BRONCHIAL ARTERIOGRAPHY AND TRANSCATHETER EMBOLIZATION IN MANAGEMENT OF SEVERE HAEMOPTYSIS

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ABSTRACT

The purpose of this study was to assess the effectiveness of bronchial arteriography and transcatheter embolization in treatment of severe haemoptysis. Forty five patients with severe haemoptysis were evaluated by means of bronchial arteriography and study of non bronchial systemic arteries and underwent transcatheter embolization. Specific causes of haemoptysis were Tuberculosis (n=37), Tuberculosis with Aspergilloma (n=4) and bronchiectasis (n=4). Gel foam pellets and polyvinyl alcohol (PVA) particles were used as embolic material in 36 patients and 9 patients respectively. The angiographic signs of haemorrhage encountered were extravasation of contrast in 2 patients (4.4%), hypervascularisation in 42 (93.3%), broncho-pulmonary shunt in 13 (28.8%) and bronchial artery aneurysm in 1 patient (2.2%). Immediate control of bleeding occurred in 44 (97.7%) of 45 patients after embolization. Recurrent haemoptysis occurred in 4 cases (11.9%) more than 1 month after embolization but bleeding was less severe, than before treatment. This study suggests that bronchial artery embolization is an effective method of managing patients with severe haemoptysis, minor bleeding recurrences appear to be relatively infrequent.

MJAFI 1999; 55 : 189-192

KEYWORDS : Embolization; Haemoptysis; Lung haemorrhage.

Introduction

Haemoptysis is always an alarming event. When massive and untreated, it has a mortality rate of approx 80% [1]. Massive bleeding into tracheo-bronchial tree is an imminent threat to life, usually because of asphyxiation. The co-existence of compromised lung function, poor cough effort, and medication with sedatives contribute to the dangerous situation.

Transcatheter embolization of bronchial arteries has become an accepted procedure for control of haemoptysis occurring due to variety of causes [2-5]. Previous reports have stressed that transcatheter embolization is only a temporary measure [6] and its long term effects have not been sufficiently recognised. Here we report a prospective study of 45 patients with severe haemoptysis treated by bronchial artery embolization (BAE) in our institution from September 1995 to March 1998. We focus on the importance of bronchial arteriography and effectiveness of BAE in management of severe haemoptysis.

Material and Methods

Bronchial artery embolization was performed for medically uncontrollable haemoptysis in 45 patients (41 males and 4 fe-

males), their ages ranged from 22 to 62 years and averaged 29.6 years. The underlying causes included Tuberculosis (n=37), Tuberculosis with Aspergilloma (n=4) and Bronchiectasis (n=4) (Table 1). Cases included in this study were those who had recurrent bouts of haemoptysis in that there was loss of more than 250 ml blood in 24 hours.

Table 1
Specific causes of haemoptysis

Disease	No. of patients
Tuberculosis	37
Tuberculosis and aspergilloma	4
Bronchiectasis	4
Total	45

Transfemoral bronchial and or intercostal arteriography was performed using standard Seldinger technique using 4.5 Fr Shephard's Crook catheter and 5 Fr double angle renal and Cobra visceral catheters. The material used was gelfoam sponge cut into 2-3 mm cubes in 36 patients whereas in the rest of the patients, polyvinyl alcohol particle of more than 500 μ were used. Bronchial arteries were selected for embolization on the basis of arteriographic information. In addition to bronchial arteries, intercostal arteries and internal mammary arteries, costocervical trunk, superior thoracic and lateral thoracic arteries were also embolized.

The effectiveness of embolization was determined at short term (less than 1 month) and long term (more than 1 month) with either

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Fig. 1a & 1b : This 26 years old man a case of pulmonary tuberculosis with recurrent haemoptysis underwent embolization of right intercostobronchial trunk. a) Right costobronchial arteriogram showing hypertrophied bronchial artery, increased vascularity in right upper lobe and shunting to pulmonary vein, b) Post embolization angiogram shows complete occlusion at the level of the hilum

Fig. 2a & 2b : This 32 years old woman with pulmonary tuberculosis involving left lower lobe and recurrent haemoptysis underwent successful left bronchial artery embolization a) Selective catheterization of left bronchial artery revealed tortuous bronchial artery with hypervascularity in left lower lobe and shunting with internal mammary artery; b) Post embolization angiogram shows successful occlusion of hypervascularity and obliteration of the shunt.

complete response (CR); no haemoptysis after embolotherapy; partial response (PR): obvious decrease in volume and frequency of haemoptysis; or no change (NC): no resolution of haemoptysis. The follow up period after embolization ranged from 4 months to 22 months (average 5 months).

Results

The angiographic findings of pulmonary haemorrhage were extravasation of contrast in 2 patients (4.4%), hypervascularisation in 42 (93.3%), broncho-pulmonary shunts in 13 (28.8%) and bronchial artery aneurysms in one (2.2%) as shown in Table 2. A total of 106 arteries were successfully embolized: 37 left and 33 right bronchial arteries (Figs 1, 2), 17 intercostal arteries, 9 internal mammary arteries, 2 costocervical, 3 superior thoracic arteries and 2 costocervical, 3 superior thoracic arteries and five lateral thoracic arteries (Table 3).

