

# Radial Artery Pseudoaneurysm Following Transradial Artery Coronary Angiography: A Case Report

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## ABSTRACT

**OBJECTIVE:** This report aims to raise physician clinical awareness of radial artery pseudoaneurysm (RAP) and promote early recognition of this potentially serious complication. The article highlights various proposed treatment strategies in the management of this condition.

**BACKGROUND:** Radial artery pseudoaneurysm is a rare potentially serious complication following transradial artery coronary angiography for left heart catheterization and percutaneous coronary intervention. Risk factors associated with the development of RAP include multiple arterial puncture attempts, use of systemic anticoagulation, inadequate hemostasis following post-procedural compression, vascular site infection, use of larger sheaths, female gender, age of 70 years and older, diabetes mellitus, obesity and/or patients with high body mass index.<sup>1-3</sup> Conservative medical treatment and/or surgical repair are the primary therapeutic approaches in the management of RAP.

**CONCLUSION:** Transradial artery access is associated with a significantly lower risk of major bleeding and vascular access site complications, reduces morbidity and mortality compared with the transfemoral approach. It is important to recognize though that complications do still occur with the transradial approach. RAP is one such entity wherein prevention is key - with adequate post-procedural compression, frequent observation, and careful assessment of the radial access site.

**Keywords:** Coronary intervention, Pseudoaneurysm, Radial artery, Transradial

## CASE PRESENTATION

The patient is an 82-year old female with known essential hypertension, diabetes mellitus type 2, prior history of stroke, peripheral artery disease, and recently diagnosed Takotsubo Cardiomyopathy. She was admitted for acute abdominal pain and with persistent atrial fibrillation, non-specific ST-T changes, and an old anteroseptal wall myocardial infarction on the electrocardiogram (*Figure 1*). The patient's initial therapy included apixaban which was strongly indicated by a CHA<sub>2</sub>DS<sub>2</sub>-VASc score of 8 and a 10.8% per year risk of stroke.<sup>4</sup>

A diagnostic coronary angiogram was performed via a right transradial artery approach with a 5F catheter system

and unfractionated heparin 3,000 units administered intra-arterially upon cannulation. The pre-procedure prothrombin time INR was 1.16. The coronary angiogram revealed no significant obstructive lesion and a widely patent proximal left anterior descending artery stent which was previously implanted for non-STEMI 9 years ago. After completion of the uncomplicated procedure, the vascular sheath was removed immediately and a Terumo Trans-Radial (TR) Band™ compression device was applied for 4 hours. She was eventually diagnosed to have Takotsubo cardiomyopathy, apical ballooning variant documented on transthoracic 2D echocardiography and with persistent atrial fibrillation. The following day, she was discharged asymptomatic, with established good hemostasis of the radial artery access site. The patient presented 6 weeks later during routine clinic follow-up with a painless, pulsatile swelling at the radial artery puncture site which she first noticed several days prior. She did not complain of any pain or paresthesia on her hand. There were no other intervening clinic consults. Radial artery pulse was full, with no bruit or no ecchymosis, the right hand was warm, no pallor, and no temperature or color disparity between the right and left hand. The swelling measured 1.1 by 1.2 cm (L x W) with a normal capillary filling of the digits (*Figure 2*). Interestingly, the patient revealed that she would several times daily use the

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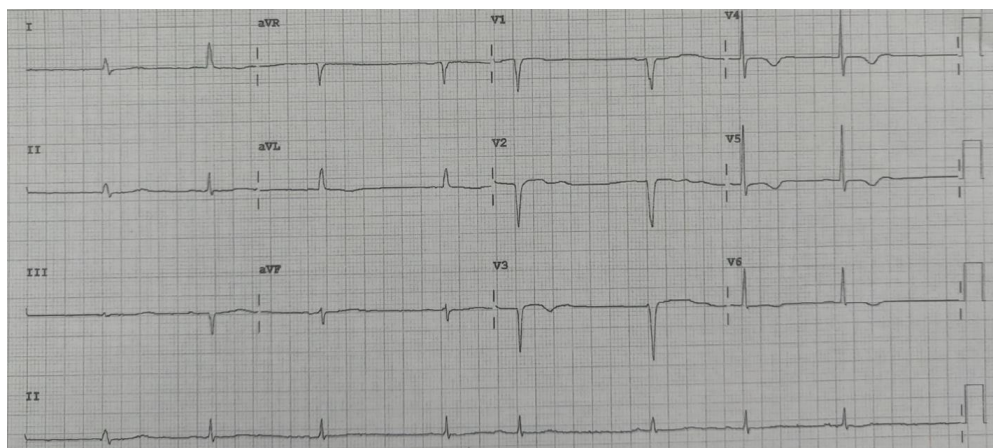


