseudoaneurysm thrombosis. This report presents a post-stab wound upper extremity pseudoaneurysm successfully managed using ultrasound-guided percutaneous thrombin injection.

INTRODUCTION

Percutaneous thrombin injection is a minimally invasive procedure used to treat vascular pseudoaneurysms or arteriovenous fistulas. Thrombin is a naturally occurring enzyme that helps with blood clotting. During the procedure, a needle is inserted directly into the pseudoaneurysm, or fistula and thrombin are injected to promote clot formation and seal off the abnormal blood vessel. This helps to prevent further bleeding and can often be done without the need for surgery. It is a safe

and effective option for treating certain vascular conditions [1].

Pseudoaneurysms are a common complication of penetrating trauma, such as stab wounds, and can occur in various locations in the body, including the upper extremities. Percutaneous thrombin injections have emerged as a minimally invasive and effective treatment option for pseudoaneurysms, particularly those induced by stab wounds in the upper extremities [2].

Pseudoaneurysms in the upper limbs might present with pain, swelling, and a pulsating mass where the injury occurred. Pseudoaneurysms can burst, causing bleeding and possibly fatal consequences, if treatment is not received. Therefore, to avoid these negative effects, timely identification and treatment are crucial [2].

Percutaneous thrombin injection has become a widely used treatment modality for pseudoaneurysms, including those induced by stab wounds in the upper extremities. Thrombin is a serine protease that converts fibrinogen to fibrin, leading to the formation of a stable clot [3]. In the context of pseudoaneurysms, percutaneous thrombin injections involve the direct injection of thrombin into the pseudoaneurysm sac under ultrasound or fluoroscopic guidance. The thrombin promotes the formation of a clot within the pseudoaneurysm, effectively sealing off the communication between the arterial lumen and the hematoma [4].

Percutaneous thrombin injections are a cost-effective treatment option for pseudoaneurysms, as it eliminates the need for open surgical repair and its associated costs. Furthermore, percutaneous thrombin injections are well tolerated by patients, with minimal discomfort and low rates of complications reported in the literature [5].

CASE REPORT

A 51-year-old male patient presented to the emergency department with a history of a stab wound to the right upper arm during a fight, resulting in active bleeding. On examination, he was hemodynamically stable, saturating well on room air, with a 2 cm stab wound without active bleeding but with a palpable hematoma. Peripheral pulses were intact, and there were no signs of paresthesia, decreased sensation, or coldness. The patient's past medical history includes non-ischemic Cardiomyopathy, Dyslipidemia, peripheral vascular ischemia on warfarin with a history of Embolectomy, and a background of alcohol abuse.

Imaging Findings

A CT run-off revealed a right mid-arm pseudoaneurysm (Figure 1). Pre-procedure Doppler ultrasound of the right upper arm showed a rounded mass with bi-phasic arterial waveform, and Yin-Yang sign of pseudoaneurysm. (Figure 2). Laboratory investigations revealed an INR of 8.05. 25 Gauge-needle was inserted, and 100 IU of thrombin

was injected (Figure 3). Post-thrombin injection, complete thrombosis of the pseudoaneurysm was achieved, and the patient tolerated the procedure well with no immediate complications (Figure 4).

Management and Follow-up

Thrombin injection was recommended as a treatment option. Under ultrasound guidance and aseptic technique, one day after the procedure, the patient was doing well with a palpable radial pulse.

The patient continued to do well, with a warm right hand, palpable radial pulse, and clean wound with suturing done under local anesthesia. Laboratory investigations showed improvement in the INR levels. Plans were made to restart warfarin, conduct a USG of the arm, and discharge the patient the following day.

As the patient's condition stabilized, subsequent assessments revealed improvements in his clinical status. With the wound cleaned, sutured under local anesthesia, and no signs of active bleeding, preparations were made for the patient's discharge the following day. Reinitiating warfarin therapy, conducting an ultrasound of the arm, and close monitoring of the patient's INR and hematological parameters were integral components of the discharge plan. Throughout the care continuum, the patient's DVT and bleeding risks remained unchanged, reflecting the efficacy of the implemented interventions.

