

A Rare Case of Bilateral Coronary Artery Fistula to Pulmonary Artery

Richard Casazza, MAS, RT(R)(CI); Arsalan Hashmi, MD; Jamie Meng, MD; Adil Pervaiz, MD

Coronary artery fistula is an abnormal vascular communication of coronary artery with cardiac chambers or any segment of the systemic or pulmonary circulation. The prevalence is 0.9% of all coronary anomalies. Coronary artery fistula arises from the right coronary artery in approximately 50.0% of patients, from the left coronary artery in approximately 42.0% of patients, and from both in approximately 5.0% of patients.¹ Low-pressure structures are the most common sites of drainage of the coronary fistulas.¹ Fistulas occurring between coronaries and the pulmonary artery are the most common form of fistula; they are usually congenital, but acquired forms have been reported. Coronary communications are present in 0.05% to 0.25% of patients who undergo coronary angiography, for varying reasons.² Patients that have significant left-to-right shunts can exhibit deleterious symptoms, including dyspnea and angina.

Case Presentation

A 63-year-old woman was referred to our hospital for diagnostic angiography. Her past medical history included hypertension, hyperlipidemia, and diabetes mellitus. She had undergone a coronary computed tomography (CT) angiography as

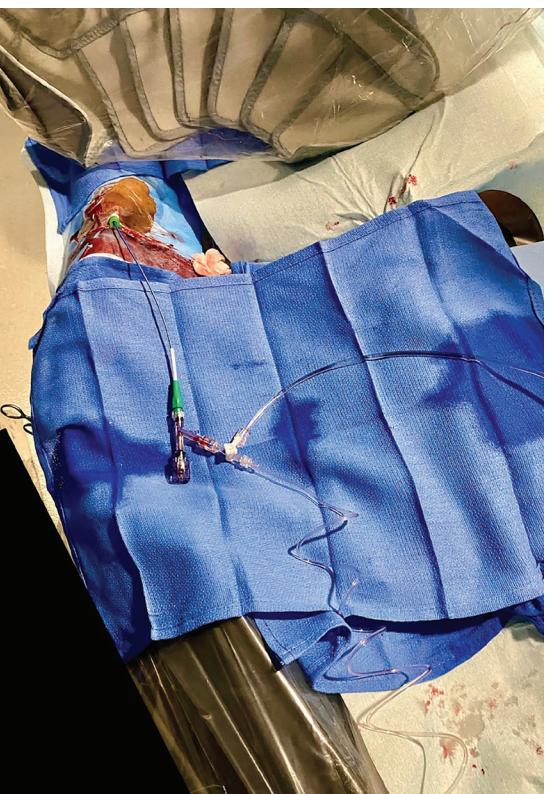


Figure 1. The HARRA method (hyper adducted right radial artery).³

an outpatient to evaluate worsening dyspnea on exertion. CTA showed right dominant coronary arteries, coronary calcium score of 381.9, and mixed composition plaque throughout the proximal to mid left anterior descending (LAD) coronary artery, resulting in up to 50% stenosis.

On arrival in the cath lab, her vital signs were unremarkable, with a heart rate of 84 beats/min, blood pressure of 134/78 mmHg, and oxygen saturation of 98% on room air. Physical examination and cardiac auscultation were unremarkable. Electrocardiogram showed sinus rhythm with rate of 85 beats/minute, with occasional premature ventricular beats and no acute ST-T changes suggestive of ischemia. Her complete blood count and basic metabolic panel were within normal limits.

She underwent a coronary angiogram via right radial artery approach utilizing the hyper adducted right radial artery (HARRA) method³ (Figure 1), with angiography showing a normal left main and left circumflex coronary artery. There was a 50% stenosis in the mid LAD and mid right coronary arteries (Figure 2). Angiography also revealed a

fistula connection between the proximal LAD and the left pulmonary artery, as well as the conus branch of the RCA and right pulmonary artery (Figures 3-5).

Different management options were discussed with the patient and the decision was made to treat the patient medically for the moment. Percutaneous intervention remains a viable option in the future.

