MID-TERM RESULTS OF TRACHEOBRONCHIAL RECONTRUCTION IN POST-TUBERCULOSIS PATIENTS

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CONTENT

INTRODUCTION

BURDEN OF TUBERCULOSIS

WHO (2022)

TB is still ranked in the top 10 causes of death world-wide.

Among the top 30 high TB burden countries, Vietnam is ranked tenth.

WHO. Global tuberculosis report 2022 (WHO/HTM/TB/2022.22). Geneva: World Health Organization; 2022 (https://https://www.who.int/publications/i/item/9789240013131)

Tuberculous tracheobronchial stenosis

TBTB

About 10% to 40% of patients with active pulmonary tuberculosis had EBTB

TBTB stenosis

TBTB stenosis may be up to 68% in initial 4 to 6 months of the disease and, in long term, more than 90% of the patients are affected

TBTB stenosis continues to be under-recognised and often misdiagnosed

Diagnose and plan for treatment base on Bronchoscopy and chest CT

Surgical reconstruction is commonly recommended for the treatment of tuberculous airway stenosis

1. Shahzad T, Irfan M. Endobronchial tuberculosis-a review. Journal of thoracic disease. 2016;8(12):3797-802.
2. Low SY, Hsu A, Eng P. Interventional bronchoscopy for tuberculous tracheobronchial stenosis. The European respiratory journal. 2004;24(3):345-7.
3. Tsukioka T, Takahama M, Nakajima R, Kimura M, Tei K, Yamamoto R. Surgical reconstruction for tuberculous airway stenosis: management for patients with concomitant tracheal malacia. General thoracic and cardiovascular surgery. 2015;63(7):379-85.
4. Vinh VH, Khoi NV, Quang NVD, Khanh HQ. Surgical repair for post-tuberculosis tracheobronchial stenosis. Asian Cardiovascular and Thoracic Annals.0(0):0218492320963972.

Previous studies worldwide

1940s Techniques of tracheobronchial surgery

1947 Griffith

1993 Kato
36 cases, 36 years.

1997 Kikuchi
39 patients

1999 Kawamura
39 patients

2015 Tsukioka
12 cases (2003 – 2013)

2018 Li
8 patients.

2021 Pulle
20 patients.

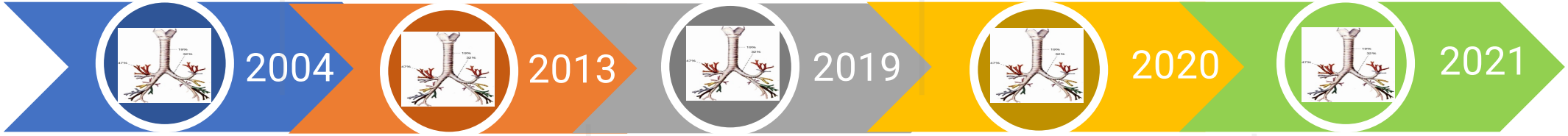
1. Kato R, Kakizaki T, Hangai N, Sawafuji M, Yamamoto T, Kobayashi T, et al. Bronchoplastic procedures for tuberculous bronchial stenosis. The Journal of thoracic and cardiovascular surgery. 1993;106(6):1118-21.
2. Kikuchi K, Kobayashi K. [Surgical treatment for tracheobronchial tuberculosis]. Kekkaku : [Tuberculosis]. 1997;72(1):43-8.
3. Kawamura M, Watanabe M, Kobayashi K. [Surgical treatment for tuberculous tracheobronchial stenosis]. Kekkaku : [Tuberculosis]. 1999;74(12):891-6.
4. Tsukioka T., Takahama M., Nakajima R., et al. (2015), "Surgical reconstruction for tuberculous airway stenosis: management for patients with concomitant tracheal malacia", Gen Thorac Cardiovasc Surg, 63(7): p. 379-85.
5. Li Z., Mao G., Gui Q., Xu C. (2018), "Bronchoplasty for treating the whole lung atelectasis caused by endobronchial tuberculosis in main bronchus", J Thorac Dis, 10(7): p. 4000-4005.
6. Pulle MV, Asaf BB, Puri HV, Bishnoi S, Kumar A. Surgical intervention is safe, feasible, and effective in tubercular tracheobronchial stenosis. Lung India : official organ of Indian Chest Society. 2021;38(3):245-51.