Figure 1. Electrocardiogram showing atrial fibrillation with slow ventricular response, poor r-wave progression across chest leads V1 to V3, minimal ST segment elevation in V1 to V3, and lateral wall myocardial ischemia



Figure 2. Radial artery pseudoaneurysm with close-up view prior to surgery

thumb and index fingers of her right hand during prayers with rosary beads.

Initial conservative medical management was adopted with a TR band carefully placed directly over the pseudoaneurysm and gradually inflated with 15mL of air sufficient to compress the swelling for 24 hours. Unfortunately, during overnight application of the compression device, the patient experienced intolerable pain at the access site and, as instructed, gradually

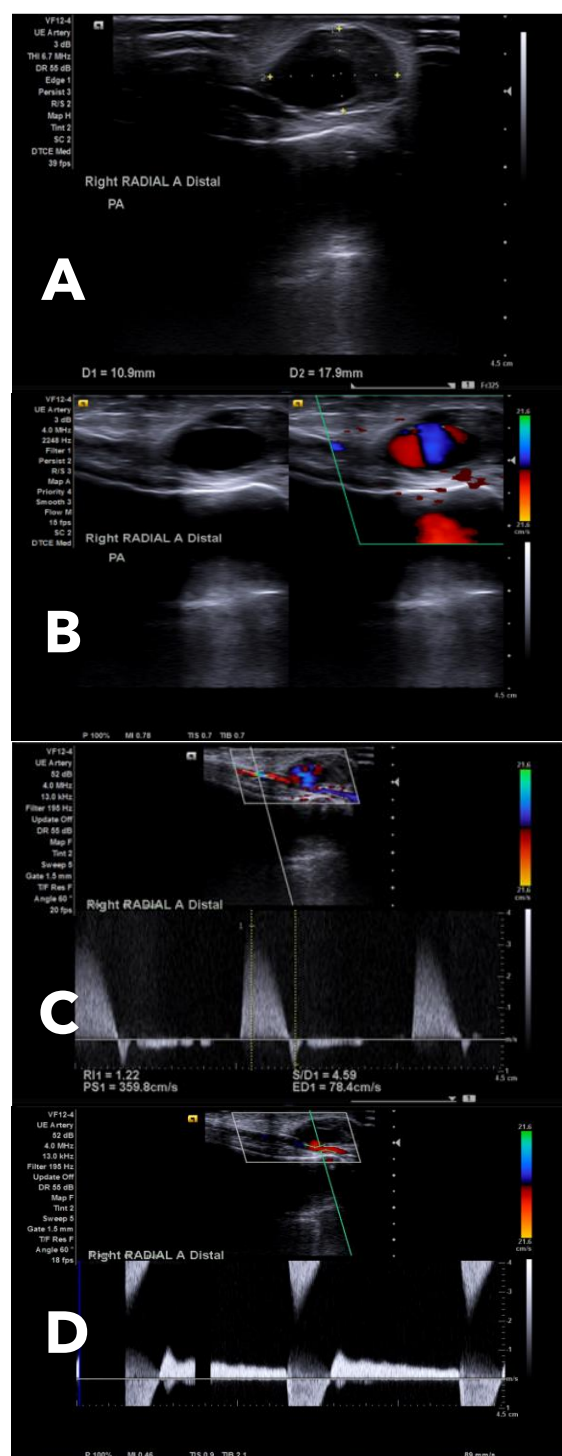
decreased the air in the compression balloon with good relief of the pain.

