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HAEMOPTYSIS IN A PATIENT WITH COPD DUE TO RIGHT BRONCHIAL ARTERY DILATION

Ayesha Banu Athur Jaffar[1], Mohammad Kais Jawish[2], Yazan Yamen Rabah[2], Abdullah Al Antabli[2], Leena Abdelrahman[3], Alaadin Hakim[4]

[1] Medical Internship Program, Graduate Medical Education, Dubai Health, Dubai, United Arab Emirates
[2] College of Medicine, University of Sharjah, Sharjah, United Arab Emirates
[3] Department of Internal Medicine, Dubai Hospital, Dubai Health, Dubai, United Arab Emirates
[4] Department of Interventional Radiology, Dubai Hospital, Dubai Health, Dubai, United Arab Emirates

Corresponding author's e-mail: ayeshabanu3@hotmail.com

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ABSTRACT

Introduction: Haemoptysis is a potentially life-threatening symptom, particularly in patients with chronic pulmonary diseases, where identifying the exact source of bleeding can be challenging.

Case description: We present the case of a 76-year-old woman with a history of chronic obstructive pulmonary disease and bronchiectasis, who experienced recurrent episodes of haemoptysis. Initial investigations, including imaging and infectious work-up, were inconclusive. While a CT pulmonary angiography excluded a pulmonary embolism, a subsequent CT aortogram revealed a contrast-filled outpouching in the right lower lobe, raising suspicion of a right basal pseudoaneurysm. Digital subtraction angiography confirmed a markedly dilated right bronchial artery with active contrast extravasation. The patient underwent successful endovascular embolization using coils and microparticles, resulting in complete resolution of haemoptysis and clinical stabilisation. The resolution of symptoms confirmed the dilated right bronchial artery as the source of bleeding, consistent with angiographic findings.

Conclusion: This case emphasises the importance of considering atypical vascular causes, such as bronchial artery dilation, in patients with haemoptysis and underlying chronic inflammatory lung conditions. Early recognition and targeted intervention are critical for effective management and prevention of serious complications.

KEYWORDS

Haemoptysis, bronchial artery dilation, COPD, digital subtraction angiography, bronchial artery embolization

LEARNING POINTS

- Vascular causes of haemoptysis, though often overlooked, should be included in the differential diagnosis for patients with chronic lung disease such as COPD and bronchiectasis.
- Digital subtraction angiography played a key role in mapping the source of bleeding, serving both diagnostic and therapeutic purposes.
- This case highlights the importance for internists of early recognition and intervention of haemoptysis from uncommon sources to prevent potential complications.

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INTRODUCTION

Haemoptysis, the expectoration of blood from the lower respiratory tract, remains one of the gravest clinical signs a patient can exhibit and is strongly predictive of serious medical outcomes. Studies indicate that approximately 38% of patients experiencing haemoptysis encounter recurrent episodes and in severe cases, this is capable of resulting in respiratory failure[1]. The dangers are significantly greater in cases of massive haemoptysis, resulting in mortality rates greater than 50% and typically as a result of airway obstruction, hypoxia or exsanguination[2]. Although haemoptysis can manifest from multiple diseases, its cause remains unknown in approximately half of all cases, emphasising the diagnostic challenge[3].

The aetiologies of haemoptysis can vary from infectious and vascular conditions to trauma cases and malignancies. These underlying conditions can cause airway bleeding via a range of pathways, indicating the significance of appropriate identification and diagnosis. Moreover, emerging evidence also highlights the importance of accurately identifying atypical sources of bleeding, with a review reporting that haemorrhage can originate simultaneously from bronchial arteries, non-bronchial systemic arteries and pulmonary arteries[3]. Failure to identify atypical sources may result in persistent bleeding and suboptimal treatment outcomes.

This case describes a 76-year-old female with a complex pulmonary history presenting with haemoptysis, highlighting the need to consider atypical bleeding sources and the use of thorough evaluation, advanced imaging and targeted management.

