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BRONCHIAL AND NONBRONCHIAL SYSTEMIC ARTERY EMBOLIZATION FOR LIFE-THREATENING HEMOPTYSIS IN TERTIARY CARE HOSPITAL IN WESTERN INDIA.

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ABSTRACT

Objectives: To report our experience with bronchial and non –bronchial systemic artery embolization in the management of major haemoptysis in pulmonary tuberculosis.

Materials and methods: From January 2013 to November 2014, total 40 patients with major haemoptysis underwent embolization. Retrospective analysis of post procedure outcome, including immediate success, recurrence and complication was performed.

Results: Immediate success was achieved in 39 (97.5%). Vessels embolised are unilateral bronchial (n=28), bilateral bronchial (n=6), bronchial systemic collateral (n=4) and systemic collaterals only (n=2). During the follow-up period recurrent haemoptysis was found in 4 patients (10%).Repeat angiogram revealed incomplete embolization in initial procedure in 2 patients and revascularisation in collateral arteries in 2 patients. The procedure related complication included transient chest pain (n=10) and transient unilateral lower limb weakness (n=1).

Conclusion: Bronchial artery embolization (BAE) has high technical and clinical success rates in controlling major haemoptysis.

KEYWORDS Bronchial arteriography, major haemoptysis, embolization.

Introduction:

Massive and untreated haemoptysis is medical emergency with high mortality rate of > 50%. [1] Pulmonary tuberculosis and its sequelae such as cavities, bronchiectasis and aspergillomas are one of most common causes of haemoptysis. Other common causes of haemoptysis are chronic inflammatory lung disease, cystic fibrosis, bronchogenic carcinoma and congenital heart diseases. Various treatment options for haemoptysis include conservative medical management, bronchial artery embolisation and definitive surgical resection. Though surgical resection appears definitive management, it is not possible in those patients associated with poor pulmonary reserve. Alone conservative management also carries higher risk of mortality rate in these cases. Asphyxiation due to aspirated blood is mainly responsible for mortality in these patients. Early management with bronchial artery embolisation can significantly reduce the mortality in these patients.

Massive haemoptysis is defined as bleeding more than 250-300 ml / 24 hr. [2] However more functional definition of massive as amount sufficient to cause a life threatening condition should be used in deciding whether undertaking interventional management.

Bronchial arteries are the source of bleeding in most of cases. Nonbronchial systemic collaterals are also involved in some cases. [3] The pulmonary artery is also a source of bleeding in the form of pulmonary arterio-venous fistula. Unusual condition includes Rasmussen aneurysm and traumatic pseudoanerysm.

Bronchial artery embolisation is logical therapeutic approach in patients with massive haemoptysis. It is also useful in recurrent haemoptysis. It is minimally invasive and carried out under local anaesthesia. Ramey et al [4] firstly used this procedure in 1973 for control of haemoptysis. Subsequently many studies are carried out to show efficacy, safety and utility of bronchial artery embolisation in control of haemoptysis.

OBJECTIVES:

- To asses efficacy of bronchial artery embolisation (clinical success rate) in control of massive haemoptysis due to the sequelae of pulmonary tuberculosis.
- To evaluate technical success rate of the procedure.
- To evaluate complications of the procedure.

Methodology:

The study was conducted after approval from institutional ethical committee in our institution which is a tertiary care hospital over period of January 2013 to November 2014. Total 40 (22 males and 18 females) patients of pulmonary tuberculosis with massive haemoptysis referred to our department were included for bronchial artery embolisation. Massive haemoptysis was defined as bleeding more than 250-300ml / 24 hr. But patient's pulmonary reserve was taken into consideration for functional approach. Chest x ray and HRCT thorax were done in these patients prior to embolisation.

Bronchial artery embolisations were done in all cases. Post embolisation; follow up for recurrence done for 6-9 months. The recurrent haemoptysis was noted in 4 patients. Repeat embolisation done in all these cases.

OBSERVATION AND RESULTS:

Table 1. Age distribution of patients (years)

Age group	Patients
18-25	6
26-35	10
36-45	16
46-65	8

Table 2. Sex distribution of patients

Male	22
Female	18

Table 3.Vessels embolised during the study

Unilateral bronchial	28
Bilateral bronchial	6
Bronchial systemic collateral	4
Systemic collaterals only	2

Table 4. Follow up of patients.

