VDM Vascular Disease Management

CASE REPORT WITH REVIEW

Iatrogenic Radial Arteriovenous Fistula After Coronary Angiography

A Case Report and Literature Review

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Abstract

Transradial access has become the standard of care for coronary angiography. Iatrogenic radial arteriovenous fistula (AVF) is a rare access site complication. Management options in literature have been poorly described. Herein we review the management of radial AVF and describe a case of an otherwise healthy man who developed a radial AVF after coronary angiography.

Case Report

Our patient is a 42-year-old man with a history of prior tobacco use but good functional status who presented with a 1-day history of back pain. He was found to have ST-segment elevation in the inferior and lateral EKG leads, prompting a left heart catheterization. Via radial access with a 6F sheath, a drug-eluting stent was placed in the right coronary artery. After the procedure, the patient had an uneventful postoperative course and was discharged home on post procedure day 1 with aspirin, ticagrelor, atorvastatin, and metoprolol tartrate.

Figure 1. Iatrogenic radiocephalic arteriovenous fistula, right dorsal wrist.

Twenty-two months after his catheterization, he was noted to have a mass on the volar aspect of his right wrist that was associated with pain on exertion (**Figure 1**). A thrill and bruit were present on physical exam. An arterial duplex and computed tomography angiography (CTA) demonstrated a 9 mm x 5 mm x 19 mm aneurysmal dilation of a radial artery branch associated with arteriovenous fistula (AVF) (**Figure 2**). An arteriogram was performed via the right femoral artery, which demonstrated an AVF from the distal radial artery into the radial veins with drainage into the cephalic vein. There was no evidence of pseudoaneurysm. Compression of the radial artery at the site of the AVF resulted in reconstitution of the distal radial artery via collateralization of the interosseous arteries and palmar arch. Additionally, there appeared to be a short segment venous occlusion with venous collateralization of arterial flow through cephalic

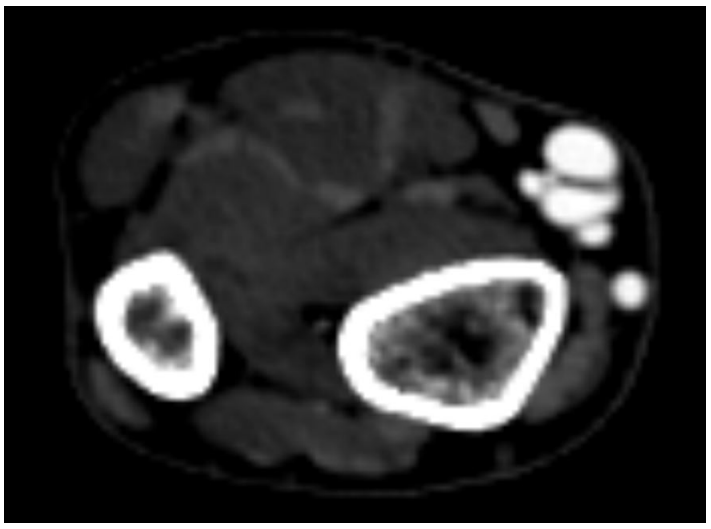

Figure 2. Axial cut of computed tomography angiogram of radial artery communicating with cephalic artery via pseudoaneurysm.