Discussion

There are several forms of intervention used to treat coronary to pulmonary artery fistula. Management options include surgical closure, transcutaneous closure, or observation. Approach to treatment of coronary artery fistula depends on anatomy, location, size, symptoms, presence of other congenital anomalies, and the experience of the interventional cardiologist and surgeons. Common indications to close a coronary artery fistula include symptoms

Coronary communications are present in 0.05% to 0.25% of patients who undergo coronary angiography, for varying reasons.² Patients that have significant left-to-right shunts can exhibit deleterious symptoms, including dyspnea and angina.

mainly from heart failure and myocardial ischemia. Large fistulas with high-flow shunting in otherwise asymptomatic patients should be closed as well in order to prevent long-term complications.

Historically, surgical closure has shown excellent safety and long-term outcomes.^{4,5} A study in 2013 by Said et al showed that 11% of patients

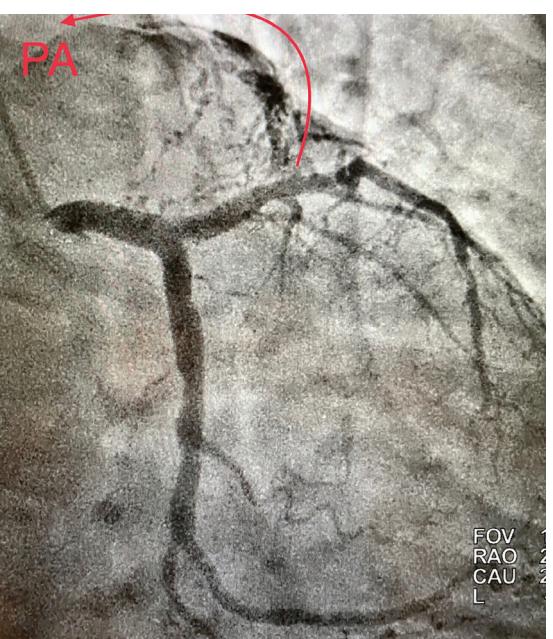


Figure 2. Left anterior descending (LAD) coronary artery to left pulmonary artery (PA) fistula.



Figure 3. Proximal right coronary artery (RCA) conus to right PA fistula.



Figure 4. Proximal RCA/conus to right PA fistula.



Figure 5. LAD to left PA fistula.

Conservative management is safe and should be carried out in asymptomatic patients. In symptomatic or complicated patients, however, percutaneous or surgical interventions are indicated.

with coronary artery fistula had postoperative myocardial infarction, because of low flow in the dilated coronary artery proximal to fistula closure.⁶

Catheter closure has become increasingly popular since its first description in 1983.⁷ Catheter closure techniques include coils, covered stents, detachable balloons, polyvinyl alcohol foam, double umbrellas, the Amplatzer Duct Occluder (Abbott Vascular), and the Amplatzer Vascular Plug (Abbott Vascular). A retrospective review of catheter closure of 45 patients with 56 coronary artery fistulae from 1997-2018 at Mayo Clinic showed acute procedural success in 89.3% of patients and 17.8% of patients had complications such as device migration, intracranial hemorrhage from anticoagulation use, and myocardial infarction. Among the 45 patients, 71.4% had embolization coils, 17.8% had vascular occluders, and 3.6% had covered stents.⁸

Safety and efficacy of transcatheter closure of coronary artery fistula was studied in another review of 35 procedures in 33 patients, including coils in 28 patients, umbrella devices in 6 patients, and a Gianturco-Grifka vascular occlusion device (Cook Medical) in 1 patient. Complete occlusion was accomplished in 82% of patients. Early complications included transient ST-T wave changes in 5 patients, transient arrhythmias in 4 patients, and single instances of distal coronary artery spasm, fistula dissection, and untrieved coil embolization. There were no deaths or long-term morbidity.^{9,10}

Of note, the HARRA (hyper adducted right radial artery) method has been shown to reduce operator radiation exposure compared with an abducted arm.¹¹ This method has become our default setup.