DISCUSSION

Etiology & Demographics

Pseudoaneurysms, also referred to as false aneurysms, arise from a breach in the arterial wall resulting in a contained hematoma that communicates with the arterial lumen. Unlike true aneurysms, pseudoaneurysms do not involve all three layers of the arterial wall and are instead confined by surrounding soft tissues. Penetrating trauma, including stab wounds, is a well-recognized cause of pseudoaneurysm formation, particularly in the upper extremities where arteries are relatively superficial and vulnerable to injury. These injuries are more commonly reported in adult males, reflecting higher exposure to traumatic mechanisms [5].

Clinical & Imaging Findings

Clinically, upper extremity pseudoaneurysms may present with pain, localized swelling, or a pulsatile mass at the site of injury. If left untreated, they carry a risk of rupture and significant hemorrhage. Duplex ultrasound is the primary diagnostic modality and typically demonstrates a rounded pseudoaneurysm sac with a characteristic bidirectional “yin-yang” flow pattern and a to-and-fro waveform at the neck. Computed tomography angiography plays a complementary role by accurately delineating the vascular anatomy, confirming the diagnosis, providing three-dimensional measurements, and assisting in procedural planning.

Treatment & Prognosis

Percutaneous thrombin injection is a minimally invasive procedure that can be performed in an outpatient setting, under local anesthesia. This technique has been widely employed and replaced US-guided compression as the initial therapeutic option for post catheterization pseudoaneurysms since Kang et al. [6] reported it. With a success rate for thrombosis that is more than 90%. It offers several advantages over traditional surgical approaches, including reduced procedural time, shorter hospital stays, and lower rates of complications. Additionally, percutaneous thrombin injections are associated with high success rates, with most patients experiencing complete resolution of their pseudoaneurysms following the procedure [4].

Several studies have evaluated the outcomes of percutaneous thrombin injection for pseudoaneurysms, including those induced by stab wounds in the upper extremities. These studies have reported high technical success rates, ranging from 80% to 100%, with few complications associated with the procedure [6]. Most patients experience immediate relief of symptoms following percutaneous thrombin injections, with resolution of the pseudoaneurysm confirmed on follow-up imaging studies. One study reported successful outcomes in 15 patients with upper extremity pseudoaneurysms treated with percutaneous thrombin injection. The study found that thrombin injection was effective in achieving immediate and complete thrombosis of the pseudoaneurysm in all cases, with no recurrence of pseudoaneurysm at follow-up [7]. Another study evaluated the use of percutaneous thrombin injections in 10 patients with upper extremity pseudoaneurysms. The study found that thrombin injection was successful in achieving complete thrombosis of the pseudoaneurysm in all cases, with no major complications reported [8]. Overall, these studies suggest that percutaneous thrombin injection is a safe and effective treatment option for post-stab wound induced upper extremity pseudoaneurysms. It offers a minimally invasive alternative to surgical intervention, with high rates of success and low rates of complications. Further research is needed to confirm these findings and establish long-term outcomes of this treatment approach.

Differential Diagnoses

The differential diagnosis of a post-traumatic upper extremity mass includes hematoma, arteriovenous fistula, true aneurysm, and soft tissue abscess. Hematomas lack internal vascular flow on Doppler imaging, while arteriovenous fistulas demonstrate high-velocity turbulent flow and early venous filling. True aneurysms involve all layers of the arterial wall and show uniform arterial dilation. Soft tissue abscesses may show peripheral enhancement and restricted diffusion on imaging. Accurate differentiation relies on Doppler ultrasound and contrast-enhanced computed tomography to guide appropriate management.

CONCLUSION

The intricate management of a stab wound in a patient with a complex medical history necessitates a collaborative

and systematic approach involving multiple specialties. By addressing acute injury, managing associated comorbidities, and ensuring comprehensive post-procedural care, healthcare providers can optimize patient outcomes and facilitate a smooth transition to discharge. The case exemplifies the importance of tailored interventions, close monitoring, and interdisciplinary coordination in delivering high-quality care to patients with intricate medical needs.

