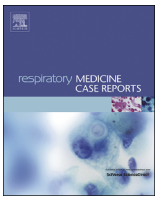
Respiratory Medicine Case Reports 45 (2023) 101897

Contents lists available at ScienceDirect

Respiratory Medicine Case Reports

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



Case Report

Rasmussen aneurysm: Case series of a rare complication of Pulmonary Tuberculosis

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ARTICLE INFO

Handling Editor: DR AC Amit Chopra

Keywords:
Rasmussen aneurysm
Pulmonary tuberculosis
Complications
Infectious disease
Embolization

ABSTRACT

Rasmussen aneurysm refers specifically to a pseudoaneursysmal dilatation of a branch of the pulmonary artery adjacent or within a tuberculous cavity. The incidence of pulmonary vascular complication secondary to tuberculosis is very rare hence underdiagnosed by many clinicians. It can present with life threatening haemoptysis and CT angiography plays an important role in localizing the lesion and guiding treatment. On contrary the most common cause of massive haemoptysis is of bronchial artery origin. Early diagnosis and proper interventions are essential as it is associated with high mortality. Herein we report three cases of Rasmussen aneurysm in patients with haemoptysis. Only one patient underwent emergency *trans*-arterial embolization of the involved pulmonary artery.

1. Introduction

Pulmonary tuberculosis (PTB) is a global burden, being 13th leading cause of death worldwide and the second leading fatal infection after COVID-19 according to WHO. An estimated 95% of deaths were reported in developing countries [1]. An estimated incidence of 10.6 million people were diagnosed with TB worldwide in 2021. A total of 1.6 million deaths have been recorded in 2021. According to WHO, most tuberculosis cases were reported from South- East Asia (45%) followed by Africa (23%) and the Western Pacific (18%), the Eastern Mediterranean (8.1%), the Americas (2.9%) and Europe (2.2%) [1]. Pulmonary tuberculosis can present by various forms of complications even after complete treatment of the disease [2]. These complications includes cavitation, bronchiectasis, pleural disease and vascular complications, however high mortality is associated with these complications. Aneurysmal dilatation of the pulmonary artery is a rare vascular complication which occurs in about one out of 14,000 patients (0.007%) [3], only few clinical case reports are published in the literature. It is commonly present by massive haemoptysis, thus associated with high mortality rate that exceeds 5–25% [4]. In PTB, the vast majority of massive haemoptysis involves bronchial circulation, whereas in Rasmussen aneurysm the bleeding is of pulmonary artery origin [5]. Cautious examination of pre and post-contrast computed tomography of the lung will exhibit focal enhancement within the aneurysmal sac which may be the first diagnostic clue [6]. It should be considered in the differential diagnosis in a patient of PTB presenting with haemoptysis, such as pulmonary embolism, bleeding from cavitary lesions and bronchiectasis secondary to PTB.

2. Case report

Case 1: A young male patient who was previously treated for pulmonary tuberculosis 10 months back presented with mild haemoptysis for the last five days. He had normal bowel and bladder habits. He had no history of smoking or hypertension. On physi-

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https://doi.org/10.1016/j.rmcr.2023.101897
Received 28 March 2023; Received in revised form 15 July 2023; Accepted 18 July 2023
Available online 20 July 2023

cal examination, patient was conscious and alert with maintained vitals. However patient appeared pale with no evidence of cyanosis, clubbing, icterus or pedal oedema. On laboratory investigations, haemoglobin was mildly reduced. The rest of the laboratory investigations were within normal limits. Chest radiograph revealed cavitary lesions in right upper zone. Computed tomography revealed fibrocalcific and fibrobronchiectatic changes in bilateral upper lobes (right > left). Fibrocavitatory lesion measuring ~15 × 13 mm with a rounded soft tissue density was noted in apical segment of right upper lobe. Patchy ground glass opacities were noted in right upper lobe. On angiography study, it showed prominent right upper lobe pulmonary artery with an aneurysmal dilatation of apical segmental branch within the cavitary lesion. Sputum examination was positive for the acid-fast bacilli, as well as the culture for TB mycobacteria. The patient was treated with antitubercular drugs for 6 months with no further episodes of haemoptysis (Figs. 1–4).

