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Mycotic aneurysm of the distal radial artery after cardiac catheterisation

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SUMMARY

A mycotic aneurysm of the distal radial artery following access for cardiac catheterisation is a rare complication that has not been described in the literature. We present the case of an 84-year-old man who developed bacteraemia and cellulitis over his left first dorsal webspace 2 days after undergoing cardiac catheterisation through the distal radial artery at the anatomic snuffbox. Ultrasound scanning and CT imaging were concerning for a possible pseudoaneurysm at that location. Once we confirmed that the patient had adequate flow through his hand with angiography and an Allen's test, we explored his left hand and found a mycotic aneurysm of the distal radial artery with surrounding frank purulence. We resected the aneurysm and ligated the artery. Pathology confirmed that this was a mycotic aneurysm. The patient quickly recovered from his infection after this definitive treatment.

BACKGROUND

Infected distal radial artery pseudoaneurysms or aneurysms following radial artery access for arterial monitoring or cardiac catheterisation are exceedingly rare, and the literature is sparse on this topic. The exact prevalence of infected pseudoaneurysms or mycotic aneurysms of the radial artery is unknown. However, the rate of radial artery pseudoaneurysm at the level of the wrist after radial artery cardiac catheterisation ranges from 0.03% to 0.009%.[1 2] When radial artery pseudoaneurysms do occur, they are often associated with *Staphylococcus aureus* bacteraemia.[3] Although this phenomenon is rare, infected pseudoaneurysms or aneurysms of the radial artery can lead to potentially life-threatening or limb-threatening complications.

Figure 1 Cellulitis and fluctuance of the left hand, first dorsal webspace with visible puncture site.

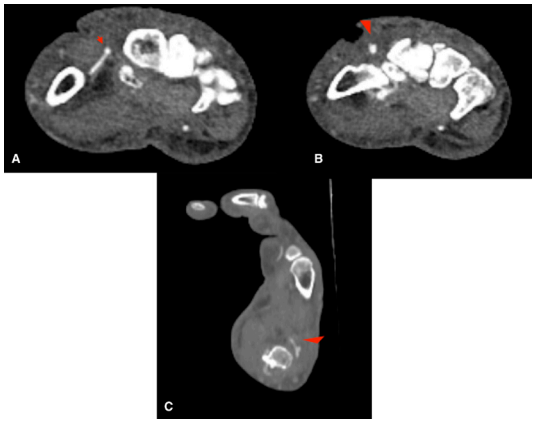

Figure 2 CT angiogram of the left hand of the outpouching of the distal radial artery. (A) Axial image of the neck (red arrow); (B) axial image of the outpouching (red arrow) and (C) coronal image of the neck and outpouching (red arrow).

We report the case of an 84-year-old man who presented with left dorsal hand cellulitis and methicillin-resistant *Staphylococcus aureus* (MRSA) bacteraemia 2 days after undergoing cardiac catheterisation and percutaneous intervention (PCI) of the right coronary artery with balloon angioplasty and stenting through the left distal radial artery. Imaging studies demonstrated a concerning outpouching of the distal radial artery at the site of catheterisation.

CASE PRESENTATION

The patient is an 84-year-old, right-hand dominant man with a complex medical history including coronary artery disease with prior coronary artery bypass and prior stents on clopidogrel, heart failure with reduced ejection fraction, atrial fibrillation on apixaban and poorly controlled type II diabetes who underwent cardiac catheterisation and PCI with balloon angioplasty and stenting of his right coronary artery at the San Francisco Veterans

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Affairs Medical Center. The cardiologists accessed his left distal radial artery, at the level of the anatomic snuffbox, using a 6F sheath using sterile technique. After the catheter was removed, a pressure band was applied to the distal radial arteriotomy site for 2 hours for haemostasis. After the procedure, he resumed his usual dosing of clopidogrel and apixaban. There were no complications during the procedure, and he was kept in the hospital overnight for observation and subsequently discharged home in good condition.

One day after discharge, he re-presented with left-hand cellulitis, fevers, leukocytosis (19.5 K/mm^3) and MRSA bacteraemia. He was initially treated with intravenous vancomycin. An ultrasound scan of his left hand showed a distal radial artery outpouching measuring 2 mm×3 mm with a 1 mm neck, which was suggestive of a pseudoanuerysm. This was initially managed with compression of the artery. Additional work-up included echocardiography which ruled out endocarditis. The plastic and reconstructive surgery team was consulted for management of this complicated hand cellulitis. He was noted to have significant oedema, erythema and a pulsatile mass around the radial artery access point on the dorsum of his first webspace. He was able to move all fingers but had significant tenderness, especially with thumb movement and palpation. On hospital day 3, he had increasing pain and swelling on the dorsum of his left hand with a worsening leukocytosis of 21.2 K/mm^3 despite antibiotic therapy. Additionally, he was febrile to 102.7°F and developed a new oxygen requirement. His examination was notable for fluctuance on the dorsum of his hand around the radial artery access site, worsened erythema and exquisite tenderness to palpation (figure 1). The plastic surgery team performed a bedside incision and drainage under ultrasound guidance which yielded purulent fluid.