Further research is needed to evaluate the long-term outcomes of percutaneous thrombin injections and their comparative effectiveness against other treatment modalities. Nonetheless, percutaneous thrombin injections represent a promising approach to the management of pseudoaneurysms in the upper extremities, providing patients with a minimally invasive and cost-effective alternative to traditional surgical repair.

TEACHING POINT

In patients with traumatic pseudoaneurysms of the upper extremity, ultrasound-guided percutaneous thrombin injection offers an effective, minimally invasive alternative to surgical repair, particularly in anticoagulated patients, with rapid clinical stabilization and low complication rates.

QUESTIONS

Question 1: Which imaging finding is most characteristic of a pseudoaneurysm on duplex ultrasound?

1. Anechoic fluid collection without internal flow
2. Homogeneous hyperechoic soft tissue mass
3. Peripheral rim vascularity only
4. Bidirectional “yin-yang” flow pattern within the lesion (applies)
5. Absence of arterial waveform

Explanation:

Pseudoaneurysms demonstrate a characteristic bidirectional “yin-yang” flow pattern on color Doppler imaging due to blood entering and exiting the pseudoaneurysm sac through a communicating neck [Clinical & Imaging Findings].

Question 2: Which mechanism best explains the formation of a pseudoaneurysm following a stab wound?

1. Degeneration of the arterial media
2. Atherosclerotic plaque rupture
3. Disruption of the arterial wall with containment by surrounding tissues (applies)
4. Congenital weakness of the vessel wall
5. Progressive arterial dilation involving all vessel layers

Explanation: Pseudoaneurysms result from a breach in the arterial wall with blood contained by surrounding soft tissues rather than involvement of all arterial layers [Etiology & Demographics].

Question 3: What is the primary mechanism of action of percutaneous thrombin injection in pseudoaneurysm treatment?

1. Vasospasm of the parent artery
2. Mechanical compression of the pseudoaneurysm neck

3. Induction of inflammatory fibrosis
4. Conversion of fibrinogen to fibrin resulting in sac thrombosis (applies)
5. Reduction of systemic blood pressure

Explanation:Thrombin promotes conversion of fibrinogen to fibrin, leading to rapid thrombosis of the pseudoaneurysm sac and closure of the arterial communication [Treatment & Prognosis].

Question 4: Which factor makes percutaneous thrombin injection particularly advantageous in selected patients with traumatic pseudoaneurysms?

1. Requirement for general anesthesia
2. High recurrence rate
3. Minimally invasive nature with high technical success (applies)
4. Inability to be performed under ultrasound guidance
5. Need for prolonged hospitalization

Explanation:Percutaneous thrombin injection is a minimally invasive technique with reported technical success rates exceeding 90% and low complication rates, allowing rapid recovery and short hospital stay [Treatment & Prognosis].

Question 5: Which condition is an important differential diagnosis of a post-traumatic upper extremity pseudoaneurysm?

1. Lipoma
2. Cellulitis
3. Arteriovenous fistula (applies)
4. Reactive lymphadenopathy
5. Soft tissue contusion

Explanation:Arteriovenous fistulas can occur following trauma and demonstrate high-velocity turbulent flow on Doppler imaging, necessitating differentiation from pseudoaneurysms [Differential Diagnoses].

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FIGURES

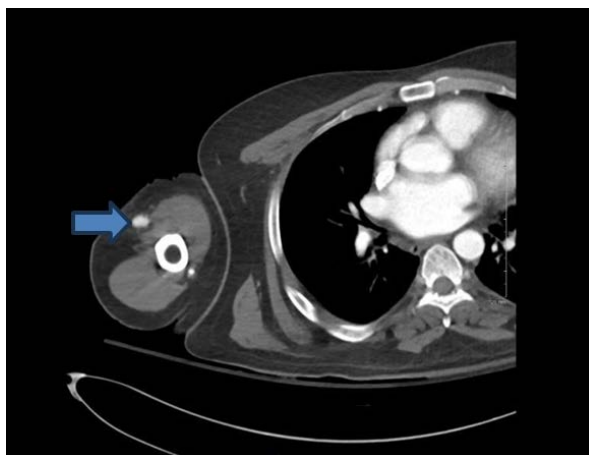


Figure 1: 51-year-old male with post-stab wound–induced upper extremity pseudoaneurysm.

