BRONCHIAL ARTERY EMBOLIZATION FOR HEMOPTYSIS : EXPERIENCEIN SRINAGARIND HOSPITAL, KHON KAEN UNIVERSITY

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ABSTRACT

Purpose: The purpose of this retrospective study was to report our experience with bronchial angiography and bronchial embolization.

Materials and Methods: A retrospectively reviewed medical record and imagings of 32 patients presented with moderated to severe hemoptysis who underwent to bronchial angiography and embolization at Srinagarind hospital Khon Kaen University from 1999 to 2002.

Results: The majority of the etiologies of hemoptysis in our series were tuberculous bronchiectasis (14 patients), pulmonary tuberculosis (9 patients) and nontuberculous bronchiectasis (6 patients). The findings of angiography included hypervascularity in 100% (32 of 32), bronchial artery hypertrophy and tortuousity in 59.3% (19 of 32), parenchymatous staining in 75.0% (24 of 32), pseudoaneurysm formation in 9.3% (3 of 32), bronchial to pulmonary artery communication in 6.2% (2 of 32) and extravasation of contrast medium into bronchial lumen in 3.3% (1 of 32). We achieved an overall success rate of 87.5% (28 of 32), in immediately control of hemoptysis and technical success rate of 98.87% (31 of 32). Recurrent rate of hemoptysis was 9.4% (3 of 32) within 1 month and 9.4% (3 of 32) in more than 1 month.

The complications of bronchial embolization in our series included subintimal dissection in one patient and chest pain during the embolization procedure in two patients.

Conclusion: Bronchial embolization is an effective and safe procedure to control hemoptysis, particularly in emergency control of hemoptysis which caused by benign diseases. Bronchial embolization may help to avoid surgery in patients who are not good surgical candidates.

INTRODUCTION

Bronchial artery embolization is a well-accepted and widely utilized technique in the management of massive hemopotysis,[1] which is defined as having blood loss of 300-600 ml over 24 hrs.[2,3] Bronchial artery embolization has been established for the treatment of massive hemop-

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tysis as an effective alternative to surgical resection in emergency treatment of massive hemoptysis which carries a mortality rate of 50-85%.[2] The cause of death is usually asphyxia. Many of the patients with severe hemoptysis are poor surgical candidates with poor respiratory reserve from extensive disease. Over the last few years, an increasing number of the patients with moderate hemoptysis have been referred to our department or emergency bronchial angiography and embolization. Our hospital is a referral tertiary center of the northeast Thailand, we therefore get the majority of bronchial embolization cases in the northeastern part of Thailand. The purpose of this retrospective study was to report our experience with bronchial angiography and bronchial embolization.

MATERIALS AND METHODS

Over a 4-years period, from 1999 to 2002, a total number of 32 patients presented with moderate to severe hemoptysis were consulted for bronchial angiography and embolization. Thirty-two patients had bronchial digital substraction angiography and embolization were performed via the femoral route. In all cases a 5Fcatheter sheath was inserted to facilitate multiple catheter changes if necessary. We used pre-shaped 4F-5F angiographic catheters. The commonest initial shape chosen was the Side-wider. Other catheters employed were the Cobra, the simple curve catheter. The guidewire used in all cases was 0.035 inch Terumo guidewire. The embolic material used was Gelfoam^{R} particles. The medical records and medical imagings of the patients who underwent bronchial angiography and embolization at the department of radiology, Khon Kaen University between 1999 and 2002 were reviewed.

RESULTS:

A total number of bronchial angiography and embolization was 32 cases. Etiology of the hemoptysis was shown in Table 1, with the majority of cases being due to tuberculous bronchiectasis. The age range of the patients was from 9-67 years (mean 58 years). There were 18 men and 14 women. Our oldest case was infected bronchiectasis with old pulmonary TB, while our youngest case was a patient with status post modified BT shunt operation of DORV with VSD.

Bronchial angiography was performed in all patients. The findings of angiography included hypervascularity (Fig. 1) in 32 patients (100%), bronchial artery hypertrophy and tortuousity (Fig. 2) in 19 patients (59.3%), parenchymatous staining (Fig. 3) in 24 patients (75.0%), pseudoaneurysm formation (Fig. 4) in 3 patients (9.3%), bronchial to pulmonary artery communication (Fig. 5) in 2 patients (6.2%) and extravasation of contrast medium into bronchial lumen in 1 patient (3.3%). In our series, no nonbronchial systemic arterial or pulmonary arterial supply hemoptysis lung was demonstrated.