Over the course of the next 36 hours, the patient's objective data improved with resolution of his oxygen requirement, leukocytosis and fevers. However, tenderness, erythema and oedema at the prior abscess site persisted. A CT angiogram of the left upper extremity was performed to evaluate for deeper fluid collections and the state of the presumed distal radial artery pseudoaneurysm, which had not changed in size (figure 2). Although there was no discreet fluid collection, he did have oedema and inflammation of the first dorsal interosseus muscle. He was taken to the operating room for exploration of his left hand.

TREATMENT

A preoperative Allen's test was reassuring for collateral flow to all fingers from the ulnar artery. However, a left upper extremity angiogram was still performed prior to the exploration to ensure that the index finger and thumb would maintain perfusion if the distal radial artery was ligated and the pseudoanuerysm excised. If perfusion to the thumb and index finger could not be maintained, then the angiogram could also identify possible distal targets for a bypass. The vascular surgery team performed a left upper extremity angiogram which showed a dilation of the distal radial artery right before entering the deep palmar arch as well as a distal target for possible bypass as it branched into the first and second dorsal metacarpal arteries (figure 3). Additionally, an Allen's test was performed by occluding the radial artery and assessing the flow through the deep palmar arch and hand via the ulnar artery, which confirmed adequate perfusion to the index finger and thumb (figure 4). Once collateral flow was confirmed, the hand was explored under regional anaesthesia. An extended incision was made over the dorsum of the first webspace where a large amount of purulent fluid was expressed from a pocket

Figure 3 Left-hand angiogram with an arrow marking a dilation of the distal radial artery at the level of the anatomic snuffbox.

deep within that space. On further dissection, we encountered the distal radial artery which had a true aneurysmal dilation (figure 5). The dilated portion of the artery was filled with purulent fluid and there was a pocket of purulence surrounding the aneurysms and within the interosseus muscle. The aneurysm was ligated proximally and distally using 3-0 silk ties and excised. His index finger and thumb maintained perfusion. The wound was washed with 6 L of normal saline. Once haemostasis was obtained, the wounds were packed with gauze and wrapped in a gauze roll. He was transferred to the ward in stable condition.

Figure 4 Left-hand angiogram during Allen's test where the radial artery is occluded. Adequate flow through the ulnar artery and deep palmar arch to the thumb and index fingers is shown.

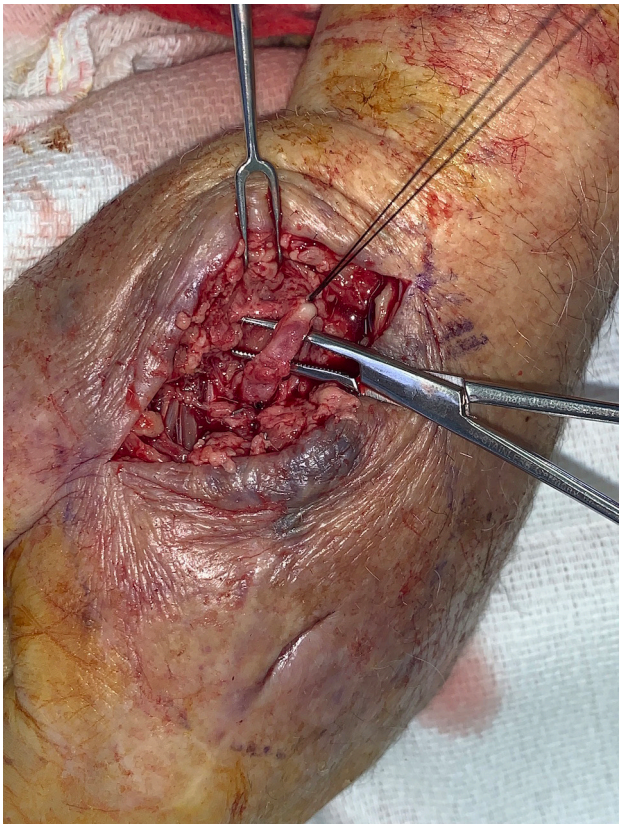

Figure 5 Intraoperative photograph of the exploration showing the mycotic aneurysm of the left distal radial artery.

OUTCOME AND FOLLOW-UP

On postoperative day 1, he had decreased erythema, oedema and pain in his left hand. Over the course of the next 3 days, this continued to improve until he had complete resolution of the cellulitis over the dorsum of his left hand (figure 6). Final tissue pathology showed a mycotic aneurysm of the distal radial artery. Tissue culture from the aneurysm was positive for MRSA sensitive to vancomycin. He was discharged from the hospital on postoperative day 5 on a 4-week course of intravenous vancomycin for his MRSA bacteraemia and wound packing for two times per day. The patient was evaluated in clinic 2 weeks after discharge and the hand was healing as expected by secondary intention.

Figure 6 Postoperative photograph after resolution of the infection.