Case 2: A 30 year old male presented to our institute with history of fever, night sweats, and productive cough since 1 year. It was associated with weight loss. After thorough clinical, radiological examination, positive sputum and culture for TB mycobacteria, pa-

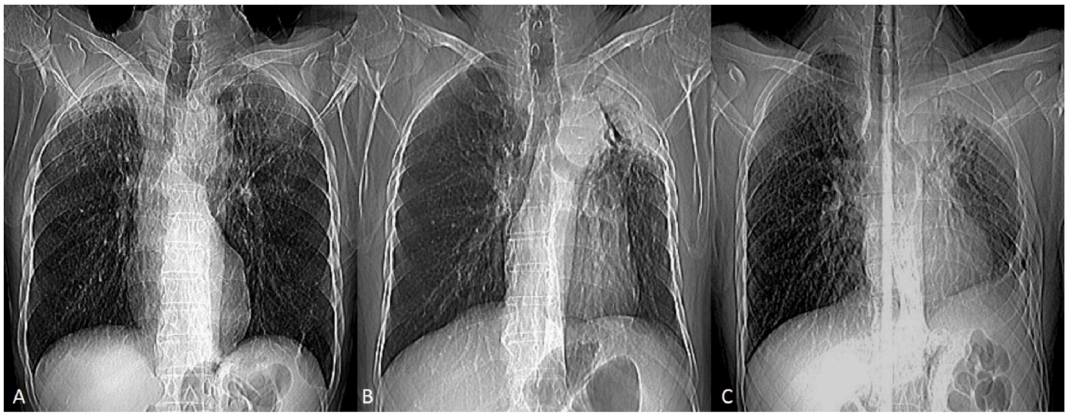

Fig. 1. Rasmussen aneurysm 2D CT: showing radiodense opacity in right upper zone in case 1 (A), left upper zone in case 2 (B) and case 3 (C).

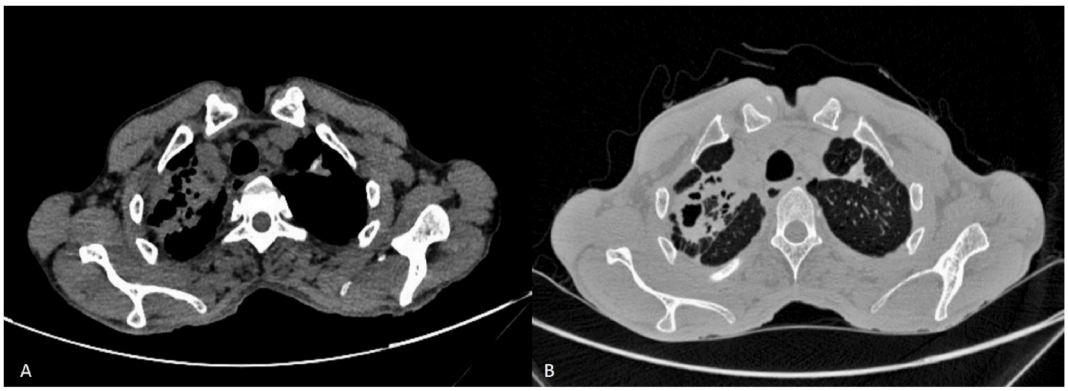

Fig. 2. Case 1: CT showing cavitary lung lesion with surrounding fibrotic and bronchiectatic changes in right upper lobe (A) soft tissue window (B) lung window.

