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Case Report

An aberrant branch originating from right coronary artery leading to acute right heart failure and massive hemoptysis after cardiac surgery: A case report

Kardiyak cerrahi sonrası, akut sağ kalp yetmezliği ve masif hemoptiziye sebep olan, sağ koroner arterden köken alan aberran dal: Olgu sunumu

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Abstract

Although there are several etiological factors for massive hemoptysis, necrosis and infarction of the lung parenchyma are rare causes. Herein, we describe a case of massive hemoptysis due to infarction and associated necrosis of the lung after cardiac surgery. The reason for necrosis was thrombosis of an aberrant artery originating from the right coronary artery and supplying the upper lobe of the left lung. The thrombosis was observed during an embolization procedure for cessation of hemoptysis. To the best of our knowledge, this is the first case in the literature to report an aberrant artery originating from the right coronary artery and supplying the left lung. Additionally, hemoptysis related to a vascular obstruction of an aberrant artery and related necrosis of parenchyma was uncommon. Finally, an acute right heart failure related to the obstruction of aberrant artery was also uncommon.

Keywords: aberrant artery; coronary artery; hemoptysis; infarction; right heart failure

Öz

Masif hemoptizi için pek çok etyolojik neden bulunmasına karşın akciğer parankiminin enfarktı ve nekrozuna bağlı hemoptizi nadirdir. Bu sunumda, kardiyak cerrahi sonrası akciğer enfarktı ve nekrozuna bağlı masif hemoptizi olgusu sunulmuştur. Akciğer parankimindeki nekrozun nedeni, sağ koroner arterden köken alan ve sol akciğer üst lobunu besleyen aberran arterin trombozu idi. Tromboz, hemoptizi tedavisi için uygulanan embolizayon işlemi sırasında fark edildi. Literatür taramasında, sağ koroner arterden çıkan aberran dalın sol akciğer üst lobunu beslediği başka olgu bulunmamaktadır. Ayrıca, aberran dalın obstrüksiyonu ve buna bağlı olarak parankim nekrozuna sekonder hemoptizi de nadirdir. Son olarak, aberran dalın obstrüksiyonuna bağlı akut sağ kalp yetmezliği de nadir olarak görülmektedir.

Anahtar kelimeler: aberran arter; koroner arter; hemoptizi; enfarkt; sağ kalp yetmezliği

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Introduction

Massive hemoptysis is a potentially serious and life-threatening condition due to the blood asphyxiation and may cause sudden airway obstruction and hemodynamic instability [1]. Several diseases have been shown to play a role in the etiology of massive hemoptysis including bronchiectasis, infectious lung diseases, and lung cancer [1]. However, the thrombosis of abnormal vascular structures and hemorrhage associated with the necrosis of the lung parenchyma supplied by the obstructed abnormal vascular structure is a rare condition.

In this article, we report a rare case of an aberrant branch originating from the right coronary artery (RCA) and supplying the upper lobe of the left lung which led to acute right heart failure and massive hemoptysis after cardiac surgery.

Case

A 43-year-old female patient underwent mitral valve replacement (MVR) due to severe mitral regurgitation. Her medical history revealed that she had minor hemoptysis which was evaluated by the chest diseases department and no underlying pulmonary pathology was found and mitral regurgitation was considered for the main reason for hemoptysis. Echocardiography (ECHO) results were detailed in Table-1. In the preoperative workup, coronary angiography did not reveal an atherosclerotic plaque in the coronary arteries, and a vessel branch originating from the RCA was observed to supply the upper lobe of the left lung (Figure-1a). During MVR surgery, the vessel branch originating from the RCA and supplying the upper lobe of the left lung was not dissected and was not ligated. During surgery, cross-clamping was simultaneously performed to the aortic and pulmonary arteries. Following left atriotomy, an excessive backflow from the pulmonary venous system was observed, despite double cross-clamping. Surgery was successfully completed, and the patient was uneventfully weaned from cardiopulmonary bypass. During intensive care unit (ICU) follow-up, arrhythmia with tachycardia and bradycardia episodes developed. A temporary pacemaker was inserted. Due to arrhythmias and respiratory problems, the length of ICU stay prolonged and the patient was discharged from the ICU on postoperative Day 6.

Table-1: Echocardiography (ECHO) results of patient.

