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Research Article

ROLE OF BRONCHIAL ARTERY EMBOLISM IN MASSIVE HAEMOPTYSIS

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A B S T R A C T

Introduction: Its a life threatening emergency when patients presenting with massive haemoptysis. In 90% of the cases the major source of bleeding is bronchial circulation. However nonbronchial systemic arteries can also be a source of haemoptysis in a case of recurrence after Bronchial Artery Embolisation . Massive haemoptysis carries a mortality rate of 50% -85% when treated with conservative management. Bronchial artery embolism can be helpful in immediate management of massive and recurrent haemoptysis.

Material and methods: 15 cases of massive haemoptysis presented at Emergency of Medical College , Kolkata was admitted at Medicine ward and subsequently treated with Bronchial Artery Embolisation at Department of Radiodiagnosis, Medical College, Kolakata . Patient selection was done based on those who are fulfilling the criteria of massive haemoptysis(100- 600 ml/24 hour) and willing to undergo the procedure.

Result: Bronchial artery embolisation was well tolerated by the patients. Persistent haemoptysis was successfully controlled in 80% of the patients. However recurrence was seen in 20 % cases who were successfully treated with reembolisation.

Conclusion: Inspite of recurrences bronchial artery embolisation continues to be a first line minimally invasive procedure. Recurrent haemoptysis from acute on chronic inflammatory lung disease and previously embolised patients can also be treated with Bronchial Artery Embolisation.

INTRODUCTION

Bronchial Artery Embolisation as a treatment for haemoptysis was first described by Remy *et al* in 1974[1]. Now it has become an established procedure for management of massive and recurrent haemoptysis. Most common cause of haemoptysis in India is pulmonary tuberculosis and tubercular bronchiectasis . However chronic inflammatory bronchiectasis , bronchogenic carcinoma, aspergillosis, cystic fibrosis is the leading cause in western countries [2-4]. In most of the condition causing massive haemoptysis, the bleeding occurs from bronchial arteries (90%) rather than pulmonary circulation(5%). Other less common causes of massive haemoptysis include bleeding from aortobronchial fistula or non bronchial systemic collaterals[5]. In chronic or acute lung conditions there are obliterative changes in the pulmonary arteriolar level , leading to enlarged bronchial arteries. These high pressure systemic vessels often tend to rupture due to increased regional blood pressure in an inflamed lung, leading to haemoptysis[6].

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The major cause of mortality in massive haemoptysis is asphyxiation due to haemoptysis not the bleeding itself[3]. Conservative management of massive haemoptysis carries mortality rate of 50-85%[7]. We will present a case series of 15 patients presented with massive haemoptysis at Emergency and later admitted at Medicine ward in Medical College, Kolkata.

The aim of this article is to outline the etiology, pathophysiology, management strategy of massive haemoptysis and evaluate the role of bronchial artery embolisation in these cases.

REVIEW OF LITERATURE

Bronchial Artery Anatomy

Bronchial arteries have variable origin, anatomical course and branching pattern. Bronchial artery typically arise from thoracic aorta at T3 to T8 level. In 80 percent of cases bronchial arteries arise from T5, T6 level. Bronchial arteries also supply bronchi, oesophagus, posterior mediastinum, vagus nerve. Among bronchial arteries most consistent is right intercosto bronchial arterial trunk seen in 80% individuals. Cauldwell *et al* described four classic bronchial artery branching pattern[8]

1. Type I - Two on the left and one on the right that presents as an intercostobronchial trunk (40%)
2. Type II - One on the left and one intercostobronchial trunk on the right (21%)
3. Type III - Two on the left and two on the right (one intercostobronchial trunk and one bronchial artery) (20%)
4. Type IV - One on the left and two on the right (one intercostobronchial and one bronchial artery) (9.7%) These four most prevalent patterns of bronchial artery anatomy has been depicted in figure 1.