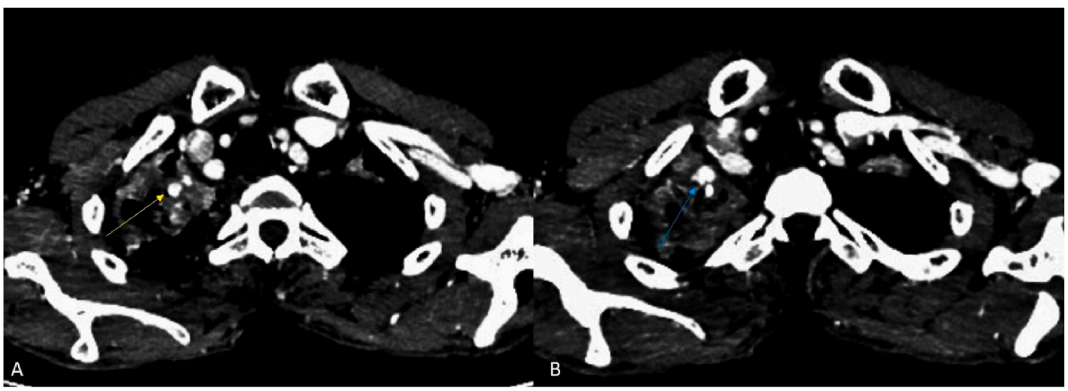

Fig. 3. Case 1: CT angiography showing an aneurysm originating from a right upper lobe segmental pulmonary artery branch (yellow and blue arrows).

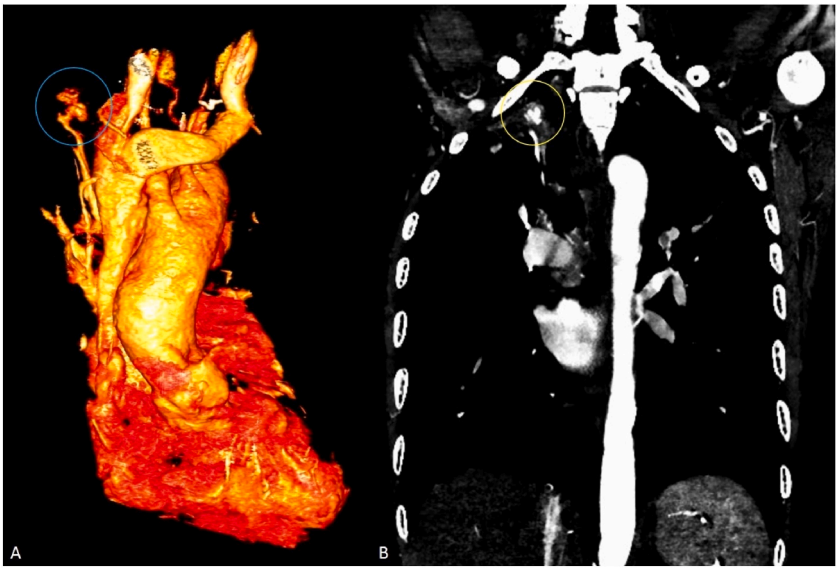

Fig. 4. Case 1: A three dimensional reconstruction of the vascular anatomy (MDCT) showing an aneurysm originating from a right upper lobe segmental pulmonary artery branch (encircled) corresponding to CT angiography on image B (encircled).

tient was finally diagnosed with tuberculosis. Patient was treated with anti-tubercular drugs for 6 months. After 2 months of completion of treatment, the patient developed excessive coughing along with massive haemoptysis (roughly 300 ml/hr) for 2 days. Subsequently the patient was brought to the emergency room with a GCS (Glasgow coma scale)of 10 of 15. His vitals were stabilized and patient was further evaluated by laboratory and radiological examinations. Mild decrease in haemoglobin level was documented. However other blood parameters were within the normal limits. A chest radiograph revealed a cavitating lesion involving the upper zone of the left lung. The patient underwent a CT pulmonary angiogram, which demonstrated an irregular shaped cavity measuring ~ 7 × 3.5 × 6.5cm in apico-posterior segment of left upper lobe (wall thickness~ 12mm). Non-enhancing dependant content was seen within the cavity. Extensive areas of fibrobronchiectasis were noted in adjoining lung parenchyma in left upper lobe. Few centrilobular nodules were seen in left lower lobe with surrounding ground glass opacity. No active extravasation of contrast was seen. Multiple focally dilated sub-segmental division of left upper lobe pulmonary artery which were seen coursing along the periphery of the cavitary lesion representing Rasmussen aneurysm. Bronchial arteries were normally visualized (Figure- 1, 5, 6, 7).