Previous studies in Vietnam

Trần Quyết Tiến
14 injured cases

Vũ Hữu Vĩnh
49 congenital cases
75 injured cases.

Nguyễn Đức Thắng
72 cases postintubation
anh tracheostomy



Nguyễn Duy Tân
132 injured cases.

Vũ Hữu Vĩnh
7 cases TBTB stenosis

1. Tiến TQ. VỠ KHÍ - PHẾ QUẢN TRONG CHẤN THƯƠNG NGỰC KÍN . Tạp chí Y học TP Hồ Chí Minh. 2004;8(1):88.
2. Tân ND. Nghiên cứu kết quả chẩn đoán và phẫu thuật sớm tổn thương khí phế quản do chấn thương: Đại học Y Dược thành phố Hồ Chí Minh; 2013.
3. Vu HV, Huynh QK, Nguyen VDQ, Thi CP, Khoi NV. Effect of resected length in reconstructive surgery for tracheobronchial injury. Asian Cardiovascular and Thoracic Annals. 2019;27(8):652-60.
4. Vu HV, Huynh QK, Nguyen VDQ. Surgical reconstruction for congenital tracheal malformation and pulmonary artery sling. Journal of Cardiothoracic Surgery. 2019;14(1):49.
5. Vinh VH, Khoi NV, Quang NVD, Khanh HQ. Surgical repair for post-tuberculosis tracheobronchial stenosis. Asian Cardiovascular and Thoracic Annals.0(0):0218492320963972.
6. Nguyễn Đức Thắng, Nguyễn Trường Giang, Trần Trọng Kiểm (2021), "Đánh giá các phương pháp phẫu thuật tạo hình di chứng hẹp khí quản do đặt ống nội khí quản hoặc mở khí quản", Tạp chí y dược lâm sàng 108, 16(4). 66

MATERIALS AND METHODS

Study design and population

A prospective study was performed in 48 tuberculous tracheobronchial stenosis who underwent surgical reconstruction at Pham Ngoc Thach hospital from January 2015 to December 2019 and follow up to December 2022.

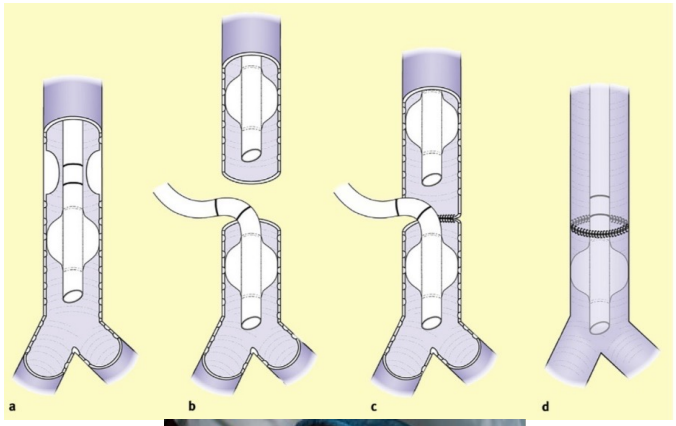
The inclusion criteria

- Previous history of Pulmonary and TBTB, Negative AFB smear or culture of Mycobacterium tuberculosis
- Patients with endoscopic and CT findings of tracheobronchial stenosis:
  - The cross-sectional area of the stenosis have >50% obstruction
  - Complications of lung under stenosis segment.
- Patients underwent surgical reconstruction