<3 months	12
3-6 months	20
6-9 months	8

Table 5. Recurrent haemoptysis during follow up.

<3 months	1
3-6 months	2
6-9 months	1

Table6. Post procedure complications:

Transient chest pain	10
Transient unilateral lower limb weakness	1

Efficacy of bronchial artery (clinical success rate) embolisation can be calculated as,

Total patients	No recurrence	Recurrence
40	36	4

$$\text{Efficacy of embolisation} = \frac{\text{Total patients- recurrence}}{\text{Total patients}} \times 100$$

$$= \frac{40-4}{40} \times 100$$

$$= \frac{36}{40} \times 100$$

$$= 90\%$$

Discussion:

Pulmonary tuberculosis and its sequelae are the major cause of haemoptysis in India. Haemoptysis can be life threatening condition with propensity to recur if definitive treatment is not instituted. Though surgical resection is curative, unfortunately many patients are not suitable surgical candidates due to poor clinical condition, extensive diseased lung and poor pulmonary functional reserve. Also many patients refuse surgical treatment. Bronchial artery embolisation has now established itself as an important management role in these situations.

We evaluated 40 patients with massive haemoptysis (>300ml/ 24 hrs) in whom bronchial artery embolisation was performed in our department. It includes 22 males and 18 females. Their mean age was 37 yrs (18-65yrs).

Pulmonary tuberculosis and its sequelae are the main etiological causes for haemoptysis in our study. The sequelae include bronchiectasis, cavitations and aspergilloma. Previous studies done by authors Ramakantan R et al (1996) [5], Tanaka et al (1997) [6], Mal et al (1999) [7] also predominantly included pulmonary tuberculosis patients presented with haemoptysis.

In our institute bronchial arteriography and subsequent embolisation for cases of massive haemoptysis were performed in digital subtraction angiography department. The procedure was well tolerated by our patients. An immediate control of active haemoptysis was achieved with embolisation in cases 30 (75%), but 10 patients had expectoration of dark red/black clots for less than 7 days after the procedure, suggestive of expectoration of retained secretions. Similar results were observed in previous studies. In 1984, Remy et al [6] treated 104 patients of haemoptysis by embolisation of both the bronchial and non bronchial arteries. The success rate of their study was 84%. They treated 49 patients during active haemoptysis and 55 after haemoptysis. Subsequently; bronchial artery embolisation was widely used for control of haemoptysis. In 1996 Ramakantan et al [5] treated 140 cases of haemoptysis with bronchial artery embolisation with immediate control achieved in 102 cases (72%). Of the remaining 38 patients with a notable amount of bleeding after the procedure, 29 were treated successfully with conservative measures and nine underwent re-embolisation.

Table 7. Comparisons with previous studies

Authors	Number of patients	Clinical success rate%	Clinical recurrence %	Complication rates%
Remy et al[4]	104	84	28.6	11.5
Rabkin et al[10]	306	90.8	33.7	0.3
Ramakantan et al[5]	140	73	27.1	27.8
Mal et al[7]	56	77	55.3	12
Uflacker et al[11]	64	76.6	21.4	10.9
Corr et al[12]	70	87	13	8.6
Swanson et al[13]	54	94	24.1	7
Baltacioglu et al[14]	25	100	16	16
Present study	40	90	10	25

Bronchial arteries are the most common source of life-threatening haemoptysis; however bronchial systemic collaterals and non-bronchial systemic circulation may also contribute to haemoptysis. The prevalence of bronchial systemic collaterals and abnormal non-bronchial systemic arteries in our study were 4 and 2 respectively.

We performed thoracic aortography after transarterial embolisation in all patients to identify additional arteries responsible for haemoptysis. Similar study was presented by Chun HJ et al [8] in 2003. They performed thoracic aortography after transarterial embolisation in 76 patients keeping the tip of the catheter just distal to the origin of the left subclavian artery. They identified 200 arteries either at the initial embolisation or on thoracic aortography as being responsible for causing haemoptysis. Among them, 29 arteries (14.5%) that were not included on the initial selection for embolisation were later identified on post embolisation thoracic aortography. The inferior phrenic and intercostal arteries were often missed on routine transarterial embolisation in patients with haemoptysis, hence a post embolisation thoracic aortography aids in detecting of arteries contributing to haemoptysis and increasing efficacy of bronchial artery embolisation.

