

## Research Article

# Immediate and long-term results of bronchial artery embolisation for life-threatening hemoptysis in bronchiectasis

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## ABSTRACT

**Background:** Bronchial artery embolization (BAE) has been established as an effective technique in the emergency treatment of life-threatening hemoptysis, but few data concerning long-term results of the procedure are available. The aim of this study was to analyze the immediate and long-term results of bronchial artery embolization (BAE) for hemoptysis due to bronchiectasis.

**Methods:** Twenty five patients (aged 28–76 years) who underwent bronchial artery embolization with polyvinyl alcohol particles, gelatin sponge and coil for massive or continuing moderate hemoptysis caused by bronchiectasis were included in the study. These patients were followed up for 3 years. Initially patients were followed up monthly for 6 months by clinical examination. Then yearly follow up by clinical and radiological examination. Results analyzed using SPSS 16 version.

**Results:** In our study 16 patients (64%) were males. 11 patients (44%) had bilateral bronchiectasis. 14 patients (56%) had no rebleeding in the three year follow-up period. Only 8% developed rebleeding within 24 hrs. Only one patient (4%) developed massive hemoptysis within one month and died. Other rebleeds were very minimal. In our study there was no significant relation with side of bronchiectasis and rebleed.

**Conclusions:** Bronchial artery embolisation can yield immediate and long-term benefit in patients with hemoptysis due to bronchiectasis.

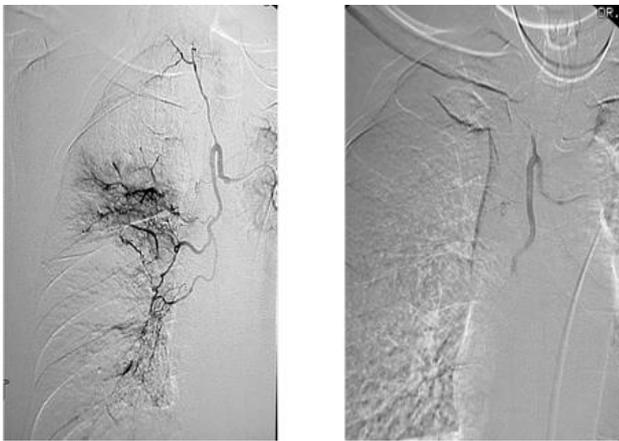
**Keywords:** Hemoptysis, Bronchiectasis, Bronchial artery, Embolization

## INTRODUCTION

In life-threatening hemoptysis, bleeding originates in most cases from bronchial arteries or from nonbronchial systemic collateral vessels. Bronchial artery embolization (BAE), first introduced two decades ago by Remy and associates was thus a logical therapeutic approach.<sup>1</sup> BAE has been established as an effective treatment for massive hemoptysis or hemoptysis that is resistant to medical treatment.<sup>1-3</sup> Death in massive hemoptysis is most often due to asphyxiation from the aspiration of blood, leading

to airway obstruction. Less commonly, death may be caused by exsanguination and acute hypotension.<sup>1</sup> Recurrent bouts of moderate hemorrhage (three or more bouts of 100 ml of blood per day within a week) are now also considered a major haemorrhagic event. In addition, chronic or slowly increasing hemoptysis is considered an indication for transcatheter therapy.<sup>2</sup> Because of the poor outcome associated with conservative therapy alone, many centres have instituted more aggressive therapeutic maneuvers. Although surgical resection may be curative for those individuals with focal disease, most patients

presenting with major hemoptysis have diffuse chronic lung disease and limited pulmonary reserves. This group is considered to contain unacceptable surgical candidates. In patients who are surgical candidates, preoperative bronchial artery embolization to control the acute hemorrhage might be beneficial. The source of bleeding must be defined clearly and hemoptysis must be differentiated from bleeding from the upper airways or alimentary tract. Once hemoptysis has been established, a multidisciplinary approach involving pulmonary medicine, thoracic surgery, and interventional radiology is optimal. All medications that might contribute to bleeding should be stopped. A coagulation profile should be obtained and a sputum sample sent for culture and sensitivity, including bacteria, mycobacterium, and fungi.<sup>4</sup> The aim of this study was to determine the immediate and the long-term outcomes of bronchial artery embolization in patients with massive hemoptysis due to bronchiectasis.



