



# Rasmussen's Pseudoaneurysm: A Rare But an Important Cause of Hemoptysis. A Case Report

Pseudoaneurisma de Rasmussen: una rara, pero importante causa de hemoptisis. Presentación de un caso

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## Palabras clave (DeCS)

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## Summary

Rasmussen's pseudoaneurysm is one of the causes of hemoptysis that, despite not being very common, is important to recognize and take into account in the approach of these patients. It typically occurs in the context of massive hemoptysis and its approach in addition to patient stabilization is focused on recognizing it as a differential diagnosis. The initial approach for these patients includes conventional chest radiography; however, computed tomography (CT) and CT-angiography have shown the highest diagnostic performance. For its treatment, transcatheter arterial embolization has established itself as the technique of choice; however, in some cases open surgical management may be necessary.

## Resumen

El pseudoaneurisma de Rasmussen es una de las causas de hemoptisis que a pesar de no ser muy común es importante conocer y tener en cuenta en el abordaje de estos pacientes. Típicamente ocurre en el contexto de la hemoptisis masiva y su abordaje, además de la estabilización del paciente, está enfocado en reconocerla como diagnóstico diferencial. El tratamiento inicial de estos pacientes incluye la radiografía de tórax convencional; sin embargo, la tomografía computarizada (TC) y la angioTC han mostrado el mayor rendimiento diagnóstico. Para su tratamiento, la embolización arterial transcatéter se ha consolidado como la técnica de elección; sin embargo, en algunos casos podría ser necesario el manejo quirúrgico abierto.

Hemoptysis, defined as bleeding from the lower respiratory tract, is a potentially life-threatening clinical scenario whose etiology varies widely. Most chronic inflammatory diseases, including tuberculosis, have the potential to increase systemic pulmonary arterial flow, which promotes the release of angiogenic growth factors and angioprotein-1, which in turn promote neovascularization, vascular remodeling, and increased collateral formation. These new collaterals have the characteristic of being fragile vessels, with a tendency to rupture, which explains the increased risk of hemoptysis in this group of patients. However, although Rasmussen's pseudoaneurysm is not the main cause of hemoptysis in patients with tuberculosis, it should be excluded in the diagnostic approach in order to provide timely and adequate treatment to reduce morbidity and mortality (1, 2).

Rasmussen's pseudoaneurysm is pathophysiologically part of the post-primary infection of tuberculosis, characterized by the formation of a dilatation of the pulmonary artery in a contiguous location or within a tuberculous cavern. This dilatation is secondary to the progressive weakening of the medial and adventitial layers of the artery, which begins with

their replacement by granulation tissue and later by fibrin, generating thickening and the formation of the same (3).

The following is a case of hemoptysis secondary to this etiology, focused on its imaging diagnosis.

## Case presentation

A 22-year-old male patient with a history of prison confinement for 8 months in 2016, who later presented with night sweats, asthenia, adynamia, weight loss and subjective fever. He consulted in January 2019 for clinical picture of dry cough and repeated hemoptysis, with final diagnosis of pulmonary tuberculosis with 10 mm tuberculin skin test and smears in which acid-alcohol resistant bacilli (AARB) were isolated. She was started on tetraconjugated treatment (HRZE) and pyridoxine. With partial improvement with the treatment, but relapsed after 5 days; she presented to the emergency department with progressive hematemesis with clot production and persistence of previous symptoms; she also reported melena and a feeling of thirst. On physical examination he was found to be in acceptable condition, tachycardic, without tachypnea, febrile, with adequate

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oxygen saturation and no other abnormal findings. It was later clarified that the hematemesis referred by the patient actually corresponded to hemoptysis. The admission paraclinicals reported leukocytosis with neutrophilia, prolonged INR (International Normalized Ratio) and elevated PCR (Polymerase Chain Reaction). In addition, an extra-institutional chest X-ray reported cavitation of the right upper lobe and parahilar adenopathies.