Conclusion

Bilateral coronary artery to pulmonary fistula is a very uncommon occurrence. Symptoms may develop resulting from a chronic left-to-right shunt, ischemia from coronary steal, or endocarditis.¹² Conservative management is safe and should be carried out in asymptomatic patients. In symptomatic or complicated patients, however, percutaneous or surgical interventions are indicated. Ultimately, management should be tailored to each patient according to their symptoms and quality of life. ■

References

1. Schicchi N, Fogante M, Oliva M, et al. Bilateral coronary-to-pulmonary artery fistulas associated with giant aneurysm in an elderly woman: case report and literature review. *Radiol Case Rep*. 2019 May 23; 14(8): 911-916. doi: 10.1016/j.radcr.2019.04.020
2. Lim JJ, Jung JI, Lee BY, Lee HG. Prevalence and types of coronary artery fistulas detected with coronary CT angiography. *AJR Am J Roentgenol*. 2014 Sep; 203(3): W237-W243. doi: 10.2214/AJR.13.11613
3. Casazza R, Truesdell AG. Hyper adducted right radial artery (HARRA) method to reduce radiation exposure and promote ergonomics. *Cath Lab Digest*. 2020 Apr; 28(4): 20-25. Accessed January 13, 2022. Available online at <https://www.hmpgloballearningnetwork.com/site/cathlab/content/hyper-adducted-right-radial-artery-harra-method-reduce-radiation-exposure-and-promote-ergonomics>
4. Urrutia-S CO, Falaschi G, Ott DA, Cooley DA. Surgical management of 56 patients with congenital coronary artery fistulas. *Ann Thorac Surg*. 1983 Mar; 35(3): 300-307. doi: 10.1016/s0003-4975(10)61563-9
5. Cheung DL, Au WK, Cheung HH, et al. Coronary artery fistulas: long-term results of surgical correction. *Ann Thorac Surg*. 2001 Jan; 71(1): 190-195. doi: 10.1016/s0003-4975(00)01862-2
6. Said SM, Burkhardt HM, Schaff HV, et al. Late outcome of repair of congenital coronary artery fistulas—a word of caution. *J Thorac Cardiovasc Surg*. 2013 Feb; 145(2): 455-460. doi: 10.1016/j.jtcvs.2012.11.028
7. Reidy JF, Sowton E, Ross DN. Transcatheter occlusion of coronary to bronchial anastomosis by detachable balloon combined with coronary angioplasty at same procedure. *Br Heart J*. 1983 Mar; 49(3): 284-287. doi: 10.1136/heart.49.3.284
8. El-Sabawi B, Al-Hijji MA, Eleid MF, et al. Transcatheter closure of coronary artery fistula: a 21-year experience. *Catheter Cardiovasc Interv*. 2020 Aug; 96(2): 311-319. doi: 10.1002/ccd.28721
9. Armsby LR, Keane JF, Sherwood MC, et al. Management of coronary artery fistulae. Patient selection and results of transcatheter closure. *J Am Coll Cardiol*. 2002 Mar 20; 39(6): 1026-1032. doi: 10.1016/s0735-1097(02)01742-4
10. Kulchetski RM, Lechinski LD, Dourado LOC, et al. Large bilateral coronary artery fistula: 10-year follow-up in clinical treatment. *Arq Bras Cardiol*. 2019 Feb; 112(2): 211-213. doi: 10.5935/abc.20180267
11. Sciahbasi A, Frigoli E, Sarandrea A, et al. Determinants of radiation dose during right transradial access: insights from the RAD-MATRIX study. *Am Heart J*. 2018 Feb; 196: 113-118. doi: 10.1016/j.ahj.2017.10.014
12. Yamamoto Y, Ushijima T, Takata M, Watanabe G. Surgical treatment of bilateral coronary-to-pulmonary artery fistulas. *Interact Cardiovasc Thorac Surg*. 2012 Jan; 14(1): 102-104. doi: 10.1093/icvts/ivr003

online at <https://www.hmpgloballearningnetwork.com/site/cathlab/content/hyper-adducted-right-radial-artery-harra-method-reduce-radiation-exposure-and-promote-ergonomics>