Bronchial artery embolization was performed in all patients (Fig. 6). The procedure was performed using selective technique. Bronchial embolization was technical successful in 31 of 32 patients (98.87%). The case of technical unsuccessful was due to subintimal dissection of the bronchial artery origin during embolization procedure. Bronchial embolization was successful controlling hemoptysis immediately in 28 of 32 patients (87.5%). Four patients had failure in controlling hemoptysis immediately. One of these patients, with severe pulmonary TB and destroyed both lungs which the angiography showed pseudoaneurysm formation, died 3 days after the attempted procedure due to sepsis. One of these patients, with infected bronchiectasis required surgery (subintimal dissection at the bronchial artery during embolization procedure, technical failure) One patient with status post BT shunt operation of DORV with VSD, required surgery to control hemoptysis 3 days after bronchial

BT shunt = Blalock taussig shunt

embolization and another patient, with malignant mesothelioma, fail to control hemoptysis before chemotherapy. Three patients had recurrent hemoptysis within 1 mouth after bronchial embolization. One of these patients, nontuberculous bronchiectasis, died of hemoptysis at his home 3 weeks after undergoing embolization. One patient with bronchiectasis underwent successful repeated embolization and another patient with tuberculous bronchiectasis required surgery.

Three patients had recurrent hemoptysis more than 1 month after undergoing bronchial embolization. Hemoptysis in one of these patients (old pulmonary tuberculosis) was mild degree off and on hemoptysis and resolved with antibiotic therapy. Two patients (tuberculous bronchiectasis) underwent successful repeated embolization 1.5 and 2 years after the first embolization.

The complications of bronchial embolization in our series included subintimal dissection in one patient and chest pain during the embolization procedure in two patients.

From the total bronchial embolization of 32 of patients, one patient had technical failure, three patients were failed in controlling hemoptysis immediately, four patients had recurrent hemoptysis within 1 mouth and three patients had recurrent hemoptysis more than 1 month as describe above. The remaining 20 patients with single session embolization and 3 patients with repeated embolization had follow up period ranging from 3 months to 3 years without evidence of recurrent hemoptysis.

Table 1. Etiology of hemoptysis

Etiology	No of cases
Tuberculous bronchiectasis	14
Pulmonary TB	9
Infected bronchiectasis (nontuberculous bronchiectasis)	6
Status post BT shunt of a case with DORV and VSD	1
Acquired heart disease (Rheumatic heart disease)	1
Malignant mesothelioma	1
Total	32

Table 2. Comparison of control hemoptysis in patients undergoing bronchial embolization. (modified from Kalen L, et al. Bronchial Artery Embolization: experience with 54 patients. Chest 2002; 121:789-95.)

Study	Technical Succes	1 mouth Control	Control > 1 mouth
Remy et al	41/49(84)	NA	35/49(71)
Uflacker et al	49/75(65)	NA	39/75(52)
Rabkin et al	278/306(91)	230/306(78)	242/306(79)
Hayakawa et al	50/63(79)	NA	36/63(57)
Cremaschi et al	205/209(98)	NA	172/209(82)
Ramakantan et al	102/140(73)	72/140(51)	94/140(67)
Mal et al	43/56(77)	36/56(64)	39/56(70)
Swenson et al	51/54(94)	46/54(85)	43/54(80)
Present study	31/32(98)	28/32(87)	25/32(78)

