

**Follow up after bronchial artery
embolization in patients with hemoptysis**

Wou Young Chung

Department of Medicine

The Graduate School, Yonsei University

**Follow up after bronchial artery
embolization in patients with hemoptysis**

Wou Young Chung

Department of Medicine

The Graduate School, Yonsei University

Follow up after bronchial artery embolization in patients with hemoptysis

Directed by Professor Joon Chang

The Master's Thesis submitted to the Department of Medicine,
the Graduate School of Yonsei University

In partial fulfillment of the requirements for the degree of Master
of Medicine

Wou Young Chung

June 2005

This certifies that the Master's Thesis
of Wou Young Chung is approved.

[Thesis Supervisor : Joon Chang]

[Se Kyu Kim : Thesis Committee Member #1]

[Do Yun Lee : Thesis Committee Member #2]

The Graduate School
Yonsei University

June 2005

Acknowledgements

I sincerely address my acknowledgement to my thesis supervisor, Professor Joon Chang, who provided every support for this series.

Other thesis committee members, Professor Se Kyu Kim and Do Yun Lee paid so much time and attention for the achievement of this article. Finally I am always sorry for my beloved wife Hee Jin to whom I acknowledge how much I owe.

TABLE OF CONTENTS

	page
I . INTRODUCTION -----	10
II . MATERIALS AND METHODS -----	12
III . RESULTS -----	13
IV . DISCUSSION -----	16
V . CONCLUSION -----	18
REFERENCES -----	19

LIST OF TABLES

Table 1: Previous studies about bronchial artery embolization outcomes--	11
Table 2: Demographic features, duration and symptoms -----	14
Table 3: Underlying diseases and previous history of bronchial artery embolization intervention -----	14
Table 4: Radiologic findings and the recurred major hemoptysis -----	15

ABSTRACTS

Follow up after bronchial artery embolization in patients with hemoptysis

Wou Young Chung

*Department of Medicine
The Graduate School, Yonsei University*

(Directed by Professor Joon Chang)

Background: Hemoptysis, when massive and untreated, has a mortality rate of over 50 percents, is considered one of most dreaded of all respiratory emergencies and can have a variety of underlying causes.

Bronchial artery embolization (BAE) has become an established procedure in the management of massive and recurrent hemoptysis, since it was first reported in 1973 by Remy. And its efficacy is widely documented thereafter by number of articles.

An immediate control of hemoptysis is achieved in 73 to 98%, with a mean follow of less than one month. Immediate success rates have increased recently because of the introduction of superselective embolization and the refinement of embolic agents and techniques.

However, the long term success rate of BAE is known to be unfavorable. Long term recurrence rate have been reported to be 10 to 52%, with a mean follow up period ranging from one to 46 months. Variety of factors influencing that control failure has been described by number of authors.

Materials and methods: Seventy five patients underwent bronchial artery embolization due to massive hemoptysis in Severance Hospital between January 2000 and January 2005. Nine patients' data were not available and could not be contacted with. Finally 66 patients' (48 males, 18 females) medical records were analyzed retrospectively during a mean follow up period of 2.74 years (ranging from 4 months to 75 months).

Results: Among 66 patients whose data were available, 23 (34.9%) patients had

recurrent major hemoptysis during a mean period of 2.74 years (ranging from 4months to 75 months).

Patients' demographic characteristics, hemoptysis etiology, previous intervention history and number of feeding vessels had no statistical validity as risk factors of recurred major hemoptysis. But bilaterality of lesion, amount of hemoptysis and pleural thickening were revealed as meaningful factors for predicting relapse ($P < 0.05$).

Conclusion: According to our series, patients presenting with larger amount of hemoptysis, pleural thickening of chest radiography and bilateral lesion are associated with increased risk of major hemoptysis in patients treated with bronchial artery embolization.

Key words: Hemoptysis; bronchial artery embolization.