1. Schicchi N, Fogante M, Oliva M, et al. Bilateral coronary-to-pulmonary artery fistulas associated with giant aneurysm in an elderly woman: case report and literature review. *Radiol Case Rep*. 2019 May 23; 14(8): 911-916. doi: 10.1016/j.radcr.2019.04.020
2. Lim JJ, Jung JI, Lee BY, Lee HG. Prevalence and types of coronary artery fistulas detected with coronary CT angiography. *AJR Am J Roentgenol*. 2014 Sep; 203(3): W237-W243. doi: 10.2214/AJR.13.11613
3. Casazza R, Truesdell AG. Hyper adducted right radial artery (HARRA) method to reduce radiation exposure and promote ergonomics. *Cath Lab Digest*. 2020 Apr; 28(4): 20-25. Accessed January 13, 2022. Available online at <https://www.hmpgloballearningnetwork.com/site/cathlab/content/hyper-adducted-right-radial-artery-harra-method-reduce-radiation-exposure-and-promote-ergonomics>
4. Urrutia-S CO, Falaschi G, Ott DA, Cooley DA. Surgical management of 56 patients with congenital coronary artery fistulas. *Ann Thorac Surg*. 1983 Mar; 35(3): 300-307. doi: 10.1016/s0003-4975(10)61563-9
5. Cheung DL, Au WK, Cheung HH, et al. Coronary artery fistulas: long-term results of surgical correction. *Ann Thorac Surg*. 2001 Jan; 71(1): 190-195. doi: 10.1016/s0003-4975(00)01862-2
6. Said SM, Burkhardt HM, Schaff HV, et al. Late outcome of repair of congenital coronary artery fistulas—a word of caution. *J Thorac Cardiovasc Surg*. 2013 Feb; 145(2): 455-460. doi: 10.1016/j.jtcvs.2012.11.028
7. Reidy JF, Sowton E, Ross DN. Transcatheter occlusion of coronary to bronchial anastomosis by detachable balloon combined with coronary angioplasty at same procedure. *Br Heart J*. 1983 Mar; 49(3): 284-287. doi: 10.1136/heart.49.3.284
8. El-Sabawi B, Al-Hijji MA, Eleid MF, et al. Transcatheter closure of coronary artery fistula: a 21-year experience. *Catheter Cardiovasc Interv*. 2020 Aug; 96(2): 311-319. doi: 10.1002/ccd.28721
9. Armsby LR, Keane JF, Sherwood MC, et al. Management of coronary artery fistulae. Patient selection and results of transcatheter closure. *J Am Coll Cardiol*. 2002 Mar 20; 39(6): 1026-1032. doi: 10.1016/s0735-1097(02)01742-4
10. Kulchetski RM, Lechinski LD, Dourado LOC, et al. Large bilateral coronary artery fistula: 10-year follow-up in clinical treatment. *Arq Bras Cardiol*. 2019 Feb; 112(2): 211-213. doi: 10.5935/abc.20180267
11. Sciahbasi A, Frigoli E, Sarandrea A, et al. Determinants of radiation dose during right transradial access: insights from the RAD-MATRIX study. *Am Heart J*. 2018 Feb; 196: 113-118. doi: 10.1016/j.ahj.2017.10.014
12. Yamamoto Y, Ushijima T, Takata M, Watanabe G. Surgical treatment of bilateral coronary-to-pulmonary artery fistulas. *Interact Cardiovasc Thorac Surg*. 2012 Jan; 14(1): 102-104. doi: 10.1093/icvts/ivr003

Richard Casazza, MAS, RT(R)(CI); Arsalan Hashmi, MD; Jamie Meng, MD; Adil Pervaiz, MD
Maimonides Medical Center, Brooklyn, New York

Disclosures: Richard Casazza is Director of R&D for Tesslagra Design Solutions. Drs Hashmi, Meng, and Pervaiz report no conflicts of interest regarding the content herein.

The authors can be contacted via Richard Casazza, MAS, RT(R)(CI) at all4ugq@aol.com or @Tesslagra.