DISCUSSION

We present the management of an 84-year-old man who developed a left-hand infection and MRSA bacteraemia following left distal radial artery catheterisation with imaging studies showing an outpouching of the artery concerning for a pseudoanuerysm. The patient was initially managed conservatively. The infection failed to resolve, and he was taken to the operating room for exploration and had a mycotic aneurysm of the distal radial artery which was excised. The distal radial artery was ligated after confirmation of collateral flow through the deep palmar arch via the ulnar artery with a left upper extremity angiogram. This is the first case report of the management of a distal radial artery mycotic aneurysm following a newer cardiac catheterisation technique.

Aneurysms and pseudoaneurysms differ fundamentally in their composition. Although an aneurysm is a dilation of the arterial wall including all three layers (tunica intima, media and adventitia), pseudoaneurysms are outpouchings of the artery that are contained with scar and fibrous tissue.[4] Pseudoaneurysms and aneurysms of the upper extremity are rare and almost always arise secondary to trauma or iatrogenic causes. Pseudoaneurysm formation after radial artery cannulation has been well-described and is a known complication of radial artery cannulation.[2 5]

The use of distal transradial access (DRA) at the anatomic snuffbox for cardiac catheterisation procedures has been growing in popularity. This approach has the advantages of decreased time to haemostasis, theoretical reduced risk of hand ischaemia and avoids the risk of bleeding associated with femoral approaches.[6] In this particular case, DRA was used because the patient was on apixaban for atrial fibrillation and clopidogrel for his coronary artery disease and this approach has a decreased risk of bleeding. Complications and puncture site outcomes following DRA are limited due to its novelty.[6] A partial occlusion rate of 1% and an arteriovenous fistula rate of 0.5% of the distal radial artery have been reported.[6] One large series (n=10 324) reported one non-infected radial artery pseudoaneurysm (<0.009%), which required surgical repair, though no further surgical details or techniques were given.[2] There have been no prior reports of the diagnosis and treatment of a mycotic aneurysm of the distal radial artery at the anatomic snuffbox due to the DRA approach. As this approach continues to gain popularity, cardiologists and hand surgeons should be aware of its sequelae, even if rare.

The term mycotic aneurysm was first coined by Sir William Osler in 1885 when describing a patient with endocarditis and refers to an aneurysm that forms due to an infection.[7] In general, mycotic aneurysms are caused by bacterial invasion into the blood vessel wall and are more common in patients with diabetes, AIDS, malnutrition, cirrhosis or a pre-existing arterial luminal defect.[8] In the upper extremity, mycotic aneurysms most commonly arise in the brachial artery secondary to intravenous drug abuse (IVDA). Catheterisation procedures or prosthetic valve endocarditis are other common inciting factors. Infections of the radial artery are most commonly secondary to arterial line placements. Overall, bacterial endocarditis is the most common source for mycotic aneurysms, although arterial trauma is usually the cause.[9] *S. aureus* is the most commonly isolated organism;[10] however, microorganisms are only recovered from approximately 25% of cases.[9] In this particular case, we postulate that the MRSA bacteria was introduced into the bloodstream at the time of DRA in a patient who was at high-risk for developing

an infection given his comorbid conditions. The aneurysm likely developed due to iatrogenic trauma to the distal radial artery during catheterisation.

The clinical features of mycotic aneurysms depend on the duration of infection, patient comorbidities and anatomic location. At least one sign of systemic infection is normally present, including fever, elevated erythrocyte sedimentation rate, leukocytosis or fulminant sepsis. Localised pain or a pulsatile mass may be present. Mycotic aneurysms in superficial locations, such as the radial artery, may be easily misdiagnosed as abscesses or cellulitis given the common association of soft tissue infection overlying the infected vessel.[11] The patient history of recent invasive procedure or IVDA may help increase the index of suspicion, but the generalised non-specific symptoms usually require imaging to assist in the diagnosis.[12 13] Doppler sonography may diagnose an aneurysm of a peripheral artery, but cannot distinguish between infected and non-infected aneurysms.[14] Peripheral mycotic aneurysms are best evaluated with CT or magnetic resonance angiograms.[14] The treatment of mycotic aneurysms requires removal of infected tissue which involves surgical resection of the mycotic aneurysm and ligation or reconstruction of the artery with an autogenous graft.[5 10] If left untreated, these aneurysms can lead to rupture, septic embolisation or fulminant sepsis.[5]

Learning points

- Mycotic aneurysms of the distal radial artery following access for cardiac catheterisation are a rare complication that has not been described in the literature.
- This complication should be suspected in patients with comorbid conditions including poorly controlled type II diabetes who have persistent signs of infection despite antibiotic therapy and drainage of any superficial abscesses who have concerning findings for pseudoaneurysm or aneurysm on imaging.
- Because the mycotic aneurysm can cause persistent infection and methicillin-resistant *Staphylococcus aureus* bacteraemia, surgical resection with distal radial artery ligation (after confirmation of distal flow) is necessary.

Contributors All authors participated in the clinical care and surgery for this patient. The senior author, SLH, was the senior surgeon for this case. The corresponding and first author, ABN, organised the paper, collected the consent and photographs, performed the literature search and drafted and revised the paper. Second author, MR, also contributed to the literature search, drafting and revising the paper.

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