Lateral Thoracic Artery Pseudoaneurysm as a Result of Penetrating Chest Trauma

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ABSTRACT

Pseudoaneurysms are potentially fatal complications of vascular trauma; however, they are rarely seen as the sole complication of penetrating injury. We present a case of a pseudoaneurysm with an associated arteriovenous fistula of the left lateral thoracic artery as a result of direct trauma from a knife stab. The patient presented only with a painful, swollen left pectoralis muscle. Upon diagnosis, he was taken to the interventional radiology suite and treated successfully with fluoroscopic guided coil embolization. Cases such as these are infrequent and should encourage more aggressive use of contrast enhanced computed tomography imaging for soft tissue injury, as a missed traumatic pseudoaneurysm may result in life-threatening hemorrhage.

CASE REPORT

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We present the case of a 52 year old male with no significant past medical history who presented to an outside hospital after being stabbed with a knife in the left upper chest. Workup at the outside facility included standard laboratory panels, which were negative for any significant derangement, and a chest x-ray showing no acute fractures, hemothorax or pneumothorax. The patient was transferred to our institution for further management. On arrival, primary survey was intact, hemoglobin was within normal limits and the patient endorsed a history of a single stab wound to the left chest and no other trauma. He was complaining of loco-regional pain and physical examination revealed a 1.5 centimeter entrance wound, circumferential soft tissue swelling without a palpable thrill or pulsation and no visible exit wound. Chest x-ray was negative for any acute abnormalities and the decision was made to proceed with computed tomography scanning of the chest to assure no occult injuries to vital structures. The chest scan conducted with intravenous contrast revealed a 6.7 (transverse) by 9.4 (craniocaudal) centimeter hematoma on the left anterior chest wall with an associated 1.4 (transverse) by 1.0 (antero-posterior) by 2.4 (craniocaudal) centimeter pseudoaneurysm and arteriovenous fistula in the left axilla (Figure 1).

The patient was subsequently admitted to the trauma service and transferred directly to the interventional radiology suite. Left subclavian arteriography identified a pseudoaneurysm with an adjacent arteriovenous fistula originating from a branch of the left lateral thoracic artery (Figure 2). The affected branch was embolized with platinum microcoils proximal and distal to the origin of the pseudoaneurysm. The arteriovenous fistula appeared to have resulted directly from the pseudoaneurysm; therefore, exclusion of the entire pseudoaneurysm and feeding artery resulted in exclusion of the arteriovenous fistula. Completion angiogram confirmed absence of flow into both the pseudoaneurysm and arteriovenous fistula (Figure 3). The patient was subsequently discharged in stable condition after the remainder of an uncomplicated hospitalization.

DISCUSSION

Etiology & Demographics:

Pseudoaneurysms are common vascular insults with the majority of cases being seen at vascular anastomotic sites [1]. They are also documented in the setting of both penetrating and blunt trauma, but are typically associated with other injuries [2]. These lesions result from a disruption in an arterial wall and subsequent pressurized extravasation of blood. Disruption in the muscular layer of the vessel precludes proper vascular contraction in response to the inciting injury. This, in turn, prevents sealing of the defect and blood extravasates, forms a clot and eventually a fibrinous wall, which is prone to rupture [3]. Arterial pseudoaneurysms are common complications of vascular access; however, isolated pseudoaneurysms from penetrating trauma are very rare [4]. Pseudoaneurysms of the lateral thoracic artery have presented in the setting of blunt force trauma, however, none have been documented in the setting of penetrating trauma. Here we present the case of a left lateral thoracic artery pseudoaneurysm with an associated arteriovenous fistula presenting as the sole injury after a stab wound to the chest.

Clinical & Imaging Findings:

Pseudoaneurysms are often missed as they do not frequently present like most arterial trauma. However, a missed diagnosis in the trauma bay can result in life threatening immediate, or delayed hemorrhage [4]. Traumatic pseudoaneurysms should be suspected after a patient develops pain and/or swelling over a muscular compartment that contains a so-called 'named' artery, or if any soft and/or hard signs of vascular trauma are evident without frank bleeding. "Hard signs" of vascular injury include an expanding hematoma, palpable thrill, audible bruit, pulsatile bleeding, absent distal pulses or a cool distal limb. "Soft signs" include peripheral nerve deficits or reduced peripheral pulses. Depending on the aneurysm site, associated symptoms such as paresthesias or numbness may be present secondary to nearby nerve compression by the aneurysmal sac [7-10]. Signs and symptoms may be delayed and present weeks to months after the inciting injury, unlike typical vascular injuries. Delayed findings may even include skin necrosis [6].

A strong clinical suspicion accompanied by a thorough history and physical examination is key to timely diagnosis. In trauma, contrast enhanced computed tomography scans are frequently obtained and can identify the exact location and the extent of the lesion. They appear as saccular, contrast-filled, arterial dilations and may demonstrate associated contrast extravasation into surrounding tissues. They are frequently accompanied by surrounding tissue edema and hematoma. In non-trauma settings, the ideal imaging is ultrasound which will show a hallmark "to and fro" pattern; blood entering the false lumen in systole and re-entering the native vessel in diastole [11]. Brightness and M-mode duplex imaging can also demonstrate vascular extravasation and arteriovenous fistula formation [5,6]. Nevertheless, angiography remains the gold standard in diagnosis, and it is both diagnostic and potentially therapeutic.