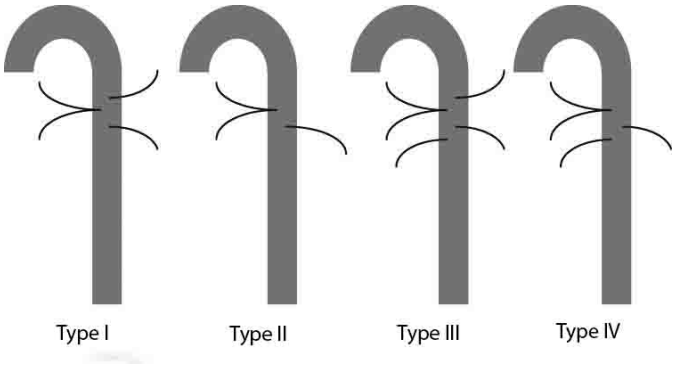

Figure 1 Four classic bronchial artery branching pattern[9]

20% of bronchial arteries have anomalous origins. Aberrant origins of bronchial arteries include the subclavian, thyrocervical, internal mammary, innominate, pericardiophrenic, superior intercostals, inferior phrenic arteries even abdominal aorta[7].
Normal calibre of the bronchial arteries range from 1.5 mm at the origin to 0.5 mm at the point of entry in a bronchopulmonary segment[10]. The arteries are defined as being enlarged when the diameter measures more than 2 mm in size[11].

Bronchopulmonary arterial anastomoses is very common in patients with chronic inflammation or pulmonary hypertension. The pulmonary parenchyma may receive arterial blood supply from transpleural systemic collateral to the bronchial circulation via intercostals, mammary, phrenic, thyrocervical, axillary, and subclavian arteries.

Consideration of arterial supply to spinal cord is very important when performing bronchial artery embolisation.The dominant arterial supply is from anterior spinal artery. Two types of arterial supply to the spine are visualized to arise from the intercostals arteries. the radicular and the anterior medullary arteries.

The radicular arteries are small branches supplying the ventral and dorsal spinal nerve roots. They are very often visulised in bronchial artery embolisation and in advertent embolisation of these arteries does not lead to any significant sequelae. [12,13]

The anterior medullary arteries are less often visualized but are of greater concern as they feed the anterior spinal artery. The artery of Adamkiewicz arises at T9 to T12 levels in most cases and reinforces the anterior spinal artery, which is the primary source of spinal cord perfusion. These may 6 – 8 in numbers and identified in angiography as hairpin loop configuration. Inadvertent embolization of the anterior medullary arteries can lead to spinal cord ischemia.[14] Though bronchial artery embolisation is a safe procedure. Transient chest pain is the most common complication. Subintimal dissection of aorta or bronchial artery has been reported up to 6.3 % of patients[11,12]. Inadvertent embolisation of anterior spinal artery is the most dreaded complication following the procedure which has been reported in 1.4- 6.5 % of cases[15,16]. Dysphagia may occur following the procedure due to embolisation of oesophageal branches which usually resolves spontaneously. Rare complication of bronchial artery embolisation includes broncho oesophageal fistula, aortic and bronchial necrosis, pulmonary infraction, pericarditis, transient cortical blindness[16-19].

Haemoptysis can be classified according to its severity in the following way:

Table 1 Classification of Haemoptysis with severity[2]

Severity of Haemoptysis	Amount/24 hours
Mild	<30 ml
Moderate	31-100ml
Severe	100-600ml

MATERIAL AND METHOD

Patients

The study was conducted in Medical College , Kolkata on patients presented at Emergency of Medical College, Kolkata with massive haemoptysis with Bronchial artery embolisation at department of Radiology DSA unit after getting informed consent from all the participients. According to Table 1 massive haemoptysis was defined as bleeding 100- 600 ml/24 hour.

Inclusion criteria

1. Patients presented at Emergency of Medical College, Kolkata with massive haemoptysis 100-600ml/24 hour
2. Those who gave informed consent for Bronchial artery embolisation
3. Patients with previous history of bronchial artery embolisation
4. Willing to participate in the study
5. Willing to have their address recorded and to come for follow up

Exclusion criteria

1. Patients unwilling to undergo the procedure
2. Patients with insignificant amount of haemoptysis

In 12 months 27 patients came in Emergency of Medical College and hospital,Kolkata with haemoptysis. Out of these 21 patients had massive haemoptysis and were eligible for inclusion in the study. The nature of the procedure was explained to the patient. Only 15 patients gave informed consent for the procedure and subsequently included in the study. The response rate was 73 % . Others were excluded from the study. Initial medical management was done in every patient . Complete blood count and platelet count was done . Liver function and coagulation profile was performed. Correction of coagulation defect was done with Vit K inj and Fresh frozen plasma. Blood for grouping and typing was done when blood transfusion was indicated. Expectorated blood was

subjected to Ziehl Nielsen staining to diagnose active pulmonary tuberculosis. Patients were followed up for a period of 6 months.