Parameter	ECHO Result
Mitral valve area	2.1 cm2
Maximum/mean gradient of the mitral valve	12/4 mmHg
Systolic pulmonary artery pressure (sPAP)	55 mmHg
Left ventricular end diastolic diameter (LVEDD)	5.6 cm
Left ventricular end systolic diameter (LVESD)	3.9 cm
Interventricular septum	1.0 cm
Ejection fraction (EF)	57%
Tricuspid annular plane systolic excursion (TAPSE)	>2cm
Left atrial diameter	4.3 x 5.6 cm
Valves	Fibrotic mitral valve, Third-degree mitral regurgitation, First- to second-degree tricuspid regurgitation.

During the ward follow-up, the patient suffered from a sudden massive hemoptysis on postoperative Day 7 (>600mL/day). The international normalized ratio (INR) was between 2.3 and 2.8, activated partial thromboplastin time (aPTT) was between 28 and 32 sec, and platelet count was between 170.000 and 230.000 count/µL, without any hematological problem. Warfarin was ceased and the INR decreased with fresh frozen plasma, while low-molecular-weight heparin was added to the treatment. The amount of hemoptysis decreased to 300mL/day; however, no cessation was observed. On the next day, a thoracic computed tomography (CT) revealed a consolidated area in the posterior segment of the left upper lobe of the lung, and the etiology of hemorrhage was considered to be associated with the vessel branch originating from the RCA and supplying the left upper lobe of the lung (Figure-2a,b). Considering that this aberrant branch might play a role in the etiology of hemoptysis and interruption of the blood flow in this branch might lead to hemoptysis cessation, selective embolization was planned for this vessel branch. However, thrombosis was detected in this vessel branch during catheterization (Figure-1b). In this case, the etiology of hemorrhage was found to be thrombosis of the aberrant artery and associated infarction of the upper lobe of the left lung, and hemoptysis was secondary to the infarction. Conservative treatment modalities were used. The amount of hemoptysis decreased within a couple of days and ceased on postoperative Day 8. During follow-up, the mean pulmonary artery pressure (mPAP) increased, and physical examination showed peripheral edema. The patient was given medical treatment and discharged on postoperative Day 25 with resolution of edema.

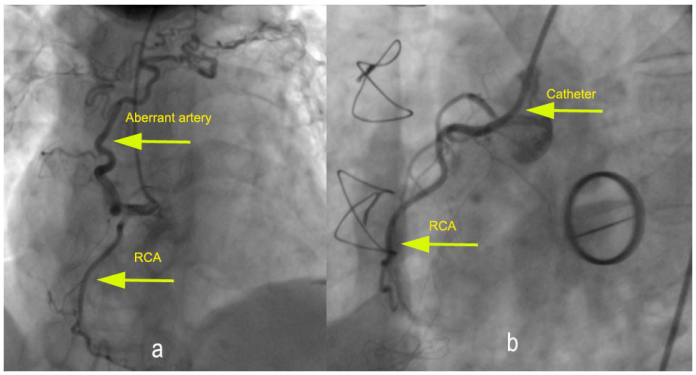

Figure 1(a): During preoperative cardiac catheterization, a vessel branch originating from right coronary artery was supplying left upper lobe, **(b):** However, after hemoptysis, trombosis was observed in this vessel during catheterization.

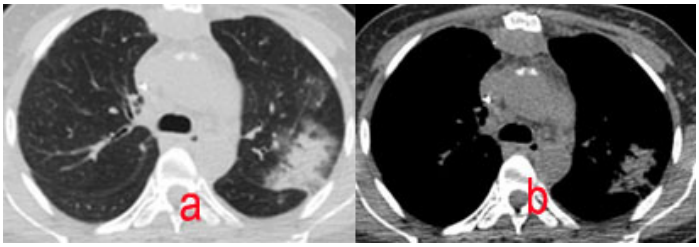

Figure 2 (a,b): Thoracic CT revealed consolidated area in the posterior segment of the left upper lobe.

At three months of follow-up, the patient was readmitted with symptoms and signs of right heart failure including peripheral edema, ascites, lip cyanosis, fatigue, and hepatomegaly. Repeated ECHO revealed non-coaptation of the tricuspid valve with significant tricuspid regurgitation (3-4) and pulmonary insufficiency (2-3), a mPAP of 40 mmHg, a TAPSE of 1.4 cm, and significantly enlarged right heart chambers. During right heart catheterization, the pulmonary capillary wedge pressure was 16 mmHg with a sPAP of 36 mmHg, a diastolic pulmonary arter pressure of 14 mmHg, and a mPAP of 24 mmHg, In addition, the pulmonary vascular resistance was 2 wood, cardiac output was 3.96 L/min, and cardiac index was 2.16 L/min/m2. Chest perfusion scintigraphy showed significantly reduced perfusion of the upper lobe of the left lung. Simultaneously, follow-up thoracic CT revealed normal parenchyma in the posterior segment of the left upper lobe. Furthermore, the right ventricular assist device implantation was planned in the cardiovascular surgery clinic of an external center; however, the patient died at eight months due to right heart failure before the implantation.