Follow up after bronchial artery embolization in patients with hemoptysis

Wou Young Chung

*Department of Medicine
The Graduate School, Yonsei University*

(Directed by Professor Joon Chang)

I . Introduction

Hemoptysis, when massive and untreated, has a mortality rate of over 50 percents, is considered one of most dreaded of all respiratory emergencies and can have a variety of underlying causes.

Bronchial artery embolization (BAE) has become an established procedure in the management of massive and recurrent hemoptysis, since it was first reported in 1973 by Remy¹. And its efficacy is widely documented thereafter by number of articles¹⁻¹¹.

An immediate control of hemoptysis is achieved in 73 to 98%, with a mean follow of less than one month¹⁻⁴. Immediate success rates have increased recently because of the introduction of superselective embolization and the refinement of embolic agents and techniques⁴. However, the long term success rate of BAE is known to be unfavorable. Long term recurrence rate have been reported to be 10 to 52%, with a mean follow up period ranging from one to 46months¹⁻⁷. Variety of factors influencing that control failure has been described by number of authors.

Bronchiectatic change on high resolution CT scan (HRCT)⁴, broncho-pulmonary shunt⁴, pleural thickening^{5,7}, underlying lung diseases⁶, the amount of bleeding⁸, multiple feeding vessels⁹, incomplete embolization¹⁰, and previous hemoptysis history¹¹ are possible risk factors of recurrent bleeding events. But these findings vary from article to article and there is not yet a proven condition to predict the recurrence.

This study is designed to survey previously documented possible risk factors of recurrence in those who underwent BAE in our hospital, during

relatively a long period.

Since nearly all patients had taken HRCT, we focused on radiological findings such as pleural thickening to be possible risk factors of the recurrence.

Table1. Previous studies about bronchial artery embolization outcomes ⁴

Study	Recurrence,%	Follow up period			Patients
		Months			
		max.	median		
Remy et al.	Immediate	16			
1977	Within 18 months	69	30	-	49
Uflacker et al.	Immediate	19.5			41
1985	Long-term	27.3	47	24	33
Cremashi et al.	Immediate	4			
1993	Within 12 months	16 ^a	168	-	209
	Within 1-14 years	14			
Osaki et al.	Immediate	0			
2000	Long-term	27			
	hemoptysis		88	47	22
	Minor hemosputa	23			

^a Recurrent severe hemoptysis

II. Materials and methods

Seventy five patients underwent bronchial artery embolization due to massive hemoptysis in Severance Hospital between January 2000 and January 2005. Nine patients' data were not available and could not be contacted with. Finally 66 (48 males, 18 females) patients' medical records were analysed retrospectively during a mean follow up period of 2.74 years (ranging from 4 months to 75 months).

Recurrence of major hemoptysis is defined if one of following conditions is fulfilled; if another gross hemoptysis (more than 100cc/day) happens or the patient had to 1) undergo another bronchial artery embolization, or 2) lung resection surgery due to hemoptysis, or 3) was advised one of these procedures or 4) died because of hemoptysis.

Minor hemoptysis including blood tinged sputum was also recorded but that was not comprised in recurred major hemoptysis group if further serious event did not occur.

Demographic characteristics such as gender and age, duration of symptom, amount of hemoptysis, previous history of treatment for hemoptysis, the main medical condition causing hemoptysis, bilaterality of pulmonary lesion, number of feeding vessels and presence of pleural thickening were our parameters analysed.

For comparison of various risk factors between recurrent major hemoptysis group and controlled hemoptysis group, Pearson's Chi-square test and Student's T-test were used. Statistical validity is defined p-value less than 0.05.

III. Results

Among 66 patients whose data were available, 23 (34.9%) patients had recurred major hemoptysis during a mean follow up period of 2.74 years (ranging from 4 months to 75 months). Eight of these 23 recurred patients had pneumonectomy or lobectomy of lung (3 pneumonectomies and 5 lobectomies) in following event, and 4 died with uncontrolled hemoptysis (one died after pneumonectomy). Out of the remaining 15 relapsed patients, 12 had to undergo another bronchial artery embolization.

