Radiology Case Reports 16 (2021) 483–486

Available online at www.sciencedirect.com

ScienceDirect

journal homepage: www.elsevier.com/locate/radcr

Case Report

A case of pulmonary arteriovenous malformation in the setting of Rendu Osler Weber syndrome ☆,☆☆

Irini Nikolaou, MD[a,*], *Vasileios Rafailidis, MD, MSc, PhD, EDiR*[a], *Anastasios Kartas, MD, MSc*[b], *Konstantinos Kouskouras, MD, PhD*[a], *George Giannakoulas, MD, PhD*[b]

[a] *Department of Radiology, AHEPA University Hospital of Thessaloniki, 54621, Thessaloniki, Greece*
[b] *Department of Cardiology, AHEPA University Hospital of Thessaloniki, Greece*

ARTICLE INFO

Article history:
Received 23 September 2020
Revised 7 December 2020
Accepted 7 December 2020
Available online 18 December 2020

Keywords:
Telangiectasia
Pulmonary arteriovenous malformation
Rendu Osler Weber syndrome

ABSTRACT

Rendu Osler Weber syndrome is a rare disorder, in which arteriovenous malformations are a hallmark feature. We describe the case of a 77-year-old female patient who presented with dyspnea, recurrent epistaxis, and signs of right ventricular heart failure, along with hypoxia and severe anemia. Several imaging modalities facilitated diagnostic workup. The computed tomography revealed an area of pulmonary arteriovenous malformation. Visceral involvement, along with clinical criteria and medical history, established the diagnosis of Rendu Osler Weber syndrome. The patient was scheduled for embolization of the PAVM soon after the diagnosis. Proper imaging, guided by clinical suspicion can be extremely helpful in diagnosing and treating this rare entity.

Introduction

Pulmonary arteriovenous malformations (PAVM) are congenital angiodysplastic lesions, consisting of interconnected pulmonary arterial and venous branches without intervening capillaries. These lesions show a female predominance, and their presentation varies from asymptomatic individuals to patients presented with serious complications, such as cerebral stroke or massive hemoptysis [1]. The diagnosis can be readily established by imaging, with contrast-enhanced computed tomography (CT) providing characteristic findings. According to the literature, a percentage of 70%-90% of patients with PAVM is associated with Rendu Osler Weber syndrome, also known as Hemorrhagic Hereditary Telangiectasia (HHT) [2], and 30% of patients with HHT have PAVM [3]. Diagnosis of HHT is based on well-established clinical criteria, named the "Curaçao criteria." Rendu Osler Weber syndrome is an autosomal dominant disorder, characterized by widespread telangiectasias and vascular malformations potentially affecting many organs of the body [3].

We herein report a case of a patient who presented with respiratory distress, peripheral edema, recurrent nasal bleed-

☆ Competing interests: None.
☆☆ Funding: No funding was used for this study. No author was paid to write this article. Authors had full access to all data in the study.
* Corresponding author.
E-mail address: irini_nik@hotmail.com (I. Nikolaou).
https://doi.org/10.1016/j.radcr.2020.12.024

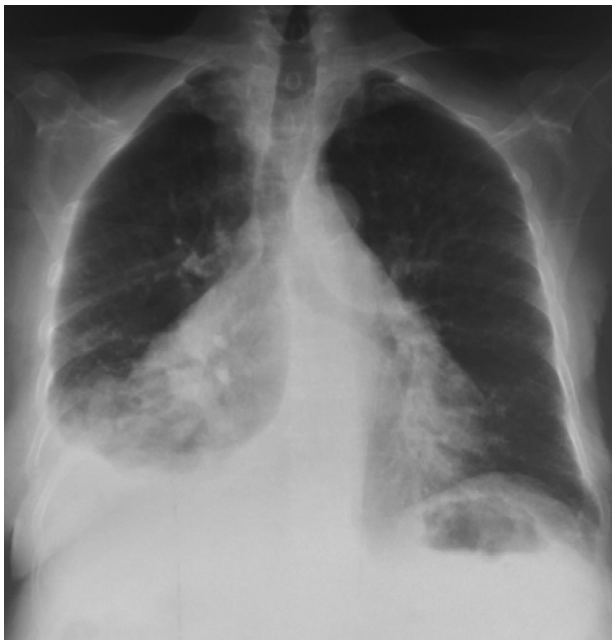

Fig. 1 – Chest radiograph showing an enlarged cardiothoracic ratio, right pleural effusion with adjacent compressive atelectasis.

ing, and intranasal telangiectasias. Imaging with CT revealed lung PVAM. The diagnosis was established based on the constellation of clinical and imaging criteria, and she was scheduled for operative management.