Patient was then transferred to the interventional radiology department for further management of the aneurysm. The patient was taken to DSA for embolization of the pulmonary artery to halt the source of bleed. The right common femoral vein approach was used in combination with a pigtail catheter and guidewire access, into the pulmonary trunk and subsequently to the left pulmonary artery. Selective angiogram revealed multiple focally dilated pulmonary artery. The patient underwent glue embolization of the aneurysms and remained stable without further haemoptysis.

Case 3: A 28 year old male patient who was treated for pulmonary tuberculosis two years back, complained of recurrent mild haemoptysis which aggravated in the last 10 days. He also complained of cough with evening rise of temperature for 20 days. On physical examination, patient was conscious and alert with maintain vitals with no cyanosis, clubbing, icterus or pedal oedema. Labo-

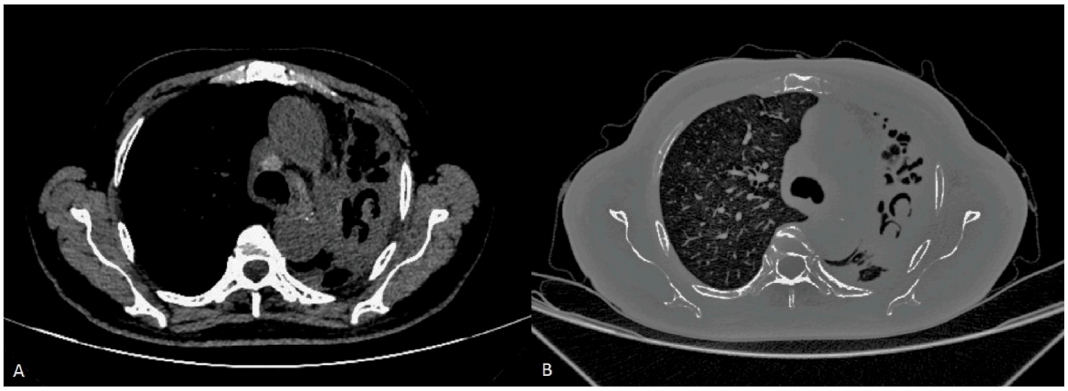

Fig. 5. Case 2: CT showing cavitary lung lesion with surrounding fibrotic and bronchiectatic changes in left lung; (A)soft tissue window (B) lung window showing multiple centrilobular nodules and ground glass opacities in right lung .

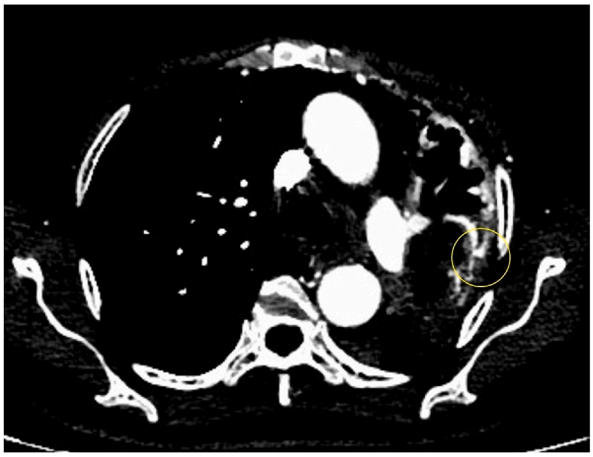

Fig. 6. Case 2: CT angiography showing an aneurysm originating from a left upper lobe segmental pulmonary artery branch (encircled).