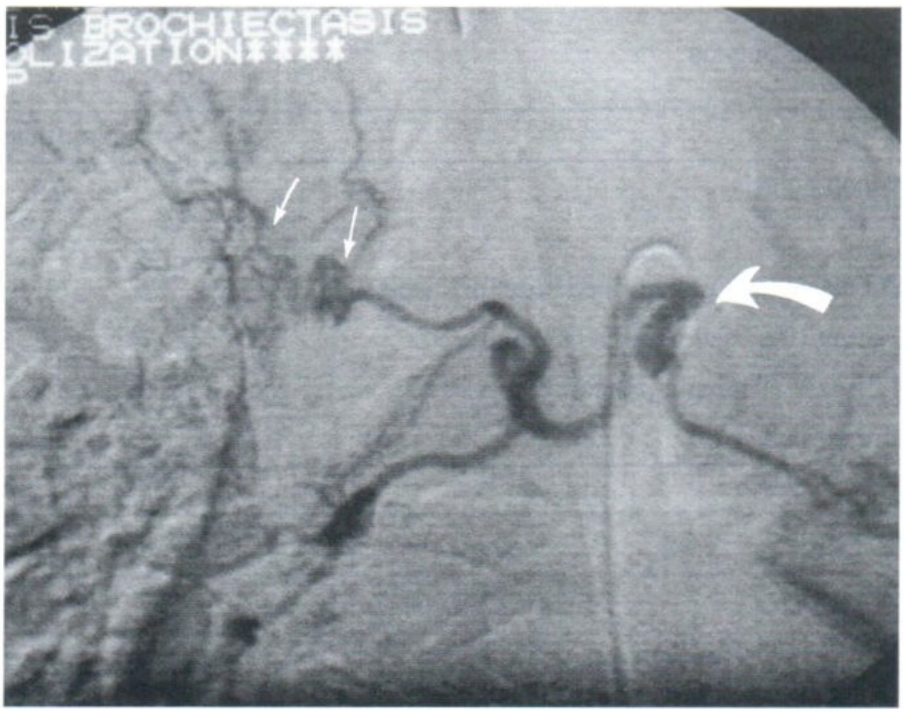


Fig. 1 Bronchial angiogram reveals common trunk of right and left bronchial arteries and hypervascularity in the right lung. Small arrows showed hypervascularity. Curve arrow showed common trunk.