Case presentation

A 77-year-old female patient presented with dyspnea, intermittent palpitations, and recurrent nasal bleeding since many years. History included heavy smoking and left mastectomy combined with radiotherapy and chemotherapy due to primary breast cancer. Previous imaging investigations included a CT scan of the upper and lower abdomen showing an incidental abdominal aorta aneurysm. Clinical examination revealed signs of heart failure, including peripheral edema and ascites. The patient was hypoxic (pulse oximetry 88% in room air). Pulmonary auscultation was unimpressive. Laboratory testing revealed severe anemia, which was attributed to the long-standing, recurrent bleeding episodes. The chest radiograph revealed an increased cardiothoracic index with right pleural effusion associated with atelectasis of the right lower lobe of compressive type (Figure 1). Echocardiography demonstrated increased right atrium area (21 cm^2), dilated inferior vena cava (right atrial pressure of 10 mmHg), elevated pulmonary artery systolic pressure, and dilated right ventricle; findings suggestive of increased right ventricular filling pressures. Left ventricular systolic function was preserved (ejection fraction of 70%). These findings were indicative of underlying pulmonary hypertension. Following confirmation with right-sided heart catheterization, a series of differential diagnostic procedures was performed. Spirometry showed a

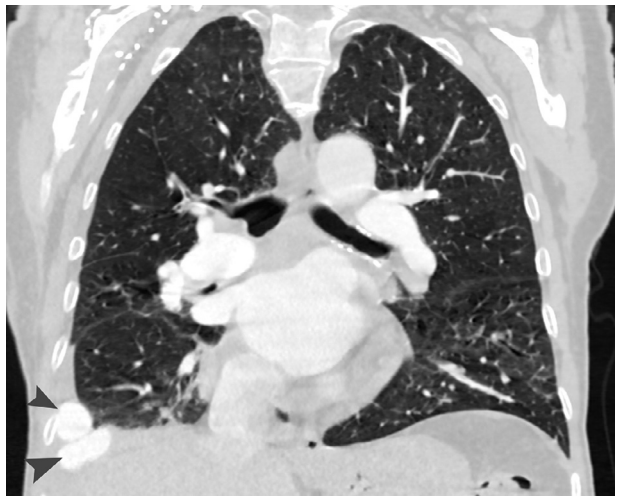

Fig. 2 – Coronal reformatted image of the chest CT in lung parenchyma window showing the dilated vascular structures (grey arrowheads) in the right costophrenic angle.

severe form of mixed type (obstructive and restrictive form) pulmonary disease (FVC predicted 52%, FEV1 50%, FEV1/FVC 104). Combined ventilation/perfusion scintigraphy (V/Q scan) revealed subsegmental and nonspecific perfusion defects in an area smaller than 25% of the bronchovascular tree in the anterior-basal segment of the right lower lobe. These defects could be attributed to right ventricle hypertrophy, chronic thromboembolic pulmonary hypertension, or acute pulmonary embolism. The right/left perfusion ratio was found to be 56.9% left and 43.1% right. Computed tomography pulmonary angiography revealed an increased diameter of the main pulmonary artery (3.25cm) and of the right and left branches (2.35 cm and 2.4 cm, respectively). There were no visible filling defects in the main pulmonary artery or its main branches suggestive of thrombi. A striking finding was a group of dilated vessels in right lower lobe, consisting of branches of the pulmonary artery and the pulmonary vein, which appeared to be interconnected. The arterial and venous origin of these vessels was confirmed by their anatomical distribution and optimal opacification of the images. The venous branch drained into the left atrium, and the arterial segment was a branch originating from the right pulmonary artery. This lesion was reported as possible arteriovenous malformation (AVM; Figure 3a-c). Pericardial, right pleural effusion, and areas of consolidation due to pressure from the adjacent effusion were also noted. A mosaic pattern was observed affecting the lung parenchyma, attributed to impaired perfusion combined with scattered areas of fibrosis. Mild thickening of interstitial septa was also shown, possibly due to fluid congestion (Figure 2). The abdominal CT scan showed a portal vein with increased diameter (2.1 cm), dilated hepatic veins (cardiogenic etiology), cirrhotic liver, enlarged spleen (14 cm), abdominal aorta aneurysm with intraluminal stent, and ascites. The patient was also examined by otorhinolaryngologists, who identified telangiectasias within the nasal mucosa. Based on the combination of nasal mucocutaneous telangiectasias, the pulmonary AVM, and the presence of a