Bronchial artery embolisation procedure

The procedure was performed in DSA Cathlab under aseptic precaution .Catheterisation of aorta was done under local anaesthesia using transfemoral retrograde approach with 5F sheath, 5F catheter and guide wire by Seldinger's technique. Initial thoracic aortogram was performed to localize prominent arterial feeders which was followed by selective catheterization of bronchial and intercostals arteries and angiogram. After identification of feeding vessels embolisation was done with mixture of 300 and 500 micron PVA particle / microcoils.

Follow Up

Patients were closely observed for recurrent haemoptysis and early complication of bronchial artery embolisation. After discharge the patients were followed up on outpatient basis for a period upto 6 months.

Ethical consideration

The study was conducted after getting approval from Institunal Ethics Committee and other authority. Informed consent will be taken from all participents.

Analysis

Data of individual case will be coded and entered MS Excel sheet and was analysed using stastical package of social sciences(SPSS) 21.0. Statistical significance was set at $p \leq 0.05$. Descriptive stastic will be used.

RESULTS

Among 15 patients 12 were male with average age of 42 years. 13 patients(86%) out of these 15 cases have bleeding episode for the first time. Out of these 13 new cases 9 patients(60%) have active tuberculosis. 3 patients who have already undergone bronchial artery embolisation were negative for Acid Fast Bacilli. Diagnosis of active tuberculosis was done in 9 patients (60%), rest 6 patients(40%) were suffering from bronchiectasis. Among 6 patients 2 had previous history of bronchial artery embolisation for haemoptysis Ziehl Nielsen staining was negative for Acid fast bacilli in all bronchiectasis patients. None of the patients was suffering form lung carcinoma. In chest X Ray cavitation was present in 8 cases(53%) and infiltration in 7 patients(46%). 11 patients(73%) had history of antitubercular treatment.

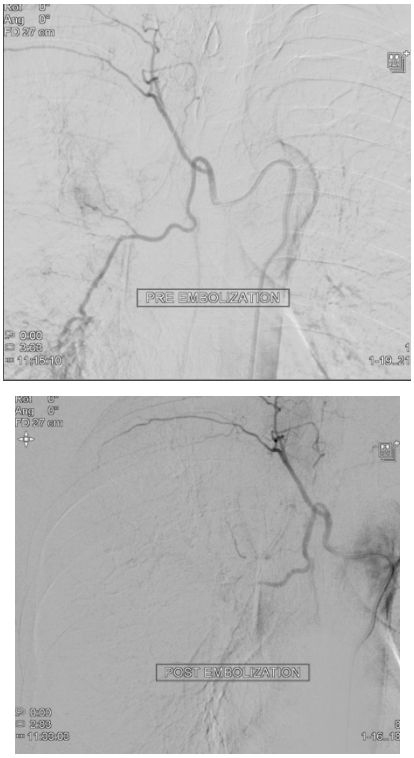

Figure 2 Selective angiography of Right Upper Bronchial Artery was done which showed contrast blush in two of it's branches.Embolisation was done using 300um PVA particles. Post embolisation showed marked reduction in contrast blush

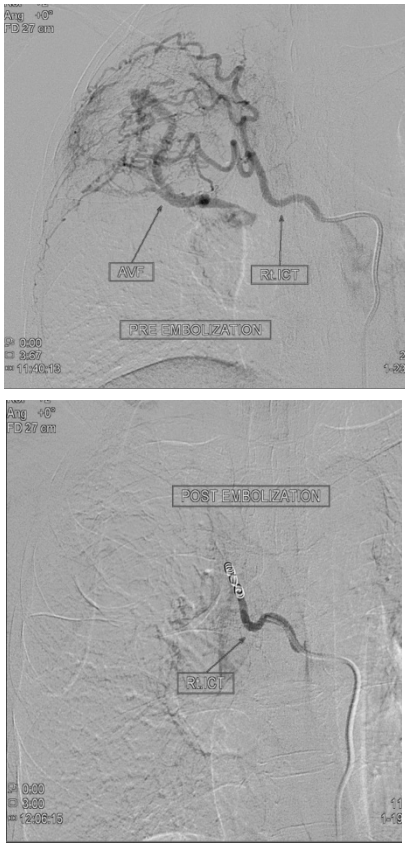

Figure 3 Angiography of the Right Inter-costo Bronchial Artery revealed contrast blush and also evidence of A-V fistula in one of its branches. Embolisation was done using 3 micro-coils. Post embolisation showed marked reduction in contrast blush.