**Figure 1: Pre and post embolization.**

**METHODS**

Bronchiectasis patients with massive hemoptysis were evaluated with x-ray chest and high resolution computed tomography. Bronchoscopy was not done in any patients. Initially they were treated with medical management. In patients in whom medical management failed where treated with bronchial artery embolization. 25 patients with bronchiectasis underwent bronchial artery embolisation during the year 2009 to 2011. They were selected for studies. During follow up 2 patients lost follow up after 1month. Within one month 1 patient died of massive hemoptysis and 2 patients died due to non-respiratory causes. Hence remaining 20 patients were followed up for three years, initially only clinical follow up monthly for 6months and later clinical and radiological follow up for yearly for three years. Incidence of rebleed noted. Rebleed is defined as spitting out of fresh bright red blood of more than 10ml. Data were entered into computer and analysed using spss16 version. Patients with active tuberculosis, carcinoma lung and second attempt bronchial artery embolisation were excluded from the study.

**Angiography technique and embolization**

Selective bronchial artery catheterization done using a 5F CobraC2 catheter (Cordis) The diagnostic catheter (without side holes) can be advanced deep into the arteries, the embolotherapy is performed directly, without a significant risk of reflecting material into the aorta. The bronchial arteries are found by scraping the catheter tip along the aortic wall in the anticipated location of the vessels (level of 4<sup>th</sup> to 6<sup>th</sup> thoracic vertebra), which corresponds to the position of left mainstem bronchus. The classic finding in patients with bronchial artery bleeding include enlargement of main artery >3 mm, hyper vascularity, parenchymal stain, and bronchial to pulmonary artery shunting.

Embolization done using polyvinyl alcohol particles (Size-500-1000microns) in 14 patients (56%). Gelfoam used in 9 cases (36%). Coil embolization along with PVA particles done in 2 cases (8%). PVA particles are delivered as slurry made with diluted contrast material. Small aliquots (1 to 2 ml) were injected slowly to avoid reflux into the aorta. Contrast was injected after each delivery to follow the progress of embolisation, which is continued until blood flow is static.

Embolisation termed as complete when 95% of the peripheral branches of the bronchial artery were occluded and the antegrade flow stopped.

**RESULTS**

**Table 1: Baseline characteristics.**

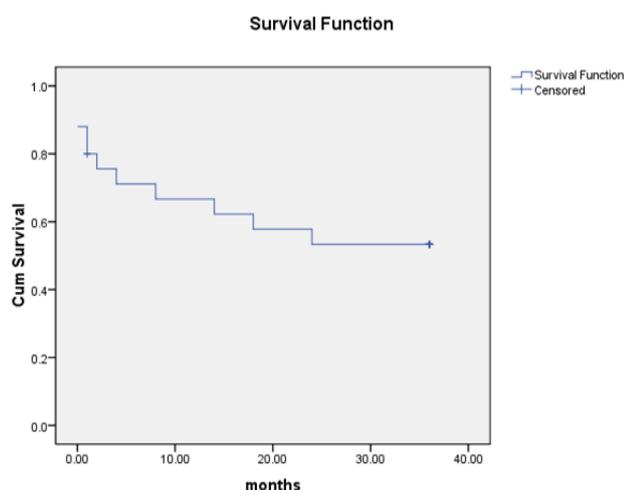
	Number	%
Age		
<30	5	20
30-49	7	28
50-69	9	36
>=70	4	16
Sex		
Male	16	64
female	9	36
SIDE		
Bilateral	11	44
Unilateral	14	56
Type of material used for embolisation		
PVA	14	56
Gelform	9	36
coil	2	8

Incidence of re-bleed following bronchial artery embolisation= 2.1 per 100 person months of follow up  
 Mean time duration of rebleed= 22.4 months (Standard error: 3.2).