Treatment & Prognosis:

Treatment options for traumatic pseudoaneurysms include both operative and non-operative modalities. While many injuries can be managed non-operatively, surgical intervention is indicated in the presence of "hard signs" of vascular injury [5,6]. While small, 2-3 centimeter pseudoaneurysms do exhibit spontaneous thrombosis [6], it is not uncommon to intervene on said lesions given the catastrophic magnitude of the potential complications. Ultrasound guided compression results in successful thrombosis 74-86% of the time; however, invasive procedures such as ultrasound guided fibrin injection or angiographic coil embolization also demonstrate high thrombosis rates with lower recurrence rates and no change in hospital length of stay or complication rates [6,12-14]. Another less common intervention is endovascular stent deployment and exclusion of the pseudoaneurysm neck [6]. If the patient develops overlying soft tissue infection or mass effects (i.e. compression of adjacent neurovascular structures) surgical hematoma evacuation and arterial reconstruction are indicated [5,6]. If identified in a timely fashion and treated accordingly, traumatic arterial pseudoaneurysms have an excellent prognosis.

Differential Diagnoses:

Arterial Aneurysm

Traumatic arterial aneurysms may present in a very similar fashion to pseudoaneurysms; however, aneurysm sacs are focal outpouchings that are still bordered by all the true layers of the vascular wall. Pseudoaneurysms are generally only bordered by a false boundary, therefore making them more prone to rupture. This diagnosis can only be differentiated by imaging.

Hematoma

Traumatic hematomas appear as subcutaneous swelling in the region of trauma. They may also create a mass effect resulting from compression of adjacent neurovascular structures. However, these lesions do not demonstrate a palpable thrill or pulsation, nor is there an associated bruit. Diagnostic imaging will reveal a collection of blood outside the artery in the absence of arterial malformation or contrast extravasation.

Compartment Syndrome

The development of compartment syndrome may mimic a traumatic pseudoaneurysm of an extremity. Compartment syndrome presents with a tense muscle compartment with associated exquisite pain on passive movement of the associated extremity. Paresthesias and loss of pulses are frequently a late clinical finding. Additionally, compartment syndrome may develop as result of a traumatic hematoma or pseudoaneurysm. In the absence of vascular trauma, imaging will only demonstrate soft tissue edema.

Conclusion:

While infrequent, traumatic pseudoaneurysms present a potentially life threatening complication from seemingly innocuous trauma. Lesions of the lateral thoracic artery are not insignificant and hemorrhage from this artery has been associated with catastrophic outcomes [15]. Cases such as these strengthen the argument for more aggressive use of

contrast enhanced computed tomography scans targeting musculoskeletal regions of the body affected by trauma. In the presence of swelling, an intact pulse exam or absence of a thrill or bruit does not exclude the presence of a pseudoaneurysm. Once diagnosed, we recommend a multidisciplinary approach to treatment involving prompt, if not emergent, consultation with interventional radiology or vascular surgery. Successful management of these lesions prevents immediate, as well as delayed hemorrhagic complications.

TEACHING POINT

Pseudoaneurysms represent a potentially fatal complication of trauma. They are readily identified by use of computed tomography and can be treated successfully by ultrasound-guided techniques or selective radiological procedures. Several therapeutic options exist and a multidisciplinary approach with interventional radiology can frequently obviate the need for surgical intervention.

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FIGURES

Figure 1: A 52 year old male status post stabbing with a traumatic left lateral thoracic artery pseudoaneurysm.
Findings: A saccular, contrast-enhanced 1.4 (transverse) by 1.0 (antero-posterior) by 2.4 (craniocaudal) cm pseudoaneurysm (A) within the musculature of the left chest wall. In the surrounding soft tissue there is a heterogeneous fluid collection measuring 6.7 (transverse) by 9.4 (craniocaudal) cm, suggested of hematoma formation. Demonstrated are coronal (a), sagittal (b) and axial (c) views.
Technique: GE Healthcare Discovery CT 750HD™ chest computed tomography scan enhanced with 300 cc of intravenous iohexol solution (1.25 mm slice thickness, 5060 mAs, 120 kVp).

Figure 2: A 52 year old male status post stabbing with a traumatic left lateral thoracic artery pseudoaneurysm.
Findings: Image: A lobulated pseudoaneurysm of the left lateral thoracic artery (A). Early venous filling his demonstrated (B) indicating arteriovenous fistula formation. Contrast is then seen returning into the central venous system (C).
Technique: Spot radiograph during the venous phase of digital subtraction angiography sequence with injection of iohexol contrast solution through a Renegade Hi-flo microcatheter.