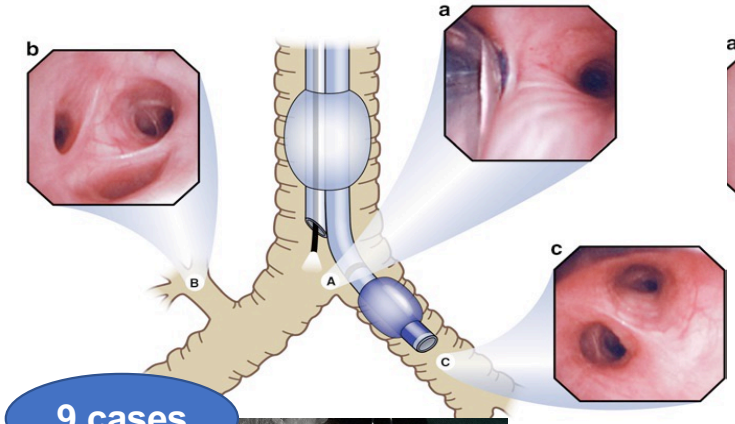
The exclusion criteria

- Patients with tracheobronchial complex stenosis at multiple sites with several intervention.
- Patients with incomplete clinical data.

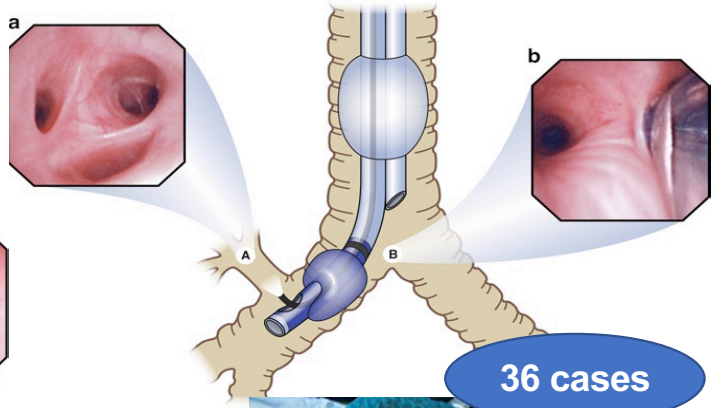
SURGICAL SELECTION



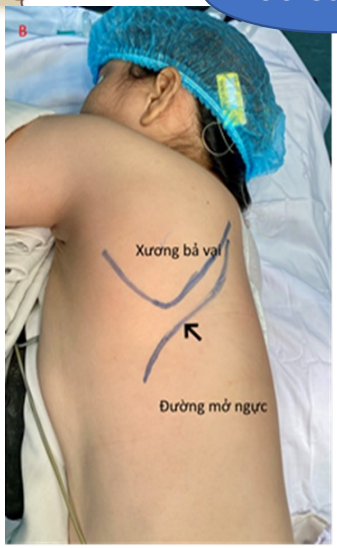
3 cases



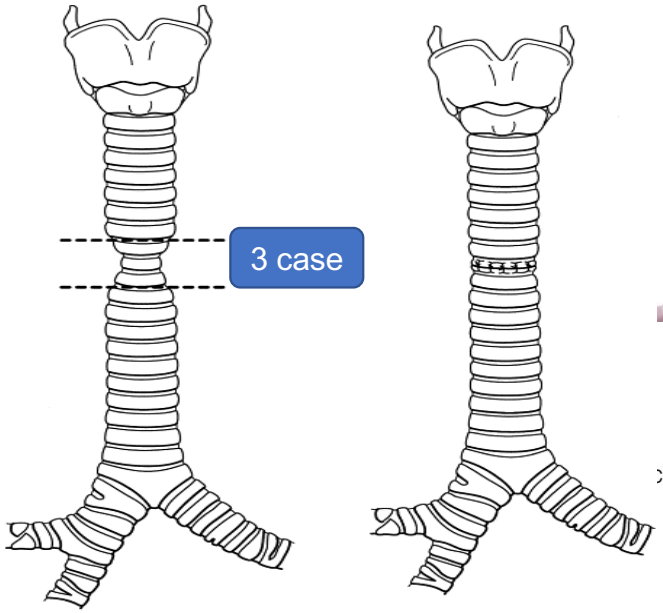
9 cases

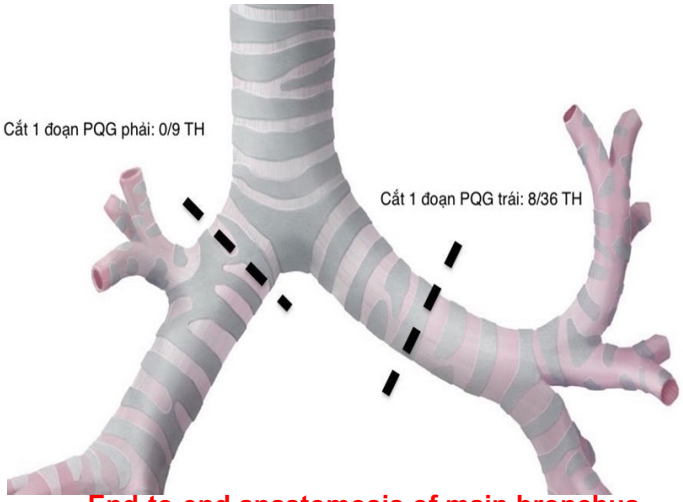


36 cases

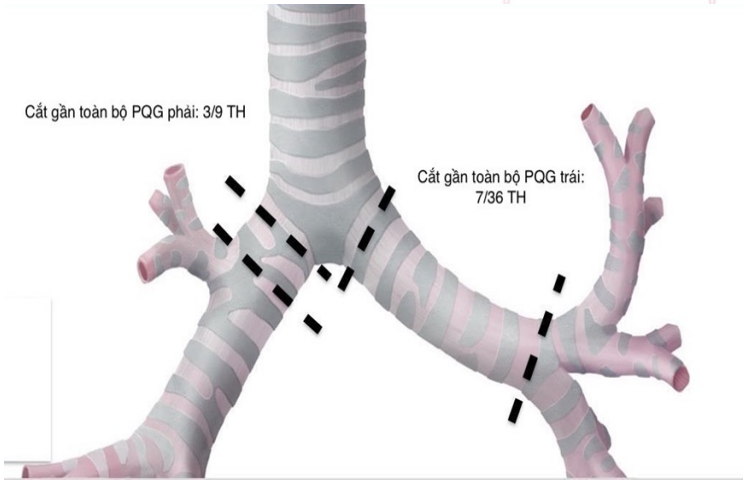


OPERATIVE TECHNIQUE

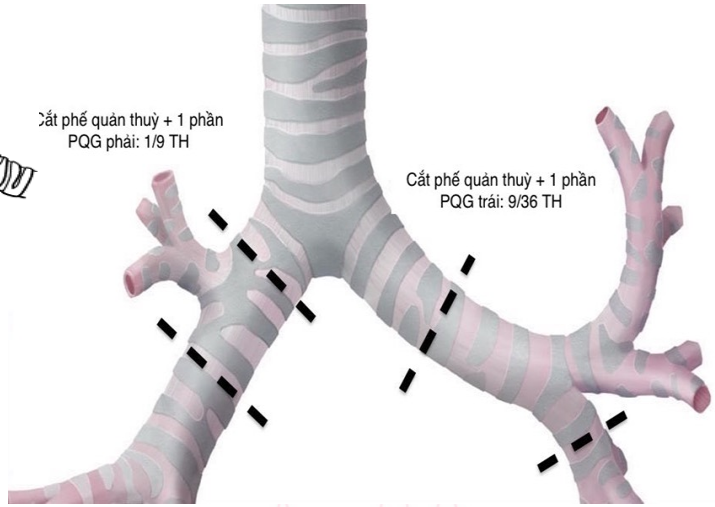




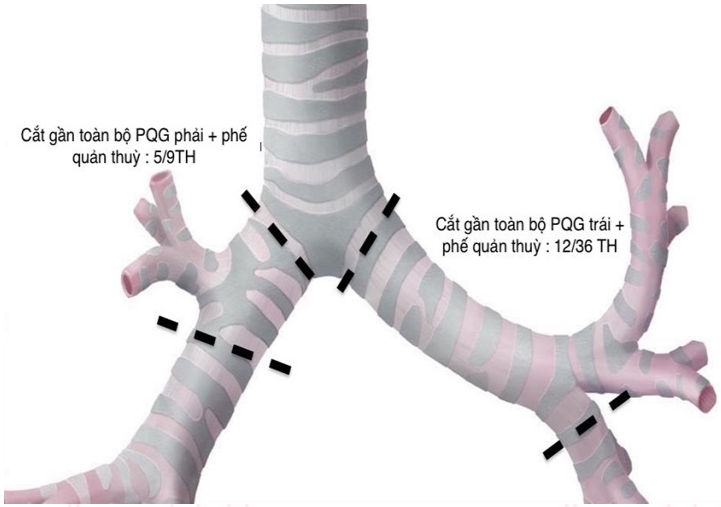
End-to-end anastomosis of main bronchus



Anastomosis of main bronchus to carina or trachea



Anastomosis of lobe bronchus to main bronchus



Anastomosis of lobe bronchus to carina or trachea

PERIOPERATIVE EVALUATION