In our study, right intercostobronchial and right bronchial artery were mainly involved in majority of cases i.e 20cases, which may be due to greater involvement of right-side lung parenchyma in comparison to left side. Left bronchial artery was concurrently involved in only 8 cases.

Out of 40 patients embolised in our institute, 4 had recurrent haemoptysis during follow up period .Recurrent haemoptysis after successful bronchial artery embolisation is particularly a problem for patients with aspergillosis who tend to develop extra pulmonary systemic collateral arteries. Another major cause of recurrence is presence of bronchial arteries of anomalous origin. Out of 4 recurrent cases 2 patients had aspergillosis and 2 had bronchial arteries of anomalous origin. Ramakantan R et al (1996) [5] noted 39 cases of recurrence out of 140 embolisation. Sancho et al (1998) [9] observed 25 bronchial arteries of anomalous origin in their 27 recurrent haemoptysis. Other causes of recurrence include inadequate embolisation, imprecise localization of initial bleeding, bronchial artery recanalization, and progression of underlying disease.

Procedure related complications are of three types: acute, subacute and chronic. Acute complications last less than one day .These complications include allergic reaction to contrast media and catheter-related complications. Test dose of contrast and intravenous hydrocortisone played important role to reduce allergic reaction in our study. Sub acute complications last between

2–7 days. It includes chest pain, back pain, fever and transient dysphagia . The most common subacute complication noted in our study was chest pain (25%). It was managed conservatively with analgesics. Chronic complications last more than 7 days and include paraparesis and neurological complications. There were no chronic complications during the course of our study due to super selective embolisation of the bronchial arteries. Only one patient suffered transient unilateral lower limb weakness. It was mostly secondary to pain in puncture site. Patients showed improvement with physiotherapy within 4 days.

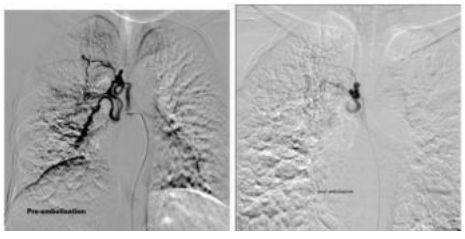
Conclusions:

- Pulmonary tuberculosis and its sequelae are the most common causes of haemoptysis.
- Bronchial artery embolisation has high technical and clinical success rates in controlling massive haemoptysis.
- Chest pain is the most common post procedural complication.
- Bronchial artery embolisation is an effective and safe procedure to control haemoptysis.

Representative cases:

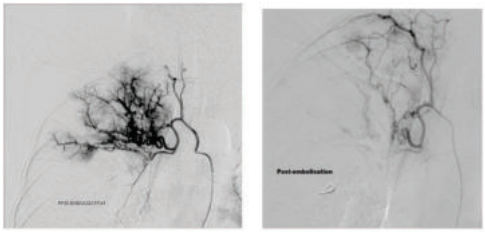
Case 1)

32 yrs, F, k/c/o pulmonary tuberculosis presented with 2 episodes of haemoptysis (300 ml/ 24 hrs).



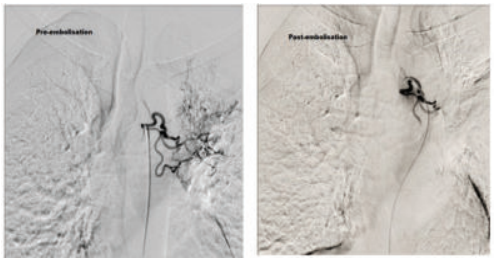
Case 2)

26y, F, k/c/o pulmonary tuberculosis presented with 2 episodes of massive haemoptysis (>400 ml/ 24 hr).



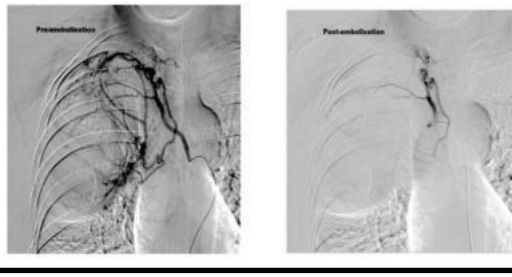
Case 3)

56yrs, M, k/c/o pulmonary tuberculosis presented with two episodes of massive haemoptysis (>350ml/ 24hrs



Case 4)

58 yrs, M, k/c/o pulmonary tuberculosis presented with two episodes of massive haemoptysis (>300ml/ 24hrs).



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