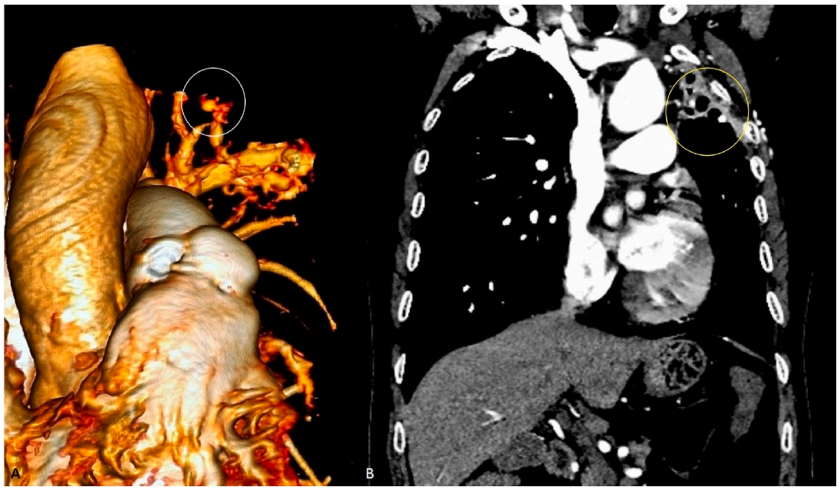

Fig. 7. Case 2: A three dimensional reconstruction of the vascular anatomy (MDCT) showing an aneurysm originating from a left upper lobe segmental pulmonary artery branch on image A (encircled) corresponding to CT angiography on image B (encircled).

ratory investigations were within normal. Computed tomography demonstrated fibrotic opacities with varicose bronchiectatic changes in entire left upper lobe with volume loss and ipsilateral mediastinal shift. A thick walled cavity measuring ~35 × 20mm was noted in left upper lobe with soft tissue density within. Few patchy fibrotic opacities were also noted in apical segment of right upper lobe. On angiography a small aneurysmal dilatation of segmental branch of left pulmonary artery was noted, coursing along the cavity. Multiple other tortuous dilated vessels were also seen surrounding the cavity. Sputum and culture for TB mycobacteria were positive. He was treated successfully with antitubercular drugs for six months. He had no further episodes of haemoptysis (Figure- 1, 8, 9, 10).

3. Discussion

Tuberculosis is a chronic inflammatory condition. In developing countries low immunity is the main cause for the development of tuberculosis along with other predisposing factors like alcohol abuse and low weight [7]. Rasmussen aneurysm is a rare complication of PTB which was first reported in literature in 19th century [8,9]. Fritz Valdemar Rasmussen et al., in 1868 illustrated a detailed pathological description of 11 cases, hence named after him [10]. It is caused as a result of progressive weakening of the adjacent pulmonary arterial wall in which both the adventitia and the media are replaced by granulation tissue and gradually replaced by fibrin, leading to thinning and pseudoaneurysm formation and subsequent rupture [11–13]. These are usually found in the upper lobes , peripherally distributed [12]. Communication of broncho-pulmonary and arterio-venous are at risk to rupture in the form of pseudoaneurysm formation, therefore combined embolization via the bronchial and pulmonary arteries is required to prevent recurrent haemoptysis [14,15]. Mild to moderate haemoptysis can be controlled by antitubercular therapy, however massive haemoptysis needs urgent intervention [16,17]. Massive haemoptysis in pulmonary tuberculosis can present as a result of multiple underlying secondary pathologies like bronchiectasis, aspergilloma, broncholiths or vascular complications [16]. CT scan and bronchoscopy are the modalities usually performed. CT pulmonary angiography is the investigation of choice. It precisely detects the source of bleeding and