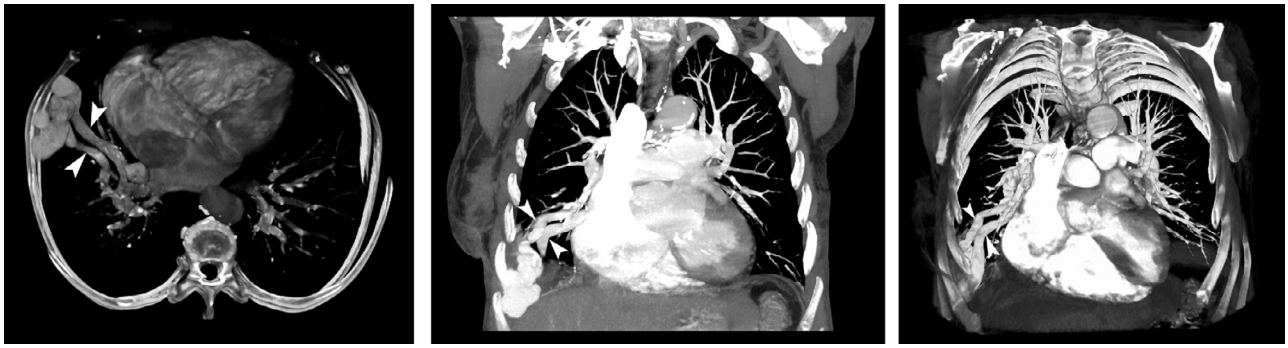

Fig. 3 – Axial (a) and coronal (b, c) reformats showing the pulmonary AVM, optimally opacified, located in the right lower lobe. The feeding and draining vessel are adequately visualized (white arrowheads).

first degree relative (her son) with the diagnosis of HHT, the diagnosis of HHT was established, in accordance with the "Curaçao criteria." The patient necessitated repeated blood transfusion during her hospital stay. She was discharged and scheduled for embolization of the PAVM as an outpatient. Despite, her persisting episodes of bleeding and poor state of health eventually led to her death several months later.

Discussion

Rendu Osler Weber syndrome, or HHT, is an autosomal dominant vascular disease of female predominance, involving multiple systems. It is rare, with a prevalence of 10-20 per 100,000 individuals. The syndrome is characterized by AVM affecting various visceral organs throughout the body and the skin. The lungs are affected with the formation of PAVM in 30% of patients. The clinical presentation of this entity varies from asymptomatic to the occurrence of serious complications requiring urgent treatment, including cerebral stroke and massive hemoptysis. Early and accurate diagnosis of this condition is crucial and is facilitated by proper imaging. An urgent diagnosis is sometimes necessary, depending on the symptoms gravity or the clinical condition of the patient. The diagnosis is based on both clinical and imaging criteria and can be confirmed by molecular biology techniques identifying the causative mutations in either the "ENG" or the "ACVRL1" gene coding endoglin and ALK1 protein, respectively [4]. A definite diagnosis of HHT requires the presence of at least 3 of the "Curaçao criteria," namely spontaneous recurrent nasal bleeds, mucocutaneous telangiectasias, visceral involvement, or a first-degree family history of HHT [5]. Possible diagnosis is assumed by the presence of 2 criteria. Finally, the diagnosis is unlikely when less than 2 criteria are met [1].