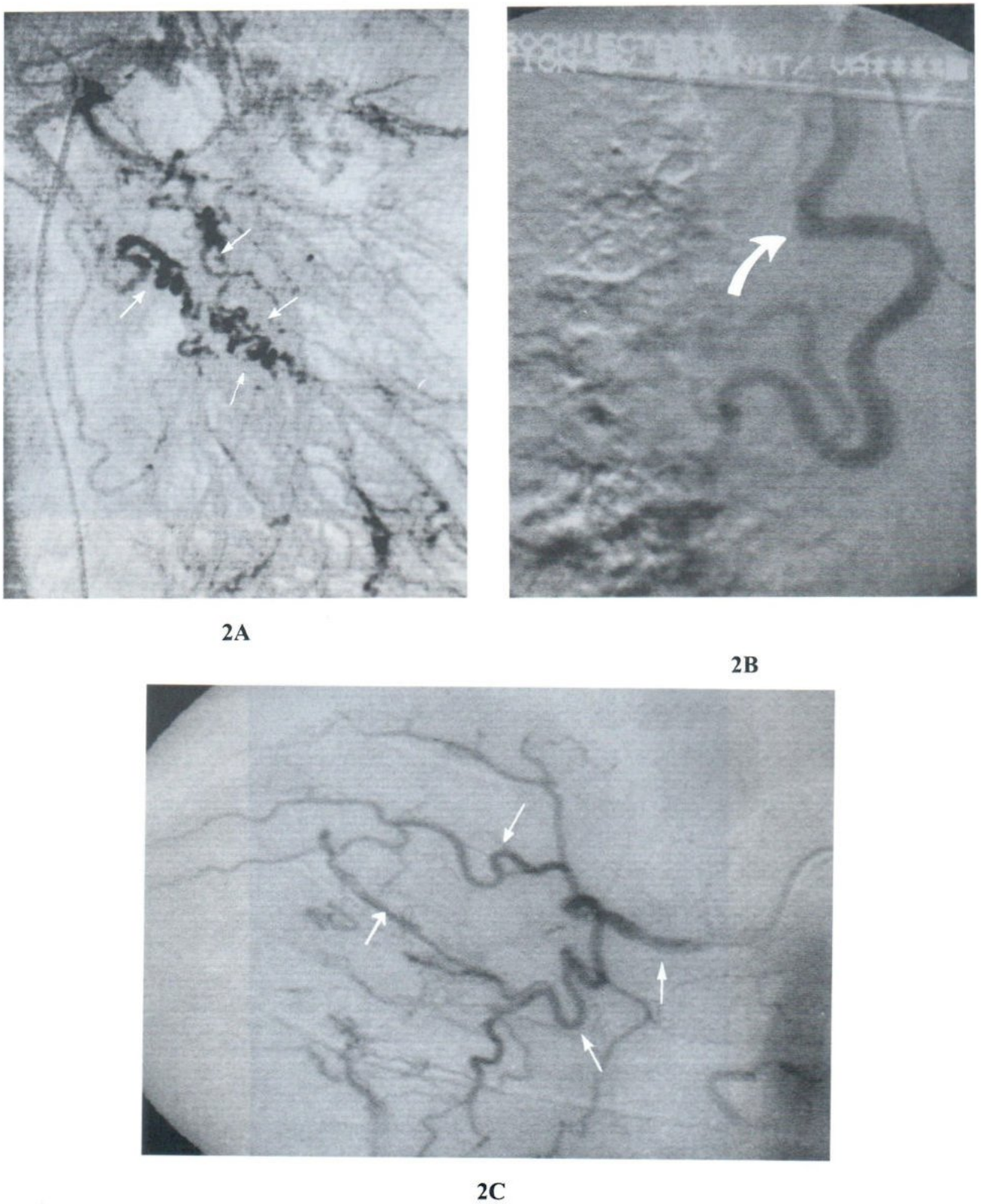
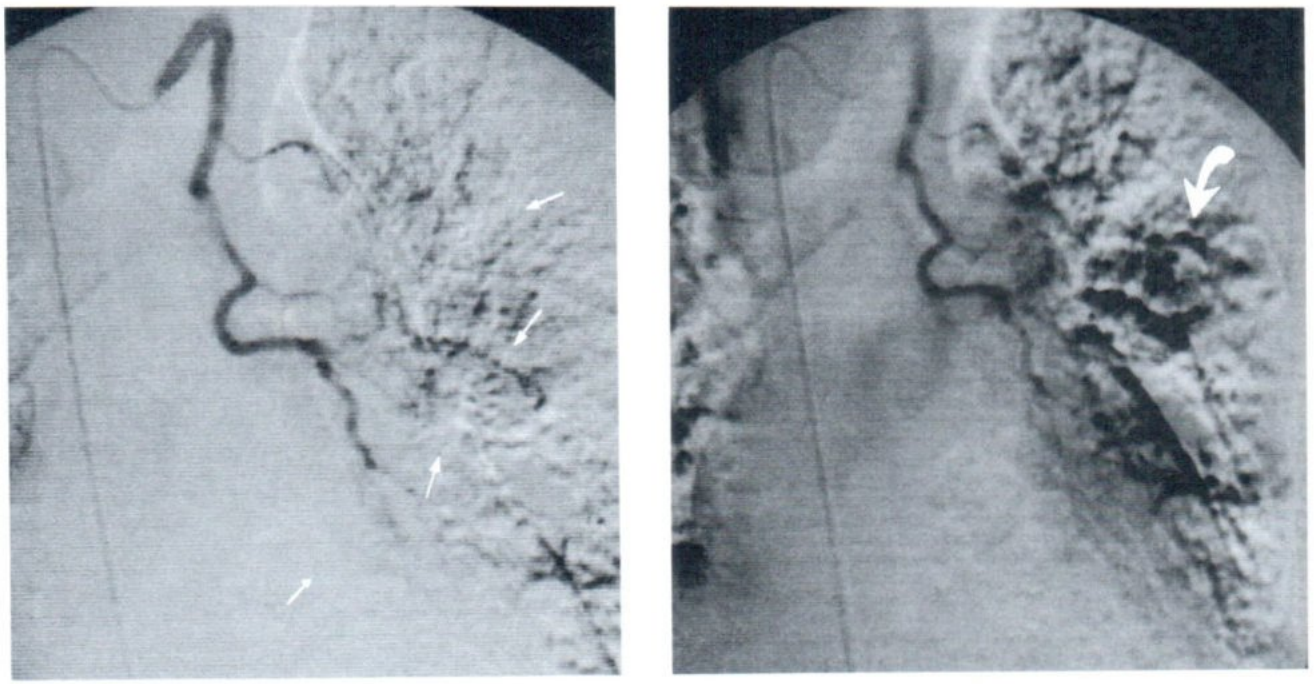


Fig. 2 Bronchial angiogram reveals hypertrophy and tortuousity of the bronchial arteries (A-C), small arrows showed hypervascularity. Curve arrow showed common trunk.