FINDINGS: Axial contrast-enhanced computed tomography angiography demonstrates a focal contrast-filled pseudoaneurysm arising from a mid-arm arterial branch (arrow), measuring approximately $12 \times 10 \times 9$ mm.

TECHNIQUE: Axial computed tomography angiography of the right upper extremity performed after intravenous administration of iodinated contrast material in the arterial phase.

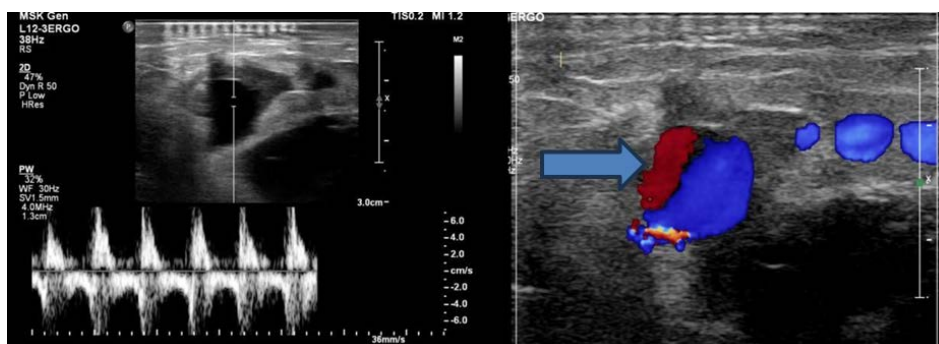


Figure 2: 51-year-old male with post-stab wound–induced upper extremity pseudoaneurysm.

FINDINGS: Duplex ultrasound demonstrates a rounded pseudoaneurysm sac with characteristic bidirectional “yin-yang” flow pattern on color Doppler imaging.

TECHNIQUE: High-frequency linear transducer ultrasound examination of the right upper arm with color and spectral Doppler imaging.



Figure (3): 51-year-old male with post-stab wound–induced upper extremity pseudoaneurysm.

FINDINGS: Ultrasound-guided placement of a needle within the pseudoaneurysm sac prior to thrombin injection.

TECHNIQUE: Real-time ultrasound-guided percutaneous needle placement using a 25-gauge needle under sterile conditions.

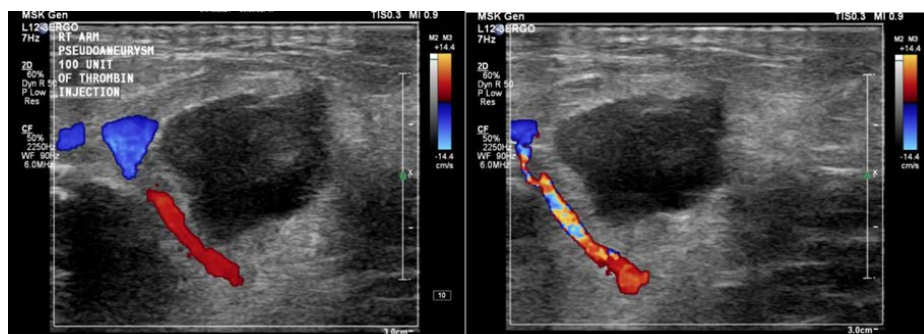


Figure (4): 51-year-old male with post-stab wound–induced upper extremity pseudoaneurysm.

FINDINGS: Post-procedural ultrasound demonstrates complete thrombosis of the pseudoaneurysm with preserved distal arterial flow.

TECHNIQUE: Follow-up duplex ultrasound examination with color and spectral Doppler imaging.

KEYWORDS

Percutaneous, Thrombin Injection, Post-Stab Wound, Upper Extremity, Pseudoaneurysm.

ABBREVIATIONS

CT = Computed Tomography
INR = International Normalized Ratio
IU = International Units
US = Ultra Sound
DVT = Deep Vein Thrombosis

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