The safety and feasibility of surgical reconstruction

- **Follow up: First 30 days after surgery.**
- **Criteria:**
  - **Mortality and morbidity.**
  - **Chest X - ray**
  - **Bronchoscopy**

1. Palade E, Holdt H, Passlick B. Bronchus anastomosis after sleeve resection for lung cancer: does the suture technique ayhave an impact on postoperative complication rate? Interactive cardiovascular and thoracic surgery. 2015;20(6):798-804.
2. Tân ND. Nghiên cứu kết quả chẩn đoán và phẫu thuật sớm tổn thương khí phế quản do chấn thương: Luận án tiến sĩ. Đại học Y Dược thành phố Hồ Chí Minh; 2013.
3. Vu HV, Huynh QK, Nguyen VDQ, Thi CP, Khoi NV. Effect of resected length in reconstructive surgery for tracheobronchial injury. Asian Cardiovascular and Thoracic Annals. 2019;27(8):652-60.-

MID-TERM EVALUATION

The effectiveness of surgical reconstruction

- **Follow up: over 3 years.**
- **Criteria:**
  - **Clinical findings: Karnofsky, mMRC.**
  - **Chest CT**
  - **Bronchoscopy**
  - **Lung function.**

RESULTS

Patient characteristics

	All patients (N=48)
Age (years)	30.6 ± 9.9 (14 - 60)
Sex Female	44 (91.7)
Previous history of TB	
Pulmonary TB	45 (93.8)
Tracheobronchial TB	3 (6.2)
Anti TB treatment	
Uncompleted Anti TB	10 (20.8)
Complete anti TB	38 (79.2)
Time from TB diagnosis to tracheobronchial stenosis diagnosis (months)	12 (7; 60)
Symptoms	
Asymptomatic	1 (2.1)
Local symptoms only	43 (89.6)
Local and systemic symptoms	4 (8.3)
Severity of dyspnea	
None	28 (58.3)
Mild	16 (33.3)
Moderate	4 (8.3)
Karnofsky performance status score	
90	2 (4.2)
80	16 (33.3)
70	28 (58.3)
60	2 (4.2)
Length of follow-up (months)	69 (61; 74)