Concerning the factors influencing relapse, demographic findings did not play any role and duration of symptom had not any significance, but the amount of hemoptysis had a statistical significance ($P < 0.05$; Table 2).

As to the underlying diseases, we had 19 bronchiectasis, 7 malignancies (4 primary lung cancer and 3 metastatic malignancies), 20 tuberculosis, 14 aspergillomas and 6 others (including 1 bronchial artery aneurysm, 2 lung abscesses, and 2 unknown causes) and we did not find any statistical significance between them (Table 3). Nine patients had a history of previous BAE treatments for hemoptysis, but they showed no increased risk of relapse of major hemoptysis (table 3). Bilateral lesion on radiographic finding or pleural thickening on HRCT had increased risk of recurred major hemoptysis ($P < 0.05$; Table 4). Number of feeding vessels had not any statistical value concerning the relapse.

In present study, reliable risk factors for recurrent hemoptysis after BAE were: amount of hemoptysis, bilaterality of lesion and pleural thickening on HRCT.

Minor hemoptysis including blood tinged sputum occurred in 30 patients who were classified in non recurred group for major hemoptysis. So the fraction of patients who experienced any bleeding after the procedure was 80.3% (53 out of 66). We also analysed the risk factors for all patients who had at least one minor bleeding event. But there was no reliable risk factor that can predict bleeding events comprising minor hemoptysis.

Table 2. Demographic features, duration and amount of hemoptysis

		Recurred major hemoptysis	Non recurred major hemoptysis	p-value
Gender	Male	17	31	
	Female	6	12	
	Total	23	43	NS
Age		56.5 ± 16.2	54.3 ± 16.2	NS
Duration of symptom (day)		6.3 ± 12.7	8.7 ± 19.5	NS
Amount of hemoptysis (cc)		217 ± 98	153 ± 94	<0.05

Table 3. Underlying diseases and previous history of bronchial artery embolization intervention

	Recurred major hemoptysis (%) n=23	p-value
Underlying diseases		
Bronchiectasis (n=19)	5 (26)	
Malignancy (n=7)	4 (57)	
Primary lung cancer (n=4)	2 (50)	
Metastasis to the lung (n=3)	2 (67)	
Tuberculosis (n=20)	5 (25)	
Aspergilloma (n=14)	8 (57)	
Other* (n=6)	1 (17)	NS
Previous intervention		
Yes (n=9)	5 (55)	
No (n=57)	18 (32)	NS

* Other diseases include 1 bronchial artery aneurysm, 2 lung abscesses, and 2 unknown etiologies

Table 4. Radiologic findings and the recurred major hemoptysis

	Recurred major heomoptysis (%) n=23	p-value
Bilateral lesion (n=13)	8 (62)	
Unilateral lesion (n=53)	15 (28)	P < 0.05
Pleural thickening present (n=16)	12 (75)	
absent (n=50)	11 (22)	P < 0.05
Number of feeding vessels		
1 (n=33)	10 (30)	
2 (n=19)	8 (42)	
3 (n=10)	39 (100)	
4 (n=2)	1 (50)	
5 (n=2)	1 (50)	NS

IV. Discussion

We analyzed the result of bronchial artery embolization in our institution during a relatively long period. In previous literatures, long term recurrence rate have been reported to be 10 to 52%, with a mean follow up period ranging from one to 46 months¹⁻¹¹.

Remy et al.¹ reported that of 49 patients treated during hemoptysis, an immediate arrest was achieved in 41 but 6 of these patients suffered a relapse in 2-7 months after BAE, but there was no recurrent bleeding in the remaining 35 patients. However, only 7 of 35 (20%) patients had not experienced re-bleeding in follow up period beyond the 18 months. Ulfacker et al. reported that an immediate control of hemoptysis was achieved in 33 of 41 patients (80.5%) while hemoptysis recurred in 9 of 33 patients (27.3%) in the long term follow up (mean 24.8months). In our analysis, bronchial artery embolization effectively controlled 65.1% of life threatening massive hemoptysis (23 recurs in 66 cases) in a mean follow up period of 31.9 months.