Upper extremity arterial duplex scan ultrasonography demonstrated a 1.15 X 1.87 cm (L x W) pseudoaneurysm with no neck and with partial thrombosis. (Figure 3) Apixaban was discontinued. Ultrasound-guided direct thrombin injection into the pseudoaneurysm was considered, but the absence of a pseudoaneurysm neck was deemed a high risk feature for the inadvertent downstream escape of thrombin to the distal circulation which could trigger thrombosis of the vascular bed of the digits.<sup>5</sup> The patient was referred to the vascular service for surgical excision of the pseudoaneurysm with embolectomy by insertion of a Fogarty catheter proximally to ensure vessel patency and optimal blood flow, followed by primary repair of the radial artery. The surgical site showed a clean wound and established good hemostasis. The patient was discharged and low dose apixaban at 2.5mg taken twice daily was resumed.

The pre-surgical pseudoaneurysm and hemodynamically significant stenosis several centimeters proximal to the pseudoaneurysm in the distal right radial artery were no longer evident in a repeat ultrasound performed 3 weeks post-surgical repair (Figure 4).

## DISCUSSION

The transradial artery access is increasingly the preferred technique adopted worldwide versus the traditional percutaneous femoral approach for cardiac catheterization and coronary intervention. Importantly, a transradial artery approach has significantly decreased the incidence of major bleeding and vascular access site complications and reduced major adverse cardiovascular events and mortality.<sup>6,7</sup> It allows for early discharge, reducing hospitalization costs, due to little to no post-procedural prolonged bed rest, allowing earlier patient ambulation.<sup>8</sup> However, vascular arterial complications following transradial artery access do still occur such as vascular access failure, hematoma formation, non-occlusive radial artery injury, and radial artery occlusion which are infrequent in high volume centers.<sup>9,10</sup>



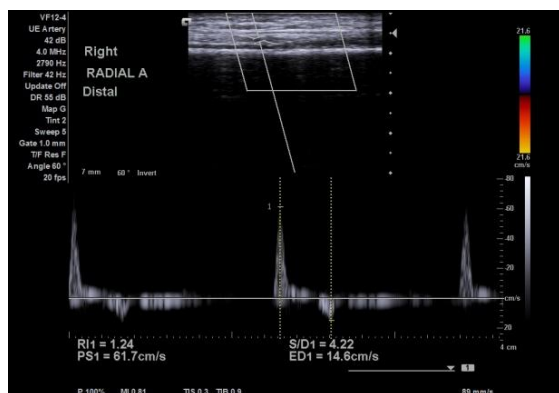
**Figure 3.** A. Right upper extremity ultrasonography showed a 1.09cm x 1.79cm dilatation in the right distal artery with a hyperechoic intraluminal density in the periphery. B. Doppler study showing the turbulent forward and backwards flow or “yin-yang sign” characteristic of a pseudoaneurysm with partial thrombosis. C. Increased peak systolic velocities with turbulent color flow in the right distal radial artery proximal to the pseudoaneurysm. D. The classic “to and fro” pattern characteristic of a pseudoaneurysm.

RAP is one such vascular access site-related complication. Although the incidence of the condition is rare, it may lead to significant morbidity or even mortality, if not promptly recognized and adequately addressed. A pseudoaneurysm occurs when a hematoma communicates with the arterial lumen.<sup>1</sup> It is characterized as a hole through all layers of the arterial wall resulting in extravasation of blood which is then enclosed by surrounding soft tissue creating a false sac.<sup>1,11</sup> The RIVAL (Radial versus femoral access for coronary intervention) trial investigators found that one significant major vascular complication was pseudoaneurysm requiring closure, with an incidence of only 0.2% which suggests that the complication is quite rare.<sup>12</sup> It is due to trauma from invasive procedures such as arterial catheterization,<sup>3</sup> with the majority of cases being iatrogenic in etiology.<sup>11</sup>