CASE DESCRIPTION

A 76-year-old known hypertensive woman with a background of chronic obstructive pulmonary disease (COPD) and bronchiectasis presented with recurrent episodes of haemoptysis. The haemoptysis episodes were significant, soaking tissues completely on two occasions, prompting emergency evaluation for suspected pulmonary haemorrhage.

On admission, she was haemodynamically stable with mild tachycardia and normal oxygen saturation on room air. A chest examination revealed rales and diminished breath sounds bilaterally; laboratory investigations showed a haemoglobin of 15.0 g/dl and a haematocrit level of 44.8%. Inflammatory markers were checked to rule out infections such as pneumonia and tuberculosis and were only mildly raised, with a C-reactive protein of 4.2 mg/l, suggesting a low-grade inflammatory process. An acid-fast bacilli smear was performed and came out negative, which was crucial for ruling out tuberculosis as a potential cause for her recurrent haemoptysis. Arterial blood gas analysis revealed a compensated respiratory acidosis with a pH of 7.383, PCO_2 of 68.3 mmHg and bicarbonate of 38.8 mmol/l. Her haemoptysis was acutely managed in the emergency department with antifibrinolytic therapy including tranexamic acid, along with bronchodilators (ipratropium-salbutamol) and inhaled corticosteroids (budesonide), which was continued once she became an inpatient.

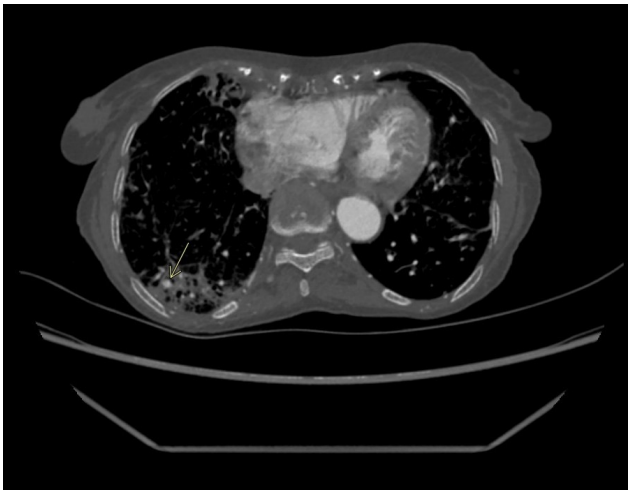


Figure 1. CT aortogram showing a contrast-filled outpouching in the right lower base (yellow arrow).



Figure 2. Angiogram of right (yellow arrows) and left bronchial artery showing common origin from descending aorta.

Initially, a contrast-enhanced computed tomography pulmonary angiography (CTPA) was performed to rule out acute pulmonary embolism, but no definitive bleeding source was detected. To further investigate atypical sources of bleeding, a computed tomography (CT) aortogram was carried out *(Fig. 1)*, which showed a small, well-defined, contrast-filled outpouching arising from a segmental-subsegmental artery within an area of right lower lobe consolidation as the cause of the bleeding, raising suspicion of a right basal pseudoaneurysm as an atypical bleeding source. Interventional radiology was consulted for digital subtraction angiography (DSA). Definitive vascular catheterisation was performed *(Fig. 2)*, revealing an abnormally dilated and torturous right basal bronchial artery with focal spasm and active contrast extravasation, consistent with acute pulmonary haemorrhage. Vascular access was established

using an 18G needle via the right common femoral artery, through which a 5F sheath was inserted, and an S1 catheter was advanced. Selective catheterisation identified two large branches supplying the right lower lobe. The medial branch of the right bronchial artery demonstrated spasm and minor contrast extravasation in its proximal segment, which was successfully treated with coil embolization to achieve haemostasis *(Fig. 3)*. The lateral branch, supplying the basal segment of the right lower lobe, was embolised using 400-micron particles until complete stasis was achieved *(Fig. 3)*. The patient responded well to combined endovascular treatment and supportive therapy. Her haemoptysis resolved, and she remained clinically stable.