Lesion characteristics

	CT-scan findings (N=48)	Bronchoscopic findings (N=48)	Intraoperative findings (N=48)
Airway stenosis	48 (100.0)	48 (100.0)	48 (100.0)
Collapse	39 (81.2)	-	-
Consolidation	16 (33.3)	-	-
Linear fibrosis	7 (14.6)	-	-
Location of stenosis			
Trachea	3 (6.2)	3 (6.2)	-
Left main bronchus	36 (75.0)	36 (75.0)	-
Right main bronchus	9 (18.8)	9 (18.8)	-
Location of the lesion in the bronchus			
Proximal bronchus	4 (8.9)	31 (68.9)	1 (2.2)
Middle bronchus	9 (20.0)	9 (20.0)	11 (24.4)
Distal bronchus	5 (11.1)	5 (11.1)	2 (4.4)
Entire bronchus	27 (60.0)	0 (0.0)	31 (68.9)
Luminal diameter of stenosis	2.3 ± 2.1	2.5 ±2.1	2.0 ±1.8
Length of stenosis (mm)	25.8 ± 8.5	-	27.5 ± 7.5
Myer-Cotton classification of stenosis			
Grade 2 (51-70%)	6 (12.5)	8 (17.8)	-
Grade 3 (71-99%)	23 (47.9)	22 (48.9)	-
Grade 4 (100%)	19 (39.6)	15 (33.3)	-

ATCSA2023
Ho Chi Minh city, Vietnam

Operative characteristics and complications

	All patients (N=48)
Surgical approach	
Resection and anastomosis	21 (43.8)
Resection and anastomosis plus lobectomy	27 (56.2)
Method of anastomosis	
End-to-end anastomosis of trachea	3 (6.3)
End-to-end anastomosis of main bronchus	8 (16.7)
Anastomosis of main bronchus to carina	8 (16.7)
Anastomosis of main bronchus to trachea	2 (4.2)
Anastomosis of lobe bronchus to main bronchus	10 (20.8)
Anastomosis of lobe bronchus to carina	16 (33.3)
Anastomosis of lobe bronchus to trachea	1 (2.1)
Operating time (mins)	160 (144; 180)
Blood loss ml)	100 (100; 200)
Duration of chest drainage (days)	4 (3; 6)
Postoperative hospital length of stay (days)	10 (8; 13)
Operative complication	13 (27.1)
Prolonged air leak	6 (12.5)
Atelectasis	2 (4.2)
Hoarseness	2 (4.2)
Cardiovascular complications	2 (4.2)
Pneumonia	1 (2.1)
Hemoptysis	1 (2.1)

Clinical parameters during the follow-up period

	Pre-surgery (N=48)	1 month (N=48)	3 months (N=48)	6 months (N=48)	1 year (N=48)	2 years (N=48)	3 years (N=48)	4 years (N=48)	5 years (N=44)	6 years (N=30)	7 years (N=9)
Karnofsky performance status score											
100	0 (0.0)	12 (25.0)	26 (54.2)	36 (75.0)	40 (83.3)	42 (87.5)	42 (87.5)	48 (95.8)	44 (100.0)	30 (100.0)	9 (100.0)
90	2 (4.2)	29 (60.4)	18 (37.5)	10 (20.8)	7 (14.6)	5 (10.4)	6 (12.5)	2 (4.2)	0 (0.0)	0 (0.0)	0 (0.0)
80	16 (33.3)	6 (12.5)	3 (6.2)	2 (4.2)	1 (2.1)	1 (2.1)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
70	28 (58.3)	1 (2.1)	1 (2.1)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
60	2 (4.2)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Severity of dyspnea											
None	28 (58.3)	46 (95.8)	47 (97.9)	48 (100.0)	48 (100.0)	48 (100.0)	48 (100.0)	48 (100.0)	44 (100.0)	30 (100.0)	9 (100.0)
Mild	16 (33.3)	2 (4.2)	1 (2.1)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Moderate	4 (8.3)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)