Due to the torpid evolution, despite therapy, he was tested for HIV infection and a new chest X-ray showed cavitation in the right upper lobe (Figure 1), and computed tomography (CT) of the chest with contrast medium. Due to the apparent hematemesis, upper gastrointestinal endoscopy was performed, which ruled out gastrointestinal tract hemorrhage. Chest CT showed Rasmussen's pseudoaneurysm in the apical segment of the left upper lobe (Figure 2). The patient underwent surgery for treatment of the pseudoaneurysm.

## Discussion

*Hemoptysis* is the term used to define bleeding from the lower respiratory tract and is related to a wide variety of etiologies, which vary according to local epidemiology and patient type. In outpatients, the most common causes of hemoptysis include respiratory infections, chronic obstructive pulmonary disease (COPD), malignant neoplasms and bronchiectasis. In developed countries, bronchiectasis, respiratory infections and lung cancer are the main causes, whereas in developing countries, tuberculosis and its sequelae are the prevalent cause (4, 9).

Hemoptysis has been defined in various ways, depending on the amount of blood and the hemodynamic effect on the patient. Currently, the American College of Radiology guidelines recognize three variants of hemoptysis: massive and life-threatening, non-massive and non-life-threatening, and recurrent. Massive and life-threatening hemoptysis is defined as hemoptysis that puts the patient at risk of asphyxia or exsanguination and with a volume greater than 100 cm<sup>3</sup> in 24 hours, with hypotension as an independent factor in defining this category. In the massive variant it is important to define whether the patient is stable or unstable. The non-massive, non-life-threatening variant does not meet the criteria for massive hemoptysis.

Finally, there is the recurrent hemoptysis variant, which is a new classification defined as repeated episodes of hemoptysis, after initial treatment with medical therapy or embolization, which usually are not life threatening and have a known cause.

In Colombia, tuberculosis has an incidence of 17.7 cases per 100,000 inhabitants as of 2018, according to data from the Boletín Epidemiológico Semanal of the Instituto Nacional de Salud y MinSalud (6).

Rasmussen's pseudoaneurysm is a rare phenomenon, with a prevalence of 5% in patients with chronic cavitary tuberculosis, which occurs in the post-primary stage of tuberculous infection; it is defined as a dilatation of the pulmonary artery at a contiguous site or even within a tuberculous cavern formed during primary infection. The mechanisms preceding such dilatation are given by the deposit of granulation tissue and subsequent fibrin deposition in the medial and adventitial layers of the artery, which results in thickening of the artery, weakening of the arterial wall and production of a pseudoaneurysm, which may rupture (3).

In the diagnostic imaging approach to hemoptysis, strategies have been defined by the American College of Radiology that will vary according to the type of clinical presentation. In patients with massive hemoptysis, bronchoscopy for tamponade and clot clearance is the initial mainstay of management, especially in the subgroup of patients with hemodynamic instability. Additionally, chest radiography is recommended to assess the extent of pulmonary involvement and the location of the endotracheal tube. Other methods include angiography with embolization, whose objective is therapeutic and not diagnostic, with success rates between 70 % to 99 % according to the series. In this scenario, both contrast tomography and angiotomography have a high level of evidence for diagnosis and localization of the bleeding source, which is why they are recommended. In non-massive hemoptysis, contrast tomography is the initial method to determine the etiology, limiting non-contrast tomography to those patients with contraindications (poor renal function or allergy to contrast medium). The use of angiotomography in this group of patients is also recommended, especially when planning angiographic embolization, which, despite not being first line, has shown an increase in its use over time. Finally, chest radiography continues to be a reasonable choice as an initial imaging study, especially when a benign clinical diagnosis (pneumonia) is to be confirmed. Finally, recurrent hemoptysis will have as pillars of its evaluation chest X-ray, contrast tomography and angiotomography with considerations similar to those previously described (7).