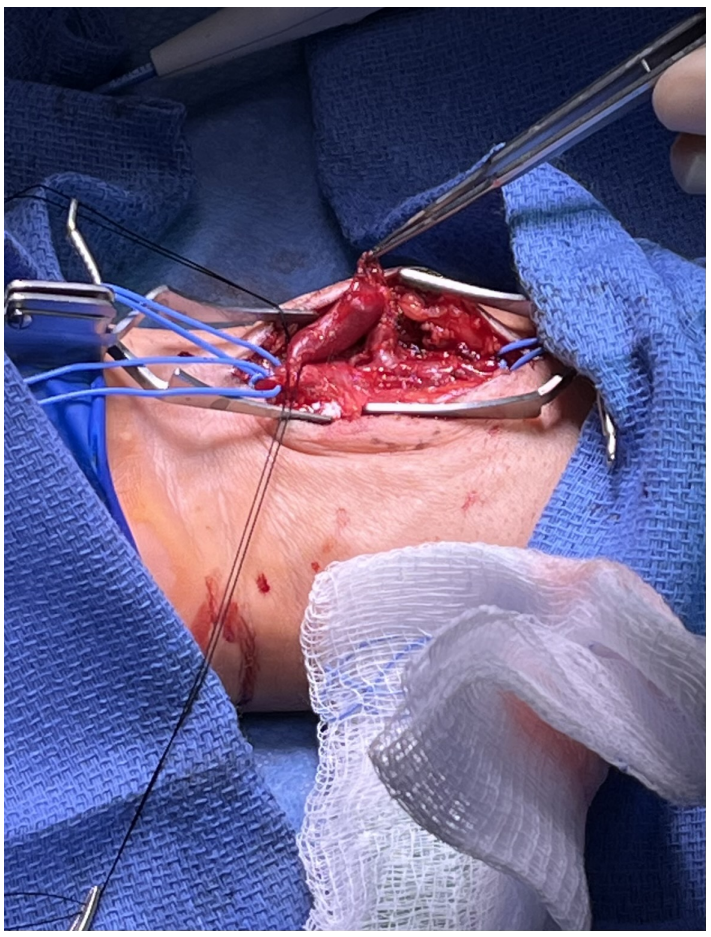

Figure 3. Intraoperative clinical image of aneurysmal sac, isolated.

and median antecubital vein tributaries. It is possible this venous obstruction was caused at time of coronary catheterization with a transradial compression band and contributed to the pressure gradient causing dilation of the arteriovenous fistula.

Due to the symptomatic nature and persistent AVF, the decision was made to pursue open repair with AVF ligation. Direct exposure of the distal radial artery was performed and the aneurysmal sac was isolated (**Figure 3**). The arterial inflow and venous outflow collaterals were ligated. The aneurysmal sac was then resected and sent for histologic examination, which revealed benign vessel and connective tissue. The radial artery remained intact and distal flow demonstrated with doppler post-ligation of arteriovenous fistula. The patient was discharged from the post anesthesia care unit after the procedure. Postoperative follow up was without any complications.

Discussion

Transradial access has become a standard approach for many endovascular procedures. Due to fewer access related complications than transfemoral access, it offers several benefits including mortality benefit in patients with acute coronary syndromes, improved patient comfort, and cost savings.[1] In 2011, Jolly et al. performed a randomized clinical trial comparing transfemoral to transradial approaches for percutaneous coronary intervention (PCI). The authors found no difference in primary outcome (composite of death, myocardial infarction, stroke, non-coronary artery bypass graft-related major bleeding) at 30 days, but a significantly increased rate of major vascular complications (large hematoma, pseudoaneurysm needing closure, AVF, or ischemic limb needing surgery) in the transfemoral group, 3.7% compared to 1.4% with transradial. No AVF were seen in the transradial group (n = 3507) compared to 5 in the transfemoral group (n = 3514, 0.1%).[2]

With the recent trend toward radial access for peripheral and vascular interventions, this case demonstrates the importance of recognizing the risk of radial access. Although rare, iatrogenic AVF after PCI has been reported in the literature and is a known risk (**Table**).[3-19] Demographically, the median and mean ages were 62 and 63.8 years, respectively, with a 2.2:1 male predominance. This is consistent with the overall trends of PCI including a mean age of 65 and 2-to-1 male-to-female predominance.[20] Risk factors for transfemoral pseudoaneurysm after PCI, which should only be applied to transradial with caution, include female sex, age greater than 60 years, hypertension, prolonged coumadin use, and high heparin dosage.[6] Due to the small sample of available cases with limited data available, statistical analysis to search for predisposing factors would be impractical.

Table. Prior case reports and series of iatrogenic radial artery AV fistulas after transradial coronary angiography.

First author	Year	Age	Sex	Timing	Chief complaint	Exam	Imaging	Intervention	Outcome
Pulikal	2004	64	M	5 weeks	Dilated superficial veins	Thrill	US	Surgery	NS
Spence	2009	61	M	1 year	Painless enlarging, pulsatile swelling	Thrill	US	Surgery	NS