Regarding the factor of recurrence after BAE, Osaki et al.⁴ concluded that bronchiectatic change on CT scan and pulmonary bronchial shunt had some statistical significance. Kim et al.⁶ described the underlying lung disease and amount of bleeding as reliable risk factors for the recurrence, in a study involving 75 patients with a result estimating 54.5% of re-bleeding rate after 3 years.

The diversity of previously proposed risk factors may be explained by variability of their criteria on recurrence, sample size, underlying diseases, follow-up time and embolization technique.

In this study, the amount of hemoptysis had some statistical relation with the recurrent event. Though the analysis of underlying disease had no statistical validity, tuberculosis tended to have more control rate compared to aspergilloma and cancer. The effective anti-tuberculosis drug therapy must have reduced the recurrent hemoptysis but its relatively modest prevalence in our series (30% compared to 43-52% in other domestic studies)^{5,6,12,14} lead to overall no statistical significance.

In 1993, Tamura et al. described pleural thickening as a risk factor for recurrent bleeding after bronchial artery embolization⁸. According to them, in the presence of pleural thickening, non bronchial systemic feeder vessels that originate from various arteries (e.g., intercostals artery, branches of the subclavian and axillary arteries, internal mammary artery and inferior phrenic

artery) may develop along the pleural surface and become enlarged as a result of the inflammatory process. In our study 16 cases showed pleural thickening on chest radiography and 12 (75%) of them experienced recurrent major bleeding, which is statistically valid compared with 22% of no pleural thickening group.

This study is a retrospective review of medical records, which often should underestimate strength of variable. But any hemoptysis including minor hemoptysis and blood tinged sputum occurred in 53 patients (80.3%). Perhaps because this portion is too high, no reliable risk factor that can predict minor bleeding was found. However minor bleeding event especially blood tinged sputum is considered as a natural course that can easily happen after embolization and is nowhere the target point of the procedure.

V. Conclusion

The amount of hemoptysis, bilaterality of lesion, and the presence of pleural thickening were revealed as reliable risk factors for relapse of gross hemoptysis after initial bronchial artery embolization.

In a well designed prospective study based on this series, one should take account of the extent of destroyed lung, the baseline pulmonary function and the selection of the same interventional radiology expert.

