Pulmonary hypertension complicating unilateral absence of pulmonary artery and coronary-pulmonary artery fistula: Report of a case and review of the literature

Chen-Chieh Lin | Cho-Kai Wu | Ping-Hung Kuo

Department of Internal Medicine, National Taiwan University Hospital and National Taiwan University College of Medicine, Taipei, Taiwan

Correspondence
Ping-Hung Kuo, Department of Internal Medicine, National Taiwan University Hospital and National Taiwan University College of Medicine, No. 7, Zhongshan S. Rd., Zhongzheng Dist., Taipei 100, Taiwan.
Email: kph712@ntuh.gov.tw

Funding information
None

Abstract
This is a case report of a 53-year-old woman who presented to our hospital in 2011 with an intermittent cough and dyspnea for 5 years. The chest X-ray showed a prominent left hilum and a smaller right lung. Computed tomography (CT) of the chest confirmed the absence of the right pulmonary artery (PA) and the right cardiac catheterization showed a mean PA pressure of 34 mmHg. Concomitant asthma and unilateral absence of pulmonary artery (UAPA) were diagnosed. In the following years, her functional class remained stable under medications including low-dose sildenafil and spironolactone. In 2020, she developed mild intermittent chest tightness and the coronary angiography showed a fistula between the proximal left circumflex coronary artery and right pulmonary circulation. She declined further intervention for her coronary-pulmonary artery fistula (CPAF) and her symptoms improved spontaneously. To our knowledge, only 16 similar cases with combined UAPA and CPAF in adults have been reported in the literature, of which, pulmonary hypertension was documented in nine patients (56.3%).

KEYWORDS
coronary-pulmonary artery fistula, pulmonary hypertension, unilateral absence of pulmonary artery

CASE DESCRIPTION
A 53-year-old woman presented to our hospital in November 2011 with intermittent dyspnea, cough, exercise intolerance, and intermittent wheezes for 5 years. She was a nonsmoker and had a past history of hypertension, dyslipidemia, and moderate persistent asthma. The physical examination showed bilateral respiratory wheezing, and mild edematous lower limbs. The chest X-ray showed a prominent left hilum and a smaller right lung, and chest computed tomography revealed the absence of the right pulmonary artery (PA) and marked enlarged main PA (Figure 1a–c). Screening spirometry suggested a mild mixed ventilatory defect [values of FEV1 (forced expiratory volume in 1 s), FVC (forced vital capacity), and FEV1/FVC were 63.6% predicted, 70.5% predicted, and 0.76].

Guarantors: Chen-Chieh Lin and Ping-Hung Kuo.
An electrocardiogram revealed sinus rhythm with right axis deviation and right atrial enlargement. Echocardiography demonstrated normal left ventricular ejection fraction and the maximal tricuspid regurgitation pressure gradient was 49.4 mmHg. Right heart catheterization (RHC) revealed a mean PA pressure of 34 mmHg, a right atrial pressure of 7 mmHg, and a pulmonary artery wedge pressure of 10 mmHg (Table S1). The ventilation scintigraphy showed fair distribution bilaterally, but the perfusion scintigraphy revealed significant perfusion defect in the right hemithorax.

In the following years, her asthma was well-controlled by inhalation therapy. Echocardiography parameters and the N-terminal pro-brain natriuretic peptide (NT-pro BNP) levels were stationary (Table S2). A follow-up RHC in February 2017 revealed stable hemodynamics (Table S1), so she was treated with spironolactone and sildenafil (40–60 mg/day) for pulmonary hypertension. Her functional class remained stable; nevertheless, it is difficult to determine the clinical benefits of these agents since her transient chest symptoms were nonspecific and might be related to asthma.

In December 2020, she consulted a cardiologist at another hospital due to intermittent chest tightness. Serial cardiology examinations found no evidence of ischemic heart disease. However, the coronary angiography demonstrated a fistula communicating between the proximal left circumflex artery and the main PA (Figure 1d,e). She declined further intervention for the potential risks, and afterwards her symptoms resolved spontaneously. Her condition remained stable at the time of this report.
DISCUSSION

This report describes the long-term outcome of an asthmatic patient with concomitant unilateral absence of pulmonary artery (UAPA) and coronary-pulmonary artery fistula (CPAF). To our knowledge, only 16 similar adult cases have been reported in the literature and pulmonary hypertension was documented in 9 (56.3%) of them (Table S3).

UAPA is a rare congenital anomaly, with an overall incidence of approximately 1 in 200,000 individuals.1 The mechanism of agenesis is thought to be the rotation and migration of the primitive sixth aortic arch.2 The absence of the right PA is usually isolated, while the absence of left PA is frequently associated with other congenital cardiac defects.2 Patients may have hemoptysis, cough, dyspnea, recurrent pulmonary infections, or sometimes are asymptomatic.