Kwac	2010	67	M	1 year	3 cm palpable wrist mass	Bruit, thrill, edema	US, CTA	Surgical ligation	NS
Na	2012	61	F	11 months	Dilated superficial veins	Thrill	US, CTA	Fistulectomy, tract ligation, closure of arterial site	Success
Dehghani	2013	62	M	1 month	“Swishing” sensation in forearm	Thrill	US	Conservative	Sustained resolution at 1 year
Dutton	2014	61	F	1 month	Wrist/hand pain	Thrill	US	Surgical resection with radial artery repair	Success
Regueiro	2014	56	M	9 months	Wrist pain	Pulsatile mass with thrill	US	Failed conservative, endovascular stenting	Success
Hashimoto	2015	61	M	6 days	Wrist swelling	Bruit	US, Agram	24 hours TR band at 70 mm Hg	Sustained resolution at 7 months
Novotny	2016	61	M	1 year	Palpable painful mass	Bruit	US	Failed percutaneous thrombin embolization x 2, underwent surgical resection	Success
Moorthy	2017	62	F	3 months	Dilated superficial veins	Thrill	US, Agram	Conservative	NS
Minhas	2019	58	M	3 days	Wrist ache/warmth	NS	US	Wrist pressure device resulted in recurrence, underwent endovascular embolization	Success
Oliveira	2019	86	M	1 year	High-output heart failure	Thrill	US	Surgical repair	Clinical resolution of heart failure at 60 days
Mehta	2020	74	M	1 day	Wrist pain	Thrill	US	Conservative	Sustained resolution at 12 months
Herzallah	2021	85	M	2 months	High-output heart failure, wrist pain	Thrill	US	Surgery	Success
Maeba	2022	71	M	1 day	Hand pain, coolness	Thrill, dilated vein, cool hand	US, CT	Surgical resection with radial artery repair	Sustained resolution at 6 months
Gu	2022	73	F	Several months	Forearm swelling, numbness of digits 1-3	Thrill, motor/ sensory impair ment of digits 1-3	US, CTA	Fistula ligation, radial artery reconstruction	Neurologic recovery by 20 months

Okam	2023	51	F	6 months	Parasthesias	NS	US	NS	NS
	2023	72	F	2 years	Increased pulse	NS	US	NS	NS
Allsbrook/ Petrochko	2023	42	M	1.8 years	Wrist mass	Bruit, thrill	US, CTA	Aneurysmectomy, fistula ligation	Success

The most common presenting complaints were pain (37%, n = 7), swelling/mass (32%, n = 6), or dilated veins (16%, n = 3). Less common presenting complaints included neurologic (11%, n = 2), high-output heart failure (11%, n = 2), “swishing” sensation in forearm (5%, n = 1), subjective increased pulse relative to contralateral upper extremity (5%, n = 1), warmth (5%, n = 1), and coolness (5%, n = 1). Authors note that multiple patients had several presenting complaints.

The timing of presentation varies considerably (1 day to 2 years) but seems to have a bimodal distribution with 47% (n = 9) of patients presenting within 3 months after PCI, and 42% (n = 8) of patients presenting 9 months or longer from PCI. One patient presented at 6 months and another patient had unclear timing of presentation.

Initial treatment options described in literature include open surgical management, endovascular, and nonoperative. Initially surgical management was the most performed (53%, n = 10), followed by nonoperative (32%, n = 6), and then by an upfront endovascular approach (5%, n = 1). Two patients’ interventions were not specified. Success rate with upfront surgery was 100%. Of the 6 patients who underwent a trial of nonoperative management (compression, observation, or unspecified), 3 were successful (50%), 1 failed and successfully underwent endovascular stenting, 1 suffered recurrence and underwent endovascular embolization, and 1 outcome was unspecified. One patient underwent upfront endovascular intervention with percutaneous thrombin embolization twice with suboptimal results, and ultimately underwent successful surgical management.

The management of a patient with an iatrogenic radial artery AVF after radial access should be based on the patient’s presenting complaints, vascular anatomy, and surgical fitness, including usage of anticoagulant and antiplatelet medications. While surgery has the highest success rate, it should be noted many of these patients will likely be poor surgical candidates given recent PCI, and not all patients are good candidates for an operation under local anesthesia or monitored anesthesia care. In available literature, the only upfront attempt at endovascular intervention failed, but the 2 salvage endovascular procedures were successful. Based on the paucity of evidence, we conclude if the patient is an appropriate surgical risk, an open repair is most feasible because it is shown to be durable with the highest technical success. Alternatively, if patient has prohibitive risk factors, managing conservatively for an asymptomatic AVF or endovascularly for symptomatic disease are viable options. However, the patient should be counseled regarding the lower chances of success compared with upfront surgery.

Conclusion

Iatrogenic radial artery AVF after PCI is an uncommon complication that cardiovascular physicians should be aware of. The timing and nature of presentation are variable, but physical examination and ultrasound are generally sufficient to confirm the diagnosis. CTA may guide management by clarifying anatomy. The decision to pursue conservative, endovascular, or open management should be shared between the patient and provider, and when in doubt, a multidisciplinary discussion may be beneficial. ■

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