Risk factors predisposing to the development of RAP include multiple arterial puncture attempts, use of anticoagulation, inadequate hemostasis following post-procedural compression, vascular site infection, use of larger sheaths, female gender, age of 70 years and older, diabetes mellitus, and obesity or patients with high body mass index.<sup>1-3</sup> A case series compiled by Zegri et al. in 2015 with 5 case reports showed that the most common factor was the use of anticoagulation (warfarin).<sup>13</sup> In our case, the patient is an elderly 82-year old female who required several radial artery puncture attempts before successful cannulation of the vessel, who post-procedure was on chronic apixaban anticoagulation which was indicated by the presence of Takotsubo Cardiomyopathy and persistent atrial fibrillation. Additionally, upon follow-up, the patient disclosed her routine practice of praying several times daily with the use of rosary beads which places stress on the right wrist which may or may not have contributed to the formation of the RAP. A 5-French catheter sheath was used during the procedure which may also have predisposed our patient to develop a pseudoaneurysm. Post-procedure hemostatic compression using a TR band (for 4 hours) followed by application of pressure dressing for 24 hours was performed to avoid hematoma formation and to ensure appropriate hemostasis.

Careful observation of the radial access site should be performed routinely after cardiac catheterization. The approach to management of RAP depends on the clinical presentation of the individual patient. Vascular arterial ultrasound is the initial preferred diagnostic imaging tool to determine the extent and severity of the pseudoaneurysm, and may be employed during manual or pneumatic balloon TR band compression. Vascular ultrasound is invaluable during a treatment strategy with ultrasound-guided injection of thrombin to trigger thrombosis of the pseudoaneurysm.<sup>11</sup> Patients can be managed initially conservatively, or if indicated, by surgical repair. Conservative medical measures include use of external compression devices, discontinuation of anticoagulation when clinically appropriate, and also percutaneous ultrasound-guided direct thrombin injection of the pseudoaneurysm (dose range between 50 and 2000 U) to promote thrombotic obliteration of the aneurysm after an initially unsuccessful prolonged





**Figure 4.** Repeat Doppler ultrasonography 3 weeks after surgery showed the absence of previously noted pseudoaneurysm.

pneumatic balloon TR band compression.<sup>5,13</sup> The use of prolonged compression via trans-radial bandage applied against the radial artery proximal to the pseudoaneurysm or careful manual prolonged compression may also successfully collapse and obliterate the pseudoaneurysm. Palpation of the radial artery during access site compression should routinely be performed to assure integrity of the pulse. Careful gradual compression is warranted since potential iatrogenic rupture with catastrophic consequences may occur.<sup>14</sup> There is no definitive time duration suggested for successful compression which may range from 6-8 hours to more than 72 hours.<sup>5</sup> Vascular surgery is indicated when there is presence of local site infection, failure of other conservative therapies, rapid expansion or enlargement of the pseudoaneurysm, skin necrosis, compartment compression syndromes, neuropathy or critical limb ischemia.<sup>11,15</sup>

In our patient, an overnight prolonged compression of the pseudoaneurysm with a TR band was the initial management. Unfortunately, the patient was unable to tolerate the planned overnight compression device due to the intolerable pain. Ultrasound-guided direct thrombin injection into the pseudoaneurysm was entertained. However, absence of a pseudoaneurysm neck was deemed a high risk feature for inadvertent downstream escape of thrombin distally which could trigger thrombosis of the arteries of the digits.<sup>5</sup> The patient was thus advised surgical repair, which was well tolerated, and was sent home stable 2 days later.

## CONCLUSION

Although a rare but potentially serious complication, RAP developed in our patient who had multiple risk factors associated with development of the condition. To our knowledge, this is the first case of radial artery pseudoaneurysm at our institution. It is important to stress meticulous application of management strategies toward prevention of RAP is crucial. Post-procedural adequate compression with regular observation and careful assessment of the radial access sites should be routinely performed in vulnerable patients with multiple risk factors

for the development of pseudoaneurysm, particularly in patients requiring chronic systemic anticoagulation therapy for other conditions. Prompt diagnosis and timely individualized corrective intervention based on the patient's clinical presentation is warranted.

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