Pulmonary hypertension is one of the complications of UAPA, and may result from an increased flow to the contralateral lung, leading to shear stress and elevated vascular resistance in the pulmonary circulation.1 The frequency of pulmonary hypertension in UAPA is approximately 30%–45%.3 The long-term outcomes and optimal strategies in the management of UAPA remains unclear. Several previous reports suggest that long-term vasodilator therapy or revascularization of the affected lung may benefit these patients.4–6

CPAF represents abnormal vessels originating from coronary arteries bypass the capillaries to terminate in the PA. CPAF accounts for 30% of all coronary artery fistula (CAF), and the prevalence of this congenital abnormality is approximately 0.68%.7 The patients are mostly asymptomatic, although a large shunt may present with myocardial ischemia or heart failure. The prevalence of pulmonary hypertension is 23% for patients with CAF, and the possible mechanism is an increased left-to-right shunting.7 The treatment options for CPAF include surgical ligation and percutaneous trans-catheter closure.8

The clinical data regarding previously reported 16 patients with concomitant UAPA and CPAF are summarized in the Table S3. The mean age was 53.3 (range: 27–74) years at diagnosis, with a slight male predominance (56.3%). Most patients had right PA atresia (75%). The collateral vessels arose from the left circumflex and right coronary arteries in 50% and 81.3% of these patients, respectively. Of note, 56.3% of them developed pulmonary hypertension, with a mean PA pressure was of 48 (range: 28–100) mmHg. The majority of patients were in functional class II or II and four of them were treated with sildenafil.

Some notable features of our patient can be addressed. First, the long-term outcome of UAPA/CPAF was available in only 2 of the 16 patients previously.9,10 Our case has been followed for more than 11 years, and it is interesting that she still remained stable in functional class and the levels of NT-proBNP were within normal limits despite the prolonged pressure overload in the right heart. Second, none of the previously reported patients had invasive reassessment of hemodynamic during follow-up. Third, the CPAF was diagnosed 6 years after the diagnosis of UAPA in our case, while both congenital anomalies were diagnosed simultaneously in the great majority (93.8%) of the patients in the literature. For patients with a clinical suspicion of UAPA, this implies that a coronary angiography should also be performed during the RHC to search for the evidence of CPAF.

In conclusion, pulmonary hypertension might be a possible complication of both UAPA and CPAF. The diagnosis of these anomalies requires a high index of suspicion based on features of the chest radiograph. The concomitant UAPA and CPAF is rare and pulmonary hypertension in these patients is usually mild. Due to the lack of randomized clinical trials, the role of target therapies for pulmonary hypertension in these patients remains unclear. Our experience in this case, however, may provide insights into the long-term management and outcomes in these patients.

AUTHOR CONTRIBUTIONS
Chen-Chieh Lin: contributed to the literature search and the drafting of the manuscript. Cho-Kai Wu: contributed to the concept of work. Ping-Hung Kuo: provided a substantial contribution to the concept of the work and revision of the manuscript. All authors have reviewed and approved the final version of the manuscript.

CONFLICTS OF INTEREST
The authors declare no conflicts of interest.

ETHICS STATEMENT
The authors declare that appropriate written informed consent was obtained for the publication of this manuscript and accompanying images.

ORCID
Chen-Chieh Lin http://orcid.org/0000-0002-0782-0250

REFERENCES
1. Bouros D, Pare P, Panagou P, Tsintiris K, Siafakas N. The varied manifestation of pulmonary artery agenesis in adulthood. Chest. 1995;108(3):670–6.
2. Toews WH, Pappas G. Surgical management of absent right pulmonary artery with associated pulmonary hypertension. Chest. 1983;84(4):497–9.

3. Wang P, Yuan L, Shi J, Xu Z. Isolated unilateral absence of pulmonary artery in adulthood: a clinical analysis of 65 cases from a case series and systematic review. J Thorac Dis. 2017; 9(12):4988–96.

4. Kruzliak P, Syamasundar RP, Novak M, Pechanova O, Kovacova G. Unilateral absence of pulmonary artery: pathophysiology, symptoms, diagnosis and current treatment. Arch Cardiovasc Dis. 2013;106(8-9):448–54.

5. Jariwala P, Maturu VN, Christopher J, Jadhav KP. Congenital isolated unilateral agenesis of pulmonary arteries in adults: case series and review. Indian J Thorac Cardiovasc Surg. 2021;37(Suppl 1):144–54.

6. Klinger JR, Elliott CG, Levine DJ, Bossone E, Duvall L, Fagan K, Frantsve-Hawley J, Kawut SM, Ryan JJ, Rosenzweig EB, Sederstrom N, Steen VD, Badesch DB. Therapy for pulmonary arterial hypertension in adults. Chest. 2019;155(3):565–86.

7. Said SA. Congenital coronary artery fistulas complicated with pulmonary hypertension: analysis of 211 cases. World J Cardiol. 2016;8(10):596–605.

8. Stout KK, Daniels CJ, Aboulhosn JA, Bozkurt B, Broberg CS, Colman JM, Crumb SR, Dearani JA, Fuller S, Gurvitz M, Khairy P, Landzberg MJ, Saidi A, Valente AM, Van Hare GF. 2018 AHA/ACC guideline for the management of adults with congenital heart disease: Executive Summary. J Am Coll Cardiol. 2019;73(12):1494–563.

9. Heper G, Korkmaz ME. High-pressure pulmonary artery aneurysm and unilateral pulmonary artery agenesis in an adult. Tex Heart Inst J. 2007;34(4):425–30.

10. Sigusch HH, Hansch A, Doenst T. Coronary artery fistula unmasking the absence of left pulmonary artery in an adult. Thorac Cardiovasc Surg Rep. 2020;09(1):e9–e10.

SUPPORTING INFORMATION
Additional supporting information can be found online in the Supporting Information section at the end of this article.

How to cite this article: Lin C-C, Wu C-K, Kuo P-H. Pulmonary hypertension complicating unilateral absence of pulmonary artery and coronary-pulmonary artery fistula: report of a case and review of the literature. Pulm Circ. 2022;12:e12160. https://doi.org/10.1002/pul2.12160