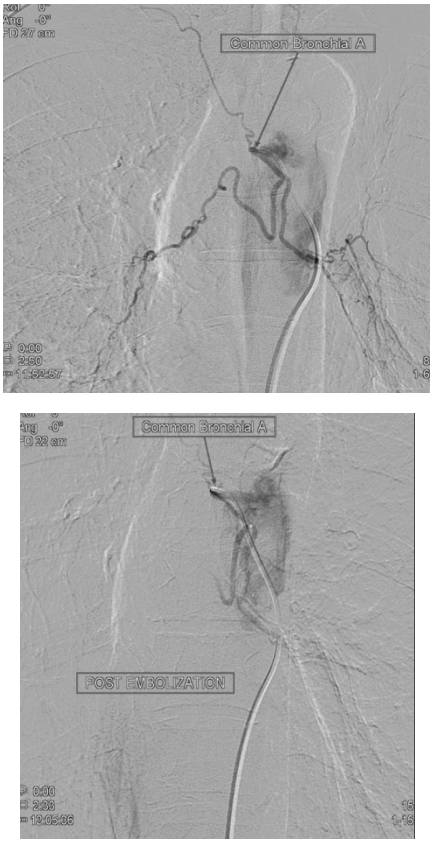

Figure 4 Angiography of the common origin of Bilateral Upper Bronchial arteries revealed contrast blush on the right side. Embolisation was done using a mixture of 300um and 500um PVA particles. Post embolisation showed marked reduction in contrast blush.

Right bronchial artery was involved in all cases (100%). Whereas right intercosto bronchial artery was involved in 10 patients (66%) and 3 patients(20%) had involvement of left bronchial artery. 1 patient have involvement of left internal mammary artery. 3 patients were alcoholic and 2 were hypertensive. In angiographic sign hypervascularisation was seen in all cases with bronchopulmonary anastomosis in 10 patients (66%). In follow up 9 patients(60%) had blood tinged expectoration for less than a week. Only 3 patient had recurrent (20%) haemoptysis in follow up period who were successfully treated with reembolisation.

None of our patients experienced any major complication except transient chest pain which was seen in most of them in immediate post procedure period.

All patients with active tuberculosis was treated with Anti tubercular therapy and others were treated with anti microbials, inhaled steroid and other supportive management.

DISCUSION

Massive haemoptysis is a life threatening condition which requires urgent intervention. Earlier surgery was the best method to control these types of bleeding. But it required a lot of preparations which were not always possible in emergency situations[20]. Besides many surgical complications resulted in lowered quality of life[21].

In 1963 Viamonte first performed selective bronchial arteriogram[22]. In 1976 Wholey *et al* published a series of 4 cases of successful bronchial artery embolisation[23]. There embolisation material consists of gelatin sponge strips and topical thrombin injection. This was followed by large series by Remy *et al*. in 1977 of 104 patients in which haemoptysis was treated with embolisation of bronchial and non bronchial arteries[24]. Subsequently bronchial artery embolisation was widely used for immediate management of haemoptysis because nonoperable patients can be treated and other patients can be stabilized before surgical management.

Bronchial artery embolisation was well tolerated by all the patients undergoing the procedure in our study. Immediate control of bleeding was achieved in 14 patients(93%). But 9 patients had expectoration of black clots upto 10 days post procedure due to retained secretion. 3 patients experienced recurrent haemoptysis after 1 month following the procedure who were successfully treated with reembolisation. Causes of recurrence includes inadequate embolisation, imprecise localization of the initial site of bleeding, bronchial artery recanalisation, progression of the disease.

Cremaschi *et al*. evaluated 209 patients who had been embolized for hemoptysis and noted that immediate control was achieved after BAE in 205 (98%) patients [25]. Rabkin *et al*. evaluated 306 patients and found that BAE controlled acute bleeding in 278 (91%) patients[26]. These studies and our study have shown than bronchial artery embolisation is an effective immediate treatment as well as stabilization in cases of haemoptysis.