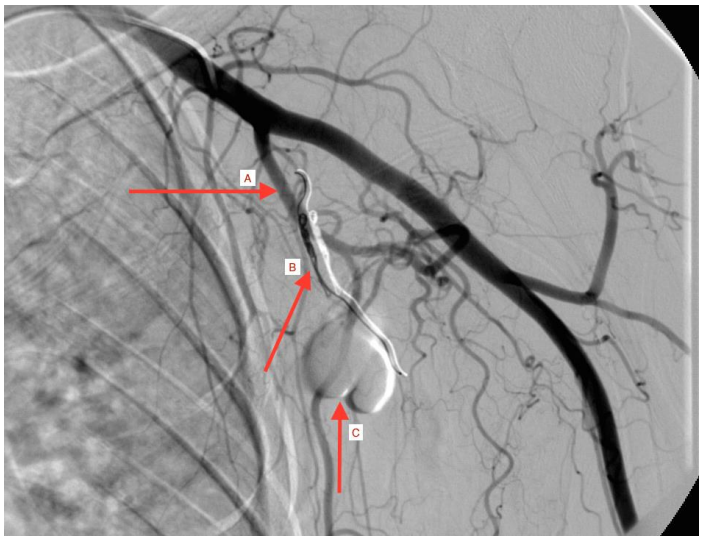

Figure 3: A 52 year old male status post stabbing with a traumatic left lateral thoracic artery pseudoaneurysm.
Findings: The lateral thoracic artery (A) is cannulated and platinum microcoils have been deployed into the lateral thoracic artery (B). The lobulated pseudoaneurysm (C) is now excluded and devoid of flow.
Technique: Spot radiograph during the arterial phase of digital subtraction angiography sequence with injection of iohexol contrast solution through a Renegade Hi-flo microcatheter.

Etiology	• Disruption in arterial wall and damage to muscular layer prevents vessel sealing and contraction. Blood extravasates and may clot. In the chronic setting, this creates a fibrinous wall which is prone to rupturing.
Incidence	• Unknown in trauma • 0.5-2% after diagnostic catheterization • 2-6% in interventional procedures
Gender Ratio	• Not gender specific
Age Predilection	• Not related to age
Risk Factors	• Blunt or penetrating trauma • Vascular anastomosis • Interventional or diagnostic vascular access
Treatment	• 2-3cm pseudoaneurysms often spontaneously thrombose without intervention • Ultrasound guided compression • Ultrasound guided fibrin injection • Angiographic coil embolization • Endovascular stent exclusion • Surgical repair
Prognosis	• If recognized and treated prior to shock and its sequelae, excellent prognosis
Imaging Findings	• US: “To and fro” pattern of blood entering false lumen in systole, re-entering native lumen in diastole. • CT: Contrast extravasation in arterial phase into a contained space. • MRI: T1-weighted MRI will demonstrate a flow void within an aneurysmal sac secondary to turbulent flow. • Angiography: Contrast extravasation from vessel lumen with circulating flow re-entering the native lumen.

Table 1: Summary table for Pseudoaneurysm.

Pseudoaneurysm	• X-Ray: No findings unless otherwise related to the etiology of the pseudoaneurysm. Possible soft tissue swelling may be seen depending on location. • US: "To and fro" pattern of blood entering false lumen in systole, re-entering native lumen in diastole. • CT: Contrast extravasation in arterial phase into a contained space. • MRI: T1-weighted MRI will demonstrate a flow void within an aneurysmal sac secondary to turbulent flow. • Angiography: Contrast extravasation from vessel lumen with circulating flow re-entering the native lumen.
Hematoma	• X-Ray: May show soft tissue swelling. • US: Fluid collection without "to and fro" pattern. • CT: Soft tissue density consistent with hematoma. No contrast extravasation. • MRI: Appearance varies by acuity. T1 weighted imaging will typically show iso-intense to bright enhancement in acute phases and dark appearance in chronic hematomas. • Angiography: No vascular abnormalities.
Compartment Syndrome	• X-Ray: May show soft tissue swelling. May show fractures depending on etiology. • US: Findings will be related to etiology, but compartment syndrome is a clinical diagnosis. • CT: Findings will relate to etiology. Compartment syndrome is a clinical diagnosis. • MRI: Findings will relate to etiology. Compartment syndrome is a clinical diagnosis. • Angiography: No vascular abnormalities.
Aneurysm	• X-Ray: Aneurysmal dilation may be evident, particularly in calcified vessels, causing the lumen to be readily visible. • US: Enlarged vessel diameter without any "To and fro" pattern and no extravasation unless rupture has occurred. • CT: Aneurysmal dilation readily evident without contrast extravasation unless the aneurysm has ruptured. • MRI: Findings similar to CT. • Angiography: Aneurysmal dilation without contrast extravasation

Table 2: Differential Diagnosis table for Pseudoaneurysm.

ABBREVIATIONS

CT: Computed tomography
MRI: Magnetic Resonance Imaging
US: Ultrasound

KEYWORDS

Pseudoaneurysm; Trauma; Interventional radiology; Hemorrhage; Computed tomography; Thoracic Trauma

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