DISCUSSION

The differential diagnosis of haemoptysis is broad. Initial investigations, including imaging, were inconclusive for the source of bleeding. Notably, TB was ruled out as an active cause despite this remaining a leading aetiology for massive haemoptysis, along with a pulmonary embolism, bronchiectasis and malignancy[3]. In our case, the diagnostic process progressively identified the underlying vascular anomalies: a dilated right bronchial artery abnormality with active extravasation. The bronchial arteries remain the predominant culprit in over 90% of cases of haemoptysis requiring arterial embolization or surgery[3]. This was successfully managed through interventional embolization.

To determine the cause of bronchial artery dilation in our patient, we considered her long history of severe COPD and bronchiectasis. These chronic conditions establish a persistent inflammatory state, likely contributing to abnormal vascular development involving hypertrophy and dilation of the bronchial arteries in response to ischaemia, resulting in increased bronchial blood flow and the formation of fragile neo vessels prone to rupture[4]. A possible underlying mechanism is vascular remodelling, in which ongoing airway injury may drive structural and functional changes in the vessels. Inflammatory mediators stimulate the release of vascular endothelial growth factor which promotes angiogenesis and vasodilation, resulting in enlarged and tortuous bronchial arteries[4]. However, our understanding on how immune cells and their cytokines influence the formation and structure of blood vessels is not yet fully understood[5].

The diagnosis of haemoptysis typically involves a progressive work-up. Various diagnostic modalities, including chest radiography, bronchoscopy, multidetector CT, multidetector CT angiography and DSA, are employed to assess the cause and guide the treatment of haemoptysis[6]. The initial step in a case of haemoptysis is a CTPA to rule out acute pulmonary embolism, which is a common and potentially life-threatening situation. CTPA can also aid in excluding malignancy or strictures, thereby narrowing the differential diagnosis. However, persistent bleeding frequently necessitates further investigation. We performed a CT aortogram to map the vascular anatomy and identify the source of bleeding as



Figure 3. Angiogram of right bronchial artery post-embolization.

bronchial arteries originate from the aorta. DSA remains the gold standard for precisely identifying culprit vessels and guiding embolisation[7]. Its superior ability to identify the precise site of bleeding is crucial for targeted intervention. Bronchoscopy is often used when imaging is inconclusive, or when endobronchial lesions are suspected. A meta-analysis by Kops et al. reported a diagnostic yield of 70% over the past decade[8]. CT and angiography are often sufficient to guide targeted intervention, potentially limiting the additional benefit of bronchoscopy in certain cases.

The successful management of haemoptysis often involves endovascular and supportive medical treatment. Bronchial artery embolization remains the first-line, minimally invasive treatment, with immediate success rates ranging from 70 to 99%[9]. However, recurrence is common (10–57%), due to incomplete embolization, recanalization, or recruitment of new collaterals[9]. A systematic review and meta-analysis by Fan et al. demonstrated that bronchial artery embolization is superior to conservative treatment alone in controlling haemoptysis, reducing recurrence (26.5 vs 34.6%) and decreasing haemoptysis-related mortality (0.8 vs 3.2%), while maintaining a very low risk of major complications (0.2%)[10].

In our case, the patient's symptomatic improvement post-embolization confirmed both immediate haemostasis and treatment success, establishing that the right bronchial artery was the source of haemoptysis, consistent with angiographic findings of dilation, tortuosity and contrast extravasation[3].

CONCLUSION

This case highlights the importance of considering dilated bronchial artery as a source of bleeding in patients presenting with haemoptysis, particularly those with chronic lung diseases such as COPD and bronchiectasis. Advanced imaging techniques, such as CT aortogram and DSA, proved essential in accurately identifying the vascular

abnormalities responsible for the bleeding. The successful management of this patient through bronchial artery embolization underscores the effectiveness of minimally invasive endovascular interventions.

Early recognition and intervention with appropriate follow up can improve outcomes by preventing life-threatening complications. Further studies can refine diagnostic protocols and embolization techniques to reduce recurrence and improve the long-term prognosis.

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