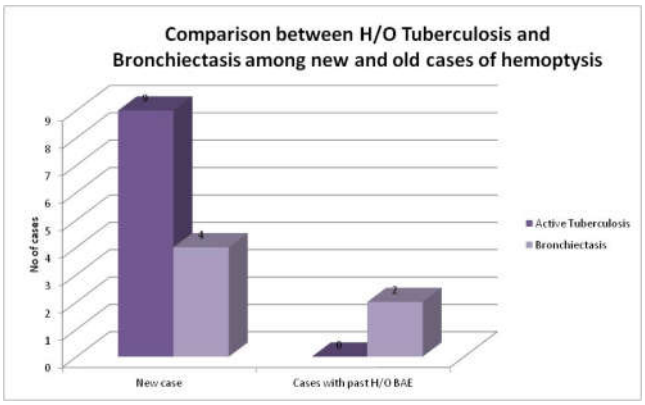

Figure 4 Comparison between history of tuberculosis and bronchiectasis among new and old cases of hemoptysis

Ramakantan *et al*. performed bronchial artery embolization in 140 patients with haemoptysis due to active or old tuberculosis[27]. Gross *et al*. performed emergency bronchial artery embolization in 61 patients with haemoptysis due to tuberculosis[28]. In our study 13 patients presented with massive haemoptysis for the first time out of whom 9 had active tuberculosis (60%) which suggests tuberculosis as major cause of massive haemoptysis in India. Chest radiograph was abnormal in all cases showing cavitation in 8 cases(53%) and infiltration in 7 cases(46%).

Knott-Craig *et al*. retrospectively studied 120 patients with hemoptysis and found that the right lung was the source in 62% and the left lung in 38%[29]. In our study Right bronchial artery and right intercostobronchial artery was involved in majority of the cases. This may be due to frequent involvement

of right sided parenchyma in comparison to left side. Subsequently left bronchial artery was involved in 3 cases.

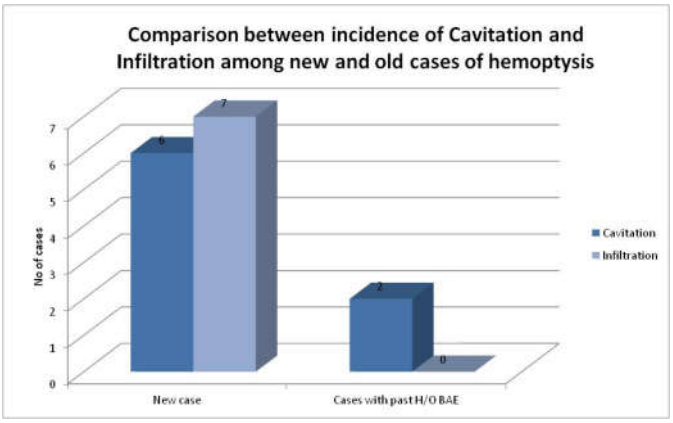

Figure 4 Comparison between incidence of cavitation and infiltration among new and old cases of hemoptysis

CONCLUSION

Major limitation of this study was only patients presented with massive haemoptysis requiring immediate intervation was included in the study, so the results could not be generalized.

In conclusion it can be said that massive haemoptysis is a significant clinical entity with high morbidity and mortality where surgical and medical management has severe limitations. Persistent haemoptysis can successfully be controlled with bronchial artery embolisation and it has a low complication rate. Though recurrence may occur following bronchial artery embolisation that can be treated with reembolisation.