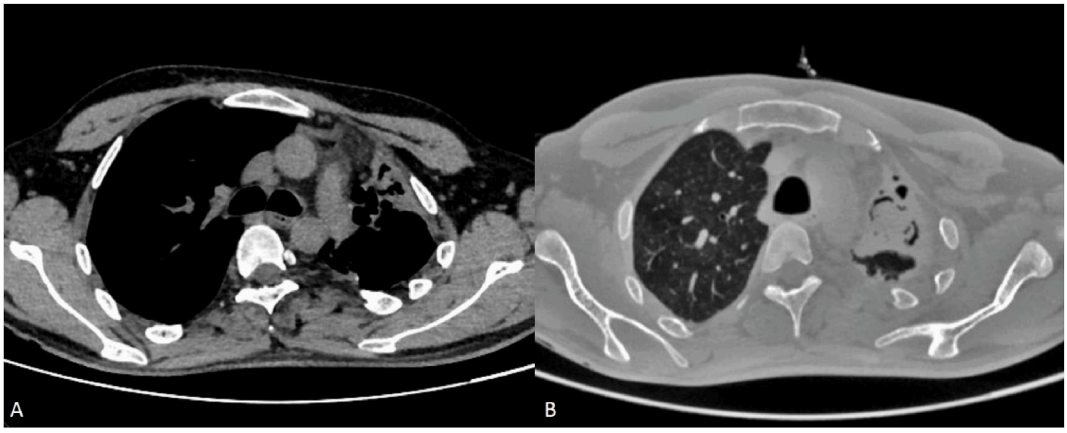

Fig. 8. Case 3: CT showing cavitary lung lesion with surrounding fibrotic and bronchiectatic changes in left upper lobe (A) soft tissue window (B) lung window.

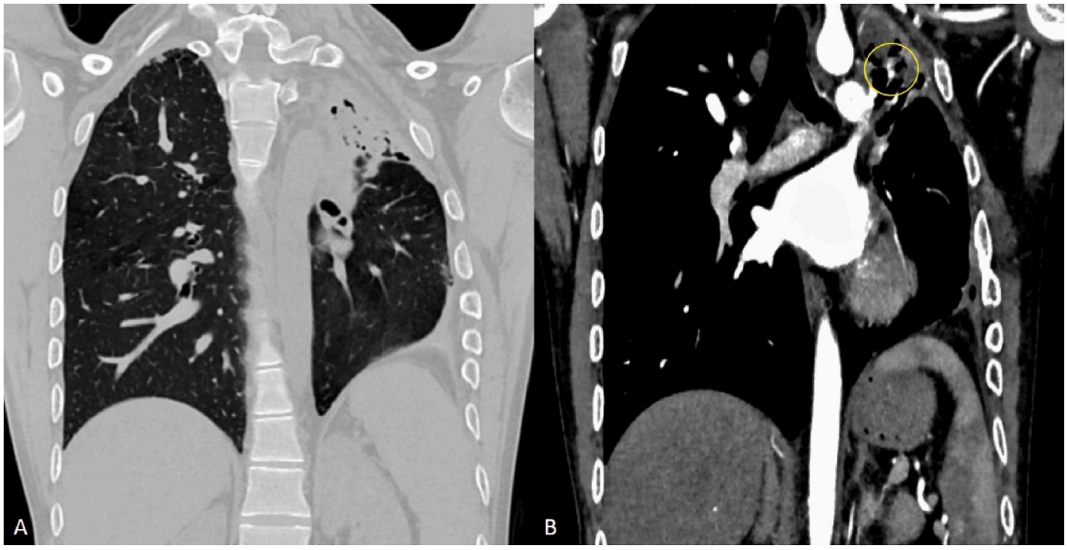

Fig. 9. Case 3: CT coronal (A) soft tissue window showing cavitary lung lesion with surrounding fibrotic and bronchiectatic changes in left upper lobe; (B) angiography showing an aneurysm originating from a left upper lobe segmental pulmonary artery branch (encircled).