3A 3B

Fig. 3 Bronchial angiogram reveals parenchymatous staining of the contrast medium in the left lung (A and B)

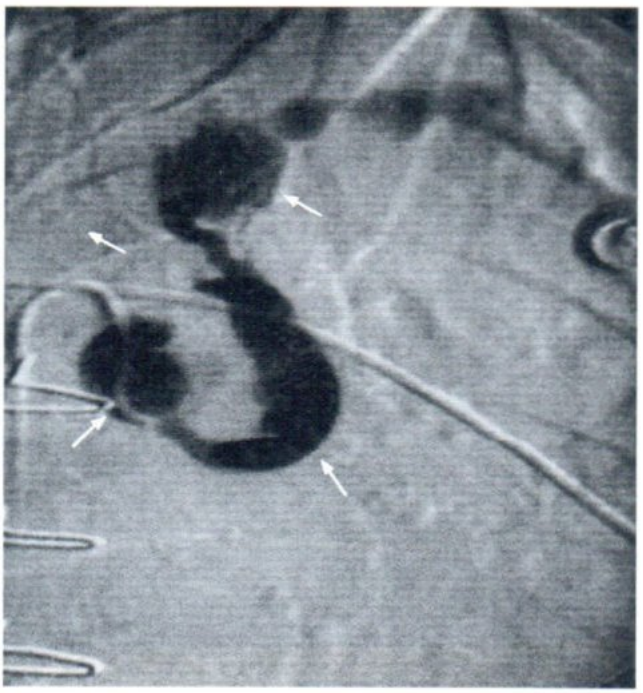
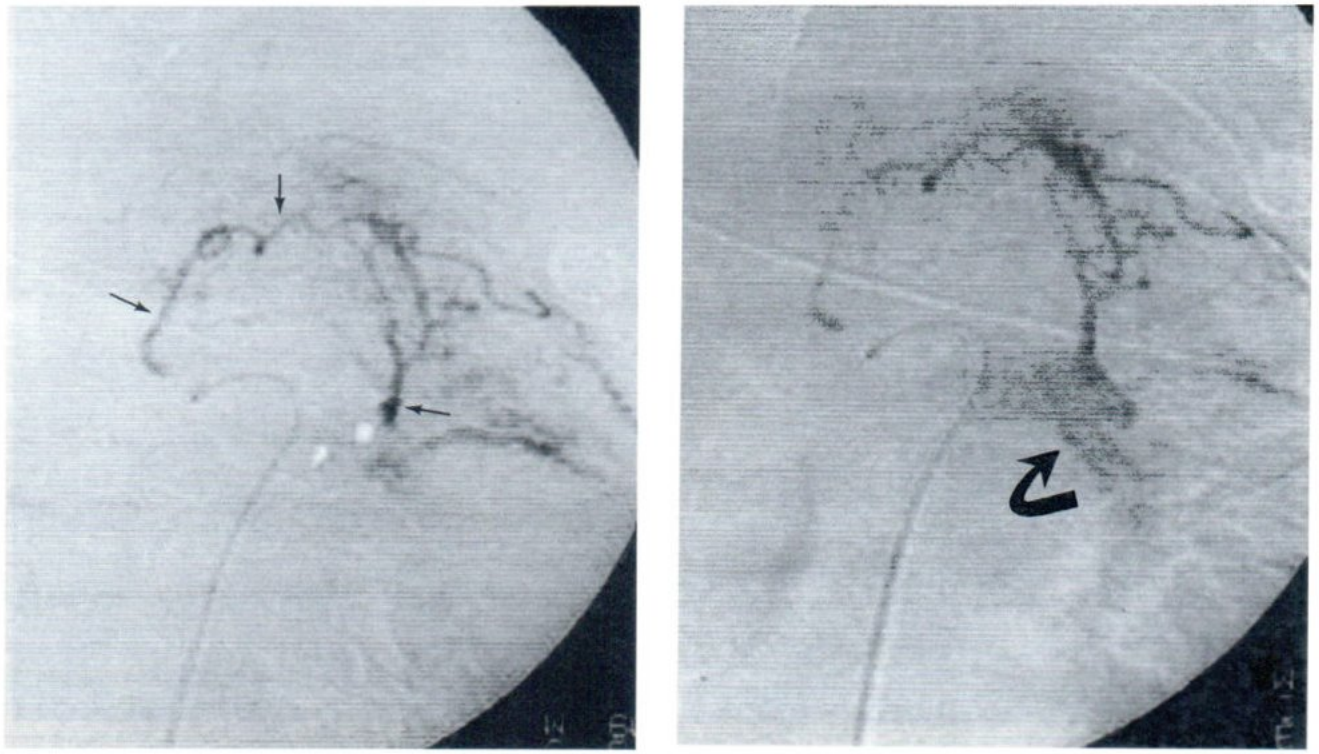
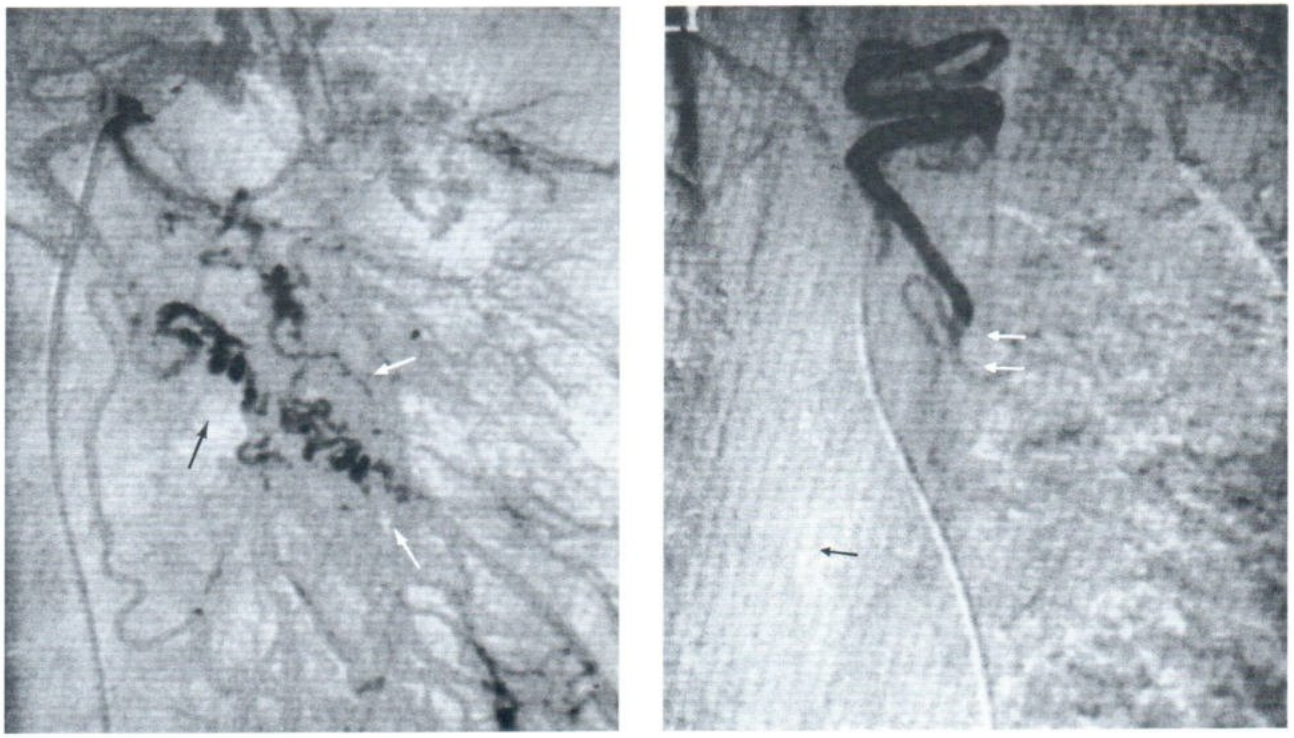