The procedure was successful in controlling haemoptysis in 44 patients (97.7%). In short term, CR in 42 (93.4%), PR in 2 (4.4%) and NC in 1 (2.2%) was seen (Table 4). In long term 33 patients (29.1%) out of 37 patients had no recurrence of haemoptysis

TABLE 2

Angiographic findings on BAE (No. of patients = 45)

Findings	No. of patients
Extravasation of contrast	2
Hypervascularisation	42
Broncho-pulmonary shunts	13
Bronchial artery aneurysm	1

whereas repeat embolization was required for recurrent haemoptysis in 4 cases. Rest eight patients underwent surgical resection for aspergilloma and bronchiectasis, in four cases each, with considerably reduced per operative blood loss following successful embolization.

Discussion

Massive haemoptysis is a major problem, related to high mortality, due to asphyxiation rather than hypo-

TABLE 3
Vessels embolized (n=106)

Vessel	Number
Left bronchial artery	37
Right bronchial artery	33
Intercostal arteries	17
Internal mammary arteries	9
Costocervical arteries	2
Superior thoracic arteries	3
Lateral thoracic arteries	5

Table 4
Cause of haemoptysis and immediate effect of BAE

Disease	CR	PR	NC	Total
Tuberculosis	36	1	—	37
Tuberculosis and Aspergilloma	2	1	1	4
Bronchiectasis	4	—	—	4
Total	42	2	1	45
	93.4%	4.4%	2.2%	100%

CR - Complete response, PR - Partial response and NC - No change.

volemia. Any massive episode of bleeding threatens to cause acute asphyxiation, especially to those patients with impaired pulmonary function. Surgery during acute massive haemoptysis has a high mortality and complication rate [6]. Bronchial artery embolization is an effective method to control haemoptysis not controlled with conservative management especially in patients with chronic pulmonary diseases, who are not suitable candidates for surgical resection.

The first step in BAE is localising the site and extent of bleeding. The present rate of localization with fiberoptic bronchoscopic examination is only 25-75% [7]. Moreover, bronchoscopic examination is not practicable for patients with massive haemoptysis. Therefore, arteriography plays an important role in localizing bleeding site. The direct sign in demonstration of extravasation of contrast from bleeding vessel is rarely seen and in most cases, indirect angiographic signs such as pathological hypervascularity, capillary stains, bronchopulmonary shunts and hypertrophied and tortuous vessels and aneurysms are common indicators of site of haemorrhage.

Immediate success rate of 86-91% has been reported with long term complete remission rates of 50-70% [9]. Patients with bronchiectasis show the best long term results. The presence of aspergilloma in a pulmonary tubercular cavity is a main cause of re-bleeding. In view of considerable hypervascularity, these lesions require extensive embolization of abnor-

mal bronchial and non bronchial systemic vessels for complete haemostasis. Most of these lesions, however, bleed if not treated surgically [6]. In our study, immediate success occurred in 97.7%. At long term follow up 89.1% of patients showed complete remission, 11.9% partial remission. All the cases with aspergilloma and bronchiectasis underwent surgical resection within 2-3 weeks of embolization with considerably reduced per operative blood loss in these cases.

Various embolic materials are currently being used for BAE. These include gel foam pellets, polyvinyl alcohol particles, isobucrylate, steel coils and detachable balloons, of all these gel foam pellets are the most easy to use and very effective in bronchial artery system. Polyvinyl alcohol particles would provide permanent occlusion but its usefulness has still not been adequately tested. In our study, PVA particles were found to be more effective than gel foam. However in view of smaller number of cases with PVA embolization it cannot be considered significant as yet. Particles less than 200 μ have been shown to cause bronchial necrosis and death [6]. We used gel foam pellets 2-3 mm in size and PVA particles more than 500 μ in size.

Recurrent haemoptysis after embolization has been reported in 12% -21% [8,9]. The recurrent bleeding has been attributed to recanalization of embolized vessels, partial/complete embolization, or progression of underlying disease. New vascular channels can develop and predispose to recurrent bleeding [2].

Reports in literature indicate that complications are rare and include trachea-esophageal fistula, mesenteric ischaemia and spinal cord damage. The latter is the most serious complication of BAE and is attributed to contrast and embolization related techniques. Its reported frequency is less than 1% [5]. Permanent injury can nearly always be avoided, provided that proper techniques are followed. Great care should be undertaken to prevent back flow of the embolic material, for any artery below bronchial artery can be inadvertently embolized.

In our study, no major complications were seen. Mild intercostal pain was observed in 17 patients, fever in 12 cases. All the cases with PVA particle embolization had moderate fever lasting 1-3 days. This post embolization syndrome however required only symptomatic management.

The present study indicates that severe and life threatening haemoptysis can be effectively and safely controlled by bronchial and non-bronchial systemic artery embolization. It may not only obviate the need for surgery in high risk cases but also greatly reduce

the morbidity and mortality in these patients. Moreover, it may be the only treatment option in these patients with poor pulmonary function or bilateral extensive disease.

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