Discussion

Hemoptysis should not be solely evaluated in terms of the volume of bleeding, and the life-threatening airway obstruction and asphyxiation should be considered. The anatomical dead space of the tracheobronchial tree is only 150 to 200 mL, and acute expectoration of only 200 mL may cause respiratory failure with altered hemodynamic states [1]. Yazicioglu et al. reported that bronchiectasis was the most common etiology of massive hemoptysis, followed by bronchial cancer, arteriovenous malformations, and infectious diseases of the lung [1]. However, pulmonary infarction and necrosis in the etiology of massive hemoptysis is uncommon. Hemoptysis related with necrosis of the lung parenchyma was frequently associated with necrotizing pneumonia of the lungs [2]. The lungs are the uncommon sites of infarctions secondary to vascular obstruction due to the presence of tissues enriched with blood flow from both the pulmonary and systemic circulation. Therefore, hemoptysis secondary to vascular obstruction is also rare.

Although the lungs may receive abnormal branches originating from a large number of arterial structures (i.e., subclavian, internal mammary, and vertebral arteries), branches originating from the coronary artery are rarely seen [3,4,5]. Battal et al. reported an incidental multi-detector computed tomography (MDCT) angiography finding of an aberrant right bronchial artery originating from the RCA [4]. However, an aberrant artery originating from the RCA and supplying the left lung was not reported previously. Our case is, therefore, unique and the branch from RCA was supplied the upper lobe of the left lung.

Abnormal vascular structures may also play a role in the etiology of hemoptysis, although pulmonary infarction is considered in the etiology of hemoptysis. Hwang et al. reported a case of massive hemoptysis from an aberrant bronchial artery originating from the descending thoracic aorta [5]. The authors treated the patient with endovascular bronchial artery embolization with a stainless steel platinum coil [5]. Gypen et al. reported an hemoptysis case previously had coronary artery bypass grafting with internal mammary artery had aberrant bronchial vessels [6]. In previous reports, bronchial and/or aberrant artery embolization with a coil

implantation was also the initial treatment method of massive hemoptysis [1,6,7]. The success rates of embolization were reported as 70 to 95% [7].

In our case, the upper lobe of the left lung was supplied by the aberrant artery originating from the RCA. In this case, the aberrant branch was suspected in the etiology of hemoptysis and, therefore, we planned aberrant artery embolization. However, during the embolization procedure, we detected thrombosis in the aberrant artery, which thrombosis probably occurred during MVR surgery. With the interruption of the blood supply, necrosis and infarction occurred in the supplied lung area and, therefore, hemoptysis was associated with the necrosis.

The differential diagnosis poses certain challenges in such cases. In the differential diagnosis, the elevated values of INR, decreased counts of platelets, or any other hematological problems may play a role in the development of hemoptysis. In our case, there was no significant increase in the INR and the platelet count was adequate without any hematological abnormalities. Although the INR was 2.3 to 2.8, it was attempted to be decreased. Despite the intervention, however, hemoptysis persisted and interruption of the blood supply from the aberrant artery via embolization was considered to discontinue bleeding. However, the lack of blood flow in the aberrant vessel during catheterization for embolization suggested another etiological cause. Therefore, several underlying causes of hemoptysis were suspected in the differential diagnosis and the exact cause was elucidated using different interventions.

Conclusion

Although hemoptysis associated with an abnormal vascular structure has been frequently reported in the literature, hemoptysis associated with the obliteration of the abnormal vascular structure is scarce. In patients with aberrant branch supplying the lungs, the possibility of hemoptysis associated with infarction or necrosis due to the obliteration of the aberrant branch and interruption of the blood flow after surgical manipulation should be kept in mind. The definite diagnosis is based on the catheterization, which is the gold standard technique, and embolization should be considered in the presence of blood flow in the aberrant artery. Otherwise, conservative methods can be used, as there may be other causes of hemoptysis to be considered. Also, clinicians should consider possible infarction and necrosis in the differential diagnosis of hemoptysis.

Declaration of conflict of interest

The authors received no financial support for the research and/or authorship of this article. There is no conflict of interest.

*This study was approved by our Institutional Review Board. Informed consent was obtained from patient and the principles of the Helsinki Declaration were followed.

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