Fig. 4 Bronchial angiogram reveals pseudoaneurysm of the left bronchial artery. (small arrows)



5A 5B

Fig. 5 Bronchial angiogram of the left bronchial artery shows communication between bronchial and pulmonary arteries (A-B). Small arrows showed bronchial arteries. Curved arrow showed pulmonary artery.



6A 6B

Fig. 6 Left bronchial angiogram of a patient with massive hemoptysis shows marked hypertrophy and tortuousity of left bronchial artery branches pre-embolization (A) and post-embolization (B)

DISCUSSION

Over the last 3 years we achieved a technical success rate of 98.87% (31 of 32) and overall success rate of 87.5% (28 of 32) in immediately control of hemoptysis. Recurrent rate of hemoptysis was 9.4% (3 of 32) within 1 mouth and 9.4% (3 of 32) in more than 1 mouths. The majority of etiology of hemoptysis in our series were tuberculous bronchiectasis, pulmonary tuberculosis and nontuberculous bronchiectasis. The findings of angiography included hypervascularity in 100% (32 of 32), bronchial artery hypertrophy and tortuousity in 59.3% (19 of 32), parenchymatous staining in 75.0% (24 of 32), pseudoaneurysm formation in 9.3% (3 of 32), bronchial to pulmonary artery communication in 6.2% (2 of 32) and extravasation of contrast medium into bronchial lumen in 3.3% (1 of 32).

Selective bronchial artery catheterization and angiography in humans was originally performed by Viamonte in 1964.[4,5] Remy et al reported the first successful bronchial artery embolization in a patient with hemoptysis.[6] This was followed by many reports of bronchial embolization for control hemoptysis.[6-19] Subsequently, bronchial embolization was widely used,[1] because patients could be treated without operative procedures. With the advent of digital subtraction angiography and non ionic contrast medium, bronchial embolization become easier, faster and safer.[1]

Bronchial angiography and embolization were well tolerated by our patients. Over the last 3 years we achieved an overall success rate of

90.6%(29 of 32 patients) in immediately control of hemoptysis. Our results are similar to those of several previous reports (Table 1). The angiographic findings also are similar to those previous reports.[6-18]

In our series, recurrent hemoptysis occured within 1 mouth in 3 of 32 patients (9.3%). Others have noted recurrent hemoptysis within 1 mouth in 10 to 30 % of patients.[6-18] Only one of four patients had repeated bronchial angiography and embolization. Bronchial collateral artery developed in this patient and bronchial collateral artery was embolized resulting in the successful control of hemoptysis. In the previous reports, bronchial and nonbronchial collateral artery developed in recurrent hemoptysis patients within 1 mouth. Although, there were some researchers analyzed outcomes by the type of embolic material that was used but there have not been any studied to determine optimal embolic material that should be used in order to prevent recanalization. The embolic material used in bronchial embolization that were reported included the followings: gelatin sponge (Gelfoam^{R}),[7,10,11,14,19] polyvinyl alcohol,[3, 7, 10- 15] microspheres,[10] coils,[7,9,11,13,14,19] Spongel,[6] polyurethane or velour plus albumin macroaggregates plus sclerosing agents,[17] gelatin sponge plus bucrylate,[10] gelatin sponge plus coils,[7,19] polyvinyl alcohol plus coils,[7,14] and polyvinyl alcohol plus gelatin sponge.[7,11,14] Polyvinyl alcohol, microspheres, and coils provide permanent occlusion, while gelatin sponge particles are considered to be temporary occlusion. In our series, we used Gelfoam^{R} as embolic material. Someone have suggested that coils should not be used for bronchial embolization because coils may cause proximal occlusion and do not allow for repeat embolization if necessary.

The complication rate for bronchial embolization has decreased gradually over the years and probably related to the toxicity of ionic contrast medium used at that time. The majority of reported case of serious complication, such as a transverse myelitis and bronchial or aortic necrosis, occurred during the early years of bronchial angiography.[1] A few cases have been reported since the availability of non ionic contrast medium. Distal non-target organ infarction, such as small bowel and limbs, has rarely been reported. More commonly, less-serious side effects are encountered such as chest pain and dysphagia. These symptoms may be due to reflect occlusion of intercostal and esophageal vessels, respectively, and are usually transient.

The complications amoung our patients included subintimal dissection in one patient and chest pain during the embolization procedure in two patients. No serious complication was found in our patients. To prevent such neurologic complication, superselective bronchial embolization was utilized. This refer to embolization of more terminal branches beyond the origin of spinal arteries. Although, co-axial catheter (microcatheter) was not used in our patients, but co-axial catheter may be required for superselective catheterization in some case where a selective catheter position can not be achieved for embolization with a conventional catheter.

In summary, bronchial artery embolization is an effective and safe procedure to control hemoptysis, particularly in immediately control hemoptysis and caused by benign diseases as the patients in our series. Bronchial embolization may help to avoid surgery in patients who are not good surgical candidates.

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