References

1. Rémy J, Voisin C, Dupuis C, Beguery P, Tonnel AB, Denies JL *et al*. Treatment of hemoptysis by embolization of the systemic circulation. Ann Radiol (Paris). Jan-Feb 1974;17(1):5-16.
2. Najarian KE, Morris CS. Arterial embolization in the chest. J Thorac Imaging 1998;13:93-104.
3. Marshall TJ, Jackson JE. Vascular intervention in the thorax: bronchial artery embolization for haemoptysis. Eur Radiol. 1997;7(8):1221-7.
4. Jean-Baptiste E. Clinical assessment and management of massive hemoptysis. Crit Care Med. 2000 May;28(5):1642-7.
5. Remy J, Remy-Jardin M, Voisin C. Endovascular management of bronchial bleeding. In: J. Butler, Editors. The Bronchial Circulation. New York, NY, USA:Dekker;1992.p.667–723.
6. Deffebach ME , Charan NB , Lakshminarayan S , Butler J The Bronchial Circulation Small, but a Vital Attribute of the Lung. American Review of Respiratory Disease.1987;135(2):463–81.
7. Burke CT, Mauro MA. Bronchial Artery Embolisation. Semin Intervent Radiol. 2004 Mar; 21(1): 43–48.
8. Cauldwell EW, Siekert RG, Lininger RE, Anson BJ. The bronchial arteries: an anatomic study of 105 human cadavers. Surg Gynecol Obstet 1948; 86:395–412.
9. Sopko DR, Smith TP. Bronchial Artery Embolization for Hemoptysis. Semin Intervent Radiol. 2011 Mar; 28(1): 48–62.
10. Deffenbach ME, Charan NB, Lakshminarayan S, Butler J. The bronchial circulation: small, but a vital attribute to the lung. Am Rev Respir Dis 1987; 135: 463–81
11. Furuse M, Saito K, Kunieda E, *et al*. Bronchial arteries: CT demonstration with arteriographic correlation.Radiology 1987; 162:393–98
12. Uflacker R, Kaemmerer A, Neves C, Picon PD. Management of massive hemoptysis by bronchial artery embolization. Radiology 1983; 146:627–34.
13. Uflacker R, Kaemmerer A, Picon PD, *et al*. Bronchial artery embolization in the management of hemoptysis: technical aspects and long-term results. Radiology 1985; 157:637–44.
14. Rosenthal D. Spinal cord ischemia after abdominal aortic operation: is it preventable? J Vasc Surg 1999; 30:391–99.
15. Tanaka N, Yamakado K, Murashima S, *et al*. Superselective bronchial artery embolization for hemoptysis with a coaxial microcatheter system. J Vasc Intervent Radiol 1997; 8:65–70.
16. Wong ML, Szkup P, Hopley MJ. Percutaneous embolotherapy for life-threatening hemoptysis. Chest 2002; 121:95–102.
17. Ivanick M J, Thorwarth W, Donohue J, *et al*. Infarction of the left main-stem bronchus: a complication of bronchial artery embolization. AJR Am J Roentgenol. 1983;141:535–37.
18. Hélénon CH, Chatel A, Bigot JM, Brocard H. Left esophago-bronchial fistula following bronchial artery embolization. Nouv Presse Med. 1977 Dec 31;6(45):4209.
19. Munk P L, Morris D C, Nelems B. Left main bronchial-esophageal fistula: a complication of bronchial artery embolization. Cardiovasc Intervent Radiol. 1990;13:95–97.
20. Al-Refaie RE, Amer S, El-Shabrawy M. Surgical treatment of bronchiectasis: A retrospective observational study of 138 patients. J Thorac Dis. 2013;5:228–33.
21. Sehitogullari A, Bilici S, Sayir F, Cobanoglu U, Kahraman A. A long-term study assessing the factors influencing survival and morbidity in the surgical management of bronchiectasis. J Cardiothorac Surg. 2011;6:161.
22. Viamonte M. Selective bronchial arteriography in man. Radiology. 1964; 83: 830–39.
23. Wholey MH, Chamorro HA, Rao G. Bronchial artery embolization for massive hemoptysis. Journal of the American Medical Association. 1976;236(22):2501–2504.
24. Remy J, Arnaud A, Fardou H. Treatment of hemoptysis by embolization of bronchial arteries. Radiology 1977; 122(1):33–38.

25. Cremaschi P, Nascimbene C, Vitulo P *et al*. Therapeutic embolization of bronchial artery: a successful treatment in 209 cases of relapse hemoptysis. Angiology 1993; 44(4):295–99.
26. Rabkin JE, Astafjev YI, Gothman LN, Grigorjev YG. Transcatheter embolization in the management of pulmonary hemorrhage. Radiology 1987;163(2):361–65.
27. Ramakantan R, Bandekar VG, Gandhi MS, *et al*. Massive hemoptysis due to pulmonary tuberculosis: control with bronchial artery embolization. Radiology 1996;200:691-4.
28. Lee JH, Kwon SY, Yoon HI, *et al*. Haemoptysis due to chronic tuberculosis vs. bronchiectasis: comparison of long-term outcome of arterial embolisation. Int J Tuberc Lung Dis 2007;11:781-7
29. Knott-Craig CJ, Oostuizen JG, Rossouw G, Joubert JR, Barnard PM. Management and prognosis of massive hemoptysis. Recent experience with 120 patients. J Thorac Cardiovasc Surg. 1993;105:394–7.

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