PAVM can be found in patients with HHT, especially those with "ENG" mutations, and less frequently, pulmonary hypertension occurs particularly in patients with "ACVRL1" mutations [4]. As mentioned above, PAVMs represent abnormal communications of angiodysplastic tissue connecting branches of pulmonary arteries and pulmonary veins. These entities are of great clinical significance, as they are included in the differential diagnosis list for causes of hypoxemia, as well as imaging of possible pulmonary nodules. Their presence was first mentioned in an autopsy report in 1897. Since then, they have been described with many different terms such as pulmonary arteriovenous fistulae, pulmonary arteriovenous aneurysms, pulmonary hemangiomas, cavernous angiomas of the lung, pulmonary telangiectasias, and lastly, PVAMs [6].

Recent studies suggested that PAVM could also be a feature of Fanconi's syndrome, caused by mitral stenosis, or present as a result of actinomycosis infection, metastatic thyroid cancer, and trauma [2]. In 15%-33% of patients with HHT, PAVMs cause right-to-left shunting, and, consequently, hypoxemia and dyspnea on exertion. Some cases may remain asymptomatic and undiagnosed unless complications occur. Severe complications at the time of diagnosis include transient ischemic attack and cerebral stroke, severe systemic infections with abscesses formation, and rarely massive hemoptysis and hemothorax, consequences that frequently occur in younger patients. These complications occur mostly in cases where visceral organs are affected. On a pathophysiologic level, the effect of right-to-left shunting could lead to the passage of emboli into the systemic and cerebral circulation, causing stroke and septic or aseptic inflammation [4]. Hemodynamically, PAVM are not of great importance contrary to systemic AVMs, but the degree of right-to-left shunt from pulmonary artery to vein determines the severity of symptoms. A degree of blood shunting from right to left greater than 20% or a drop of more than 5 mg/dl of hemoglobin may lead to polycythemia, cyanosis, and finger clubbing [7].

Chest radiograph shows abnormal findings in most of the patients with PAVM. A chest CT scan is mandatory to evaluate the nature of vessels and their anatomical distribution [1]. It is essential to perform adequately protocolled CT and to optimally opacify the pulmonary artery using techniques such as real-time bolus tracking. PAVMS appear as vascular lesions homogeneously opacified unless partially thrombosed, which on close observation originate from a pulmonary artery branch and lead to a pulmonary vein branch leading back to the left atrium. This technique can adequately characterize the location, size and nature of such lesions, and guide treatment decision making. If extended to the abdomen, CT can readily assess the occurrence of other organs involvement, such as liver, or detect other vascular abnormalities, including abdominal aorta aneurysm, as was the case in the patient presented. Oxygenation is not frequently affected in patients

with PAVM. Previous studies of patients with PAVM demonstrated that 81%-100% of them have a Sats O2 97%-98% or PaO_2 80 mmHg on room air [8]. Selection bias of patients makes the true incidence of hypoxemia difficult to estimate [9]. Terry et al. [10] reported that 10 patients with PAVM who underwent pulmonary function testing prior to embolization had exercise intolerance. Their spirometry indices were within normal limits, but the pulmonary diffusing capacity for carbon monoxide was mildly reduced in 6 of them. Other studies reported similar results [11].

Pulmonary hypertension rarely occurs as a complication in HHT. It may be the result of systemic arteriovenous shunting in the liver causing cardiac output increase or can be indistinguishable from idiopathic pulmonary arterial hypertension from a clinical and histologically point of view. It may also occur as a result of lung AVM that increases pressures in the pulmonary vascular system [12]. In most patients with HHT, PAVM act as a low resistance circuit resulting to normal or low pulmonary artery pressure. Whyte et al. [9], found pulmonary vascular resistance to be 32 dyn s cm^{-5}, a mean value which is moderate-low [8]. Despite severe oxygen desaturation in some patients, elevated mean pulmonary artery pressure (25 mmHg at rest) was present in only 8 patients [13]. Right heart catheterization is the gold standard for establishing the diagnosis of pulmonary hypertension. Furthermore, echocardiography is mandatory for imaging and measurement of dimensions of the right atrium, right ventricle, and tricuspid regurgitation peak velocity that helps for the pulmonary artery pressure measurement [12].