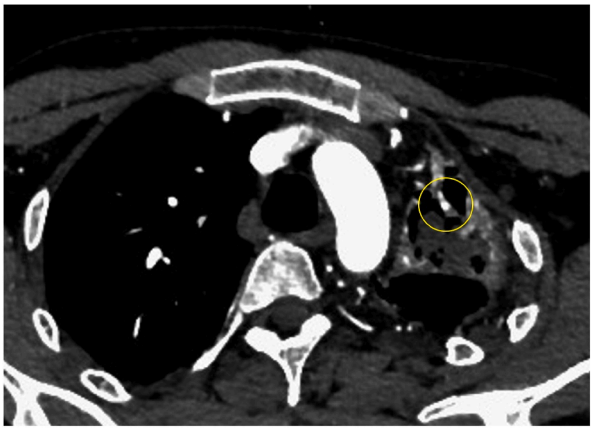

Fig. 10. Case 3: CT angiography showing an aneurysm originating from a left upper lobe segmental pulmonary artery branch (encircled).

further guides the management [18]. Stevan et al. in his study of 21,532 patients with confirmed PTB, only 54 cases (0.25%) were found to have Rasmussen pseudoaneurysms [19]. In 1939, Auerbach et al. reported an incidence of 4% when reviewing autopsy findings [20]. Another retrospective study in 189 patients with massive haemoptysis, a prevalence of 6.9% has been reported [21]. Flexible fibreoptic bronchoscopy can detect the bleeding site in 93% of cases [22], however it cannot provide specific findings in many important causes of haemoptysis such as bronchiectasis [23]. It also has therapeutic roles in localization, ensuring haemostasis or separation of the bleeding segment using other techniques [24]. In our cases, bronchoscopy only confirmed the presence of AFB in the airway. In few clinical studies, CT scan alone has shown to be the most sensitive diagnostic test [25]. Khalil et al. demonstrated the efficacy of DCTA (Dynamic CT Angiography) in directing therapy for haemoptysis of pulmonary origin [26]. Combining a CT scan with a bronchoscopy can have the highest diagnostic accuracy [25].

Rasmussen aneurysm has characteristic haemodynamics, therefore needs notable diagnostic and therapeutic care. The inflammation can induce bronchial to pulmonary arterial shunt, in which flow direction is determined by the pressure gradient from the bronchial to the pulmonary artery [27]. This result in hypo-perfusion in the diseased pulmonary segment which can affect visualization of the aneurysm on pulmonary angiography [28]. Rasmussen aneurysm arises from peripheral branches of pulmonary artery, thus requiring lobectomy or pneumonectomy [27]. In few cases, Endovascular Aneurysm Repair (EVAR) a less invasive technique has been described [29,30]. Cases refractory to angiographic embolization, surgery can be an alternative, however patients who undergo emergency resection on course of active massive haemoptysis have a high morbidity and mortality [31]. Surgery is not suitable for patients presenting with severe haemoptysis due to extensive pulmonary TB causing insufficient respiratory reserve [28]. Thus these cases require minimally invasive procedures which can control haemoptysis. Emergency angiographic embolization is the first line management in cases of massive haemoptysis [32] with a success rate of more than 90% [33]. Several techniques of embolization including stent-graft, coil packaging and glue embolization were evaluated, however no significant advantage was seen in comparison to each other [34]. Surgery is opted when embolization fails [35]. Very few cases of successful embolization of Rasmussen aneurysm with massive haemoptysis have been reported [14,27,28,36] in comparison to bronchial artery embolization which constitutes the majority of cases in published literature. Our second case was successfully embolized with complete control of haemoptysis. The other cases were managed conservatively and followed up for 6 months with no evidence of recurrent haemoptysis.

Author's contribution

Dr James R. Marak wrote the manuscript. Dr Tushant kumar is consultant in-charge who guided in writing the manuscript. Dr Harsha edited the images. Dr Shivam followed up the cases and corrected the manuscript with proof reading.

Declaration of competing interest

There is no interest to declare.

Abbreviations

WHO	World Health Organization
PTB	Pulmonary tuberculosis
CTA	Computed tomography angiography
DCTA	Dynamic Computed Tomographic Angiography
DSA	Digital Subtraction Angiography
EVAR	Endovascular Aneurysm Repair

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