References

1. Remy J, Arnaud A, Fardou H, Giroud R, Vousin C. Treatment of hemoptysis by embolization of bronchial arteries. *Radiology* 1977;122:33-37.
2. Karen L, Swanson KL, Prakash UB: Bronchial artery embolization. Experience with 54 patients. *Chest* 2002;121:749-759.
3. Ulfacker R, Kaemmerer A, Neves C, Picon P, Rizzon CF, Oliveira C. Management of massive hemoptysis by bronchial artery embolization. *Radiology* 1983;146:627-634.
4. Osaki S, Naknishi Y, Wataya H, Takayama K. Prognosis of bronchial artery embolization in the management of hemoptysis. *Respiration* 2000;67:412-416.
5. Yeo DS, Lee SY, Hyun DS, Lee SH, Kim SC, Choi YM et al. Effect of bronchial artery embolization in management of massive hemoptysis. *Tuberc Respir Dis* 1999;46:53-64.
6. Kim SO, Oh IJ, Kim KS, Kim KS, Yu YK, Lim SC. Recurrent Hemoptysis after bronchial artery embolization. *Tuberc Respir Dis* 2001;51:364-372.
7. Katoh O, Kishikawa T. Recurrent bleeding after arterial embolization in patients with hemoptysis. *Chest* 1990;97:541-546.
8. Tamura S, Kodama T, Otsuka N, Kihara Y, Nisikawa K, Yuki Y et al. Embolotherapy for persistent hemoptysis. The significance of pleural thickening. *Cardiovasc Intervent Radiol* 1993;16:85-88.
9. White R. Bronchial artery embolotherapy for control of acute hemoptysis. Analysis and outcome. *Chest* 1999;115:912-915.
10. Mal H, Rullon I, Mellot F, Brugiere O, Sleiman C, Menu Y, Fournier M. Immediate and long term results of bronchial artery embolization for life threatening hemoptysis. *Chest* 1999; 115:996-1001.
11. Lee TW. Management of massive hemoptysis. A single institution experience. *Ann Thorac Cardiovas Surg* 2000.;6:232-235
12. Yoon W, Kim JK, Kim YH, Chung TW, Kang HK. Bronchial and non bronchial systemic artery embolization for life threatening hemoptysis: a comprehensive review. *Radiographics* 2002; 22:1395-1409.
13. Yu-Tang Goh P, Lim M, Teo N, En Shen Won Wong D. Embolization for hemoptysis, a six year review. *Cadivasc Intervent Radiol* 2002;25:17-25. Epub 2001 Nov23.
14. Kim BC, Kim JM, Kim YS, Kim SM. Effect of Bronchial artery embolization in

the management of massive hemoptysis: factors influencing rebleeding.
Tuberc Respir Dis 1996;4:590-599.

기관지 동맥 색전술 후 객혈의 재발에 관한 연구

<지도교수 장준>

연세대학교 대학원 의학과

정우영

서론: 대량객혈은 치료가 이루어 지지 않을 경우, 50% 이상의 사망률을 보이는 호흡기 영역의 가장 위급한 응급상황의 하나이며 여러 원인에 의해 발생 될 수 있다. 1973년 레미 등에 의해 처음 보고된 이후로 기관지 동맥 색전술은 대량의 재발성 객혈의 치료로 확립되어 그 효과가 입증 되었다.

하루에서 한달 까지의 초기 성공률은 73에서 98% 까지 보고 되었다. 이런 초기 치료 성공률 향상은 최근 도입되어 발전하는 선택적 색전술과 색전 물질 등 기술의 발달에 기인한다.

그러나 기관지 동맥 색전술의 장기 성적은 보다 비관적으로 알려져 있으며 적게는 1개월에서 길게는 46개월 동안의 재발률은 10 에서 52 퍼센트로 보고되고 있다. 이러한 객혈의 재발을 예측 할 수 있는 위험요소들에 대한 연구 또한 많은 저자들에게 의해 발표 되었으며 각기 다른 결과를 보고하고 있다.

재료 및 방법: 2000년 1월과 2005년 1월 사이 세브란스 병원에 대량 객혈로 내원하여 기관지 동맥 색전술을 시행 받은 75명 환자들의 의무 기록을 후향적으로 분석하여 시술 후 재발의 빈도와 재발과 관련이 있는 요인에 대해 연구하였다.

결과: 75명의 환자 중 결과 분석이 가능했던 66명의 환자 중 평균 2.74년간의 추적 관찰 기간 동안 23명(34.9%)에서 심각한 객혈이 재발되었다. 병변의 양측성, 흉막 비후, 객혈의 양 등이 재발과 관련 있는 인자로 관찰되었다($P < 0.05$). 환자의 성별과 나이, 이전에 객혈로 시술 받은 과거력, 객혈의 원인 질환, 분포 혈관의 수 등은 심각한 객혈 재발과 유의한 관계가 없었다.

결론 : 흉막 비후, 병변의 양측성은 기관지 동맥 색전술 후 재발의 확률을 높이는 인자이며 객혈의 양이 많을수록 재발률도 증가 함을 관찰 할 수 있었다.

핵심 되는 단어: 객혈; 기관지 동맥 색전술.