Treatment includes measures for the management of epistaxis, surgical excision, radiotherapy, and embolization of AVM. Symptomatic patients or patients with lesions <2 cm are treated either surgically or percutaneously [14]. Operative management is based on transcatheter coil occlusion of the feeding artery causing improvement of oxygen levels and a decrease in right-to-left shunting, which reduces the risk of systemic complications. In general, symptoms correlate best with lesion size, with PAVM up to 2 cm in diameter being asymptomatic [8]. According to other consensuses, PAVM with feeding vessels <2-3 mL should be adequately treated [15]. Recanalization of embolized PAVMs and the development of new, or an increase in the untreated PAVMs size frequently occurs, justifying a long term follow up with imaging. Screening of all adult patients with HHT is mandatory by anteroposterior chest radiograph, echocardiography or CT pulmonary angiogram [4].

Author's contributions

All authors were involved in the care of the patient, and the writing and editing the manuscript.

Patient consent

Not available because the patient passed away.

Ethics approval

Approval from the Ethics Committee was obtained.

REFERENCES

[1] Wang K, Chen J, Hsu J. CASE REPORT Osler-Weber-Rendu syndrome complicated with pulmonary arteriovenous malformation : a case report and review of literatures. 2015;35(3):131–4.

[2] Pollak JS, Saluja S, Thabet A, Henderson KJ, Neil Denbow RIWJ. Clinical and anatomic outcomes after embolotherapy of pulmonary arteriovenous malformations. J Vasc Interv Radiol 2006;1(45):35–44.

[3] Guttmacher AE, Marchuk DA, White RI. Hereditary hemorrhagic telangiectasia. N Engl J Med 1995;333:918–24.

[4] Agnollitto PM, Barreto ARF, Barbieri RFP, Junior JE, Muglia VF. Rendu-Osler-Weber syndrome: what radiologists should know. Literature review and three cases report. Radiol Bras 2013;46(3):168–72.

[5] Verhelst X, Geerts A, Lecluyse C, Vlierberghe H Van, Smeets P. Severe hepatic and pulmonary involvement in Rendu-Osler-Weber Syndrome. 2018;13–8.

[6] R D SLOAN RNC. Congenital pulmonary arteriovenous aneurysm. Am J Roentgenol Radium Ther Nucl Med 1953;70(2):183–210.

[7] Khurshid I, Downie GH. Pulmonary arteriovenous malformation. Postgrad Med Journal Apr 2002;78(918):191–7. doi:10.1136/pmj.78.918.191.

[8] Dines D E, Arms R A. P E Bernatz MRG. Pulmonary arteriovenous fistulas. Mayo Clin Proc 1974;49(7):460–5.

[9] Whyte MKB, Peters AM, Hughes JMB, Henderson BL, Bellingan GJ, Jackson JE, et al. Quantification of right to left shunt at rest and during exercise in patients with pulmonary arteriovenous malformations. Thorax 1992;47(10):790–6. doi:10.1136/thx.47.10.790.

[10] Terry PB, White RI, Barth KH, Kaufman SL, Mitchell SE. Pulmonary arteriovenous malformations — physiologic observations and results of therapeutic balloon embolization. N Engl J Med 1983;308:1197–200.

[11] Jackson JE. Pulmonary arteriovenous malformations : results of treatment with coil embolization in 53 patients pulmonary arteriovenous malformations : results of treatment with coil embolization in 53 Patients. AJR Am J Roentgenol Nov 1995;165(5):1119–25. doi:10.2214/ajr.165.5.7572487.

[12] CV J-F, LG C D-GS. Pulmonary vascular manifestations of hereditary hemorrhagic telangiectasia (Rendu-Osler Disease). Respiration 2007;74:361–78.

[13] David J, Chen TT, Ravin E. Worsening pulmonary hypertension after resection of arteriovenous fistula worsening pulmonary arteriovenous fistula hypertension after resection of. AJR 2014;137:864–6 October 1981.

[14] Gossage JR, Kanj G. State of the art pulmonary arteriovenous malformations a state of the art review. Am J Respir Crit Care Med Aug 1998;158(2):643–61. doi:10.1164/ajrccm.158.2.9711041.

[15] Narsinh KH, Kinney TB. Management of pulmonary arteriovenous malformations in hereditary hemorrhagic telangiectasia patients. December 2013;30(4):408–12. doi:10.1055/s-0033-1359736.