**Table 2: Comparisons of mean re-bleed free time period (in months) across different variables.**

	Mean	Standard error	P value*
<b>Age</b>			
<50	24.6	4.3	0.6
>=50	20.1	4.8	
<b>Sex</b>			
Male	24.0	4.1	0.4
female	19.3	5.0	
<b>Side</b>			
Bilateral	24.3	4.8	0.6
Unilateral	21.0	4.1	
<b>Type of material used</b>			
PVA	17.8	4.3	0.3
Gelform	30.5	3.9	
coil	20	11.3	

\*using Log Rank Test

**Figure 2: Kaplan Meier curve showing probability of survival (absence of re-bleed) following bronchial artery embolisation across time (in month).**

## DISCUSSION

Embolotherapy is the first line treatment for massive hemoptysis or recurrent intractable hemoptysis.<sup>5,6</sup> Presence of a major spinal artery branch or radiculomedullary branch from the bronchial artery is considered to be a contraindication to embolotherapy by some interventionalist, but others perform embolisation if a micro catheter can be negotiated well beyond such a vessel.<sup>7</sup>

In 1963, Viamonte performed the first selective bronchial arteriogram.<sup>8</sup> In 1976; Wholey et al. published a series of four cases of successful BAE for the control of hemoptysis.<sup>9</sup> Their embolization materials consisted of

gelatin sponge strips (three patients) and topical thrombin injection into the left bronchial artery (one patient). This was followed by a large series by Remy et al. in 1977 of 104 patients who were treated by embolization of both the bronchial and nonbronchial arteries to control hemoptysis.<sup>10</sup> Forty-nine of these patients were treated during active hemoptysis, with immediate control of the hemorrhage seen in 41 patients (84%). Subsequently, BAE was widely used, because non-operable patients could be treated and other patients could be stabilized prior to surgery.<sup>11</sup>

Bronchial arteriography and embolization were well tolerated by our patients. In our study no rebleed occurred in 56% patients within 3 year follow up period. Only one patient (4%) developed massive bleeding within one month and died. The rebleed in other patients were only minimal quantity requiring only out patient management. Within 24 hrs 2 patients (8%) developed minimal hemoptysis.

When performed early in the patient's management, Saumench et al identified the hemorrhage in 91% of cases compared with only 50% when performed later in the clinical course.<sup>12</sup> Cremaschi et al. evaluated 209 patients who had been embolized for hemoptysis and noted that immediate control was achieved after BAE in 205 (98%).<sup>13</sup> In our study only 2 patients developed rebleed within 24 hrs. (8%) i.e., immediate control was achieved for 92%.

Rabkin et al. evaluated 306 patients and found that BAE controlled acute bleeding in 278 (91%).<sup>14</sup> Our results and those of the foregoing studies have shown that BAE is an effective procedure with which to stabilize many patients and to definitively treat some patients with hemoptysis.

In our study only bronchiectasis cases that underwent BAE were selected for study. Previous studies selected all cases with hemoptysis. In our study most common age group is 50-69 (36%). 64% patient had unilateral bronchiectasis. Akira Kato et al evaluated 100 patients who underwent bronchial artery embolisation, and found that after BAE, bleeding stopped in 94 patients (94%). Long-term cumulative hemoptysis non recurrence rates after the initial embolization were 77.7% for 1 year and 62.5% for 5 years. In bronchitis (n 59) and active tuberculosis (n 54) groups, an excellent (100%) 5-year cumulative nonrecurrence rate was obtained. The rate was lower in groups with pneumonia/abscess/pyothorax (n 58).<sup>15</sup> Rabkin et al published the largest series to date in 1987, reporting on 306 patients.<sup>16</sup> Immediate control of the hemoptysis was achieved in 91% of patients. Guo supported the optimistic results in 1992 by reporting results in the patients with bronchial artery extravasation; they found control of hemoptysis in 93, 87, and 79% of patients at 1 week, 1 month, and 3 months following bronchial artery embolization, respectively.<sup>17</sup> Goh et al published the results of a 6-year review in which they demonstrated an overall success rate of 82%.<sup>18</sup>

In our study the incidence of re-bleed following bronchial artery embolisation= 2.1 per 100 person months of follow up and Mean time duration of rebleed = 22.4 months (Standard error: 3.2).

## CONCLUSION

Major hemoptysis is a frightening and potentially fatal complication of bronchiectasis. The development of bronchial artery embolization techniques has revolutionized the approach to these patients. Persistent hemoptysis can be successfully controlled in as many as 90% of patients. In view of our results, we continue to favour the simplest and the quickest procedure, most likely to control hemoptysis. In summary, our study confirms that BAE is an effective technique in the emergency treatment of life-threatening hemoptysis.

## Limitations

- 1) It is a single centred study.
- 2) No comparison with other modalities of treatment of hemoptysis like medical conservative treatment and surgical treatment.

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