Regarding the particular diagnosis of Rasmussen's pseudoaneurysm, chest X-ray is a good initial method that allows revealing the bleeding site in approximately 46% of the cases and the cause in approximately 35% of the cases. However, contrast-enhanced CT and angioCT have become the initial modalities for the study of this group of patients because of their accuracy and availability.

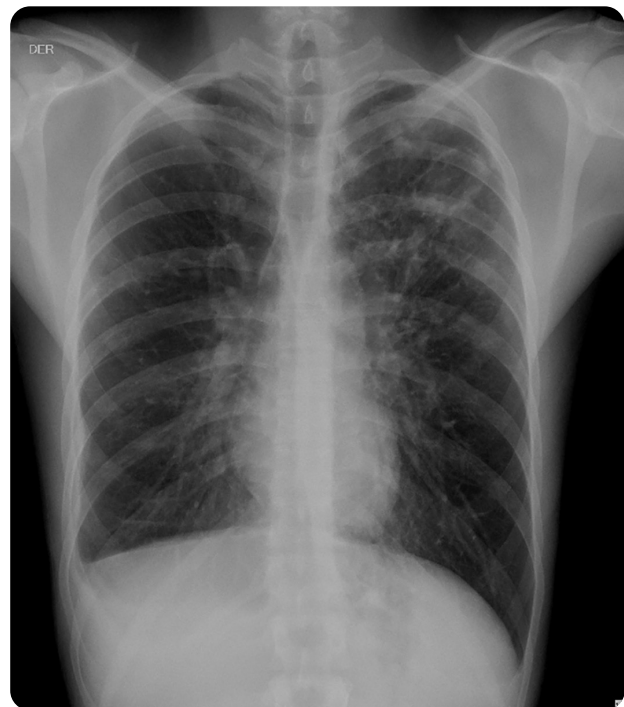


Figure 1. Chest X-ray in posteroanterior projection. Cavitation in the left upper lobe and bilateral reticulonodular opacities predominantly in the upper lobes.



Figure 2. Chest tomography with contrast medium. a) cavitation in the left upper lobe, nodules and micronodules involving mainly the upper lobes and especially the left, evident in the axial section in pulmonary window. b) In the arterial phase nodular lesion with prominent enhancement within the cavitation, which behaves the same as the pulmonary arteries both in the arterial phase and in the venous phase. c) in the venous phase. d and e). Axial section and coronal reconstruction with maximum intensity projection (MIP) shows that the lesion is branch-dependent for the left apico-posterior segment. f) Three-dimensional reconstruction shows the location of the pseudoaneurysm (white arrow).

The pseudoaneurysm will be identified as a nodule that enhances avidly in the arterial phase, with washout in the venous phase, but that preserves its morphology and is located within or adjacent to a tuberculous cavitation (1, 13, 16).

The treatment of choice is early transcatheter arterial embolization due to its high success rates and with multiple commercially available elements for embolization, such as embolization spheres, coils, tissue adhesives, gelatin sponges, balloons and stents; which in most cases replace open surgery (16, 17).

Conservative treatment has a very high mortality rate in cases of massive hemoptysis and can range from 50% to 100% of patients. On some occasions surgical management may be required (17, 18).

Surgical management was the technique of choice for a long time for the control of massive and recurrent hemoptysis; however, it has a high mortality rate of approximately 20%, which in comparison with the high mortality of conservative treatment, justifies the intervention. The indication for surgical intervention arises in patients with uncontrollable unilateral bleeding who do not respond to other first-line therapies and whose pulmonary reserve justifies treatment. Surgical techniques include surgical constriction (banding) of the pulmonary artery or aneurysm resection associated with prosthetic replacement (17, 18).

The case of this patient is an excellent way to demonstrate how, although Rasmussen's pseudoaneurysm is not one of the main causes of hemoptysis, in the Colombian population, being a developing country, it should always be considered in the diagnosis due to the high incidence of tuberculosis. The management and outcomes will be, then, highly dependent on the initial approach, according to the clinical scenario established, as in this case, which allowed a timely diagnosis and treatment.

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