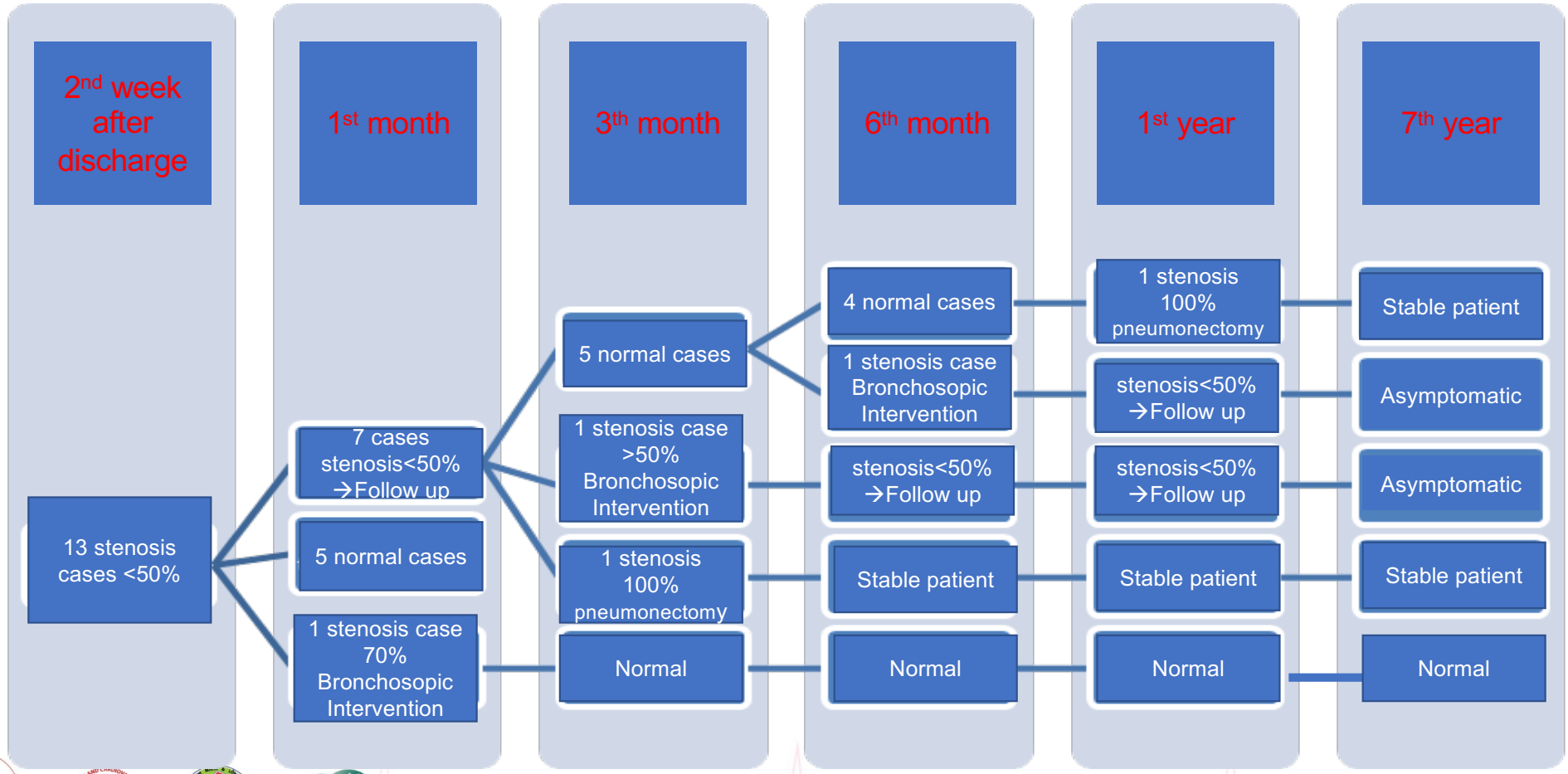
Spirometry parameters before and after surgery

	Pre-surgery (N=45)	Post-surgery (N=48)	p-value
FVC (%)	61.4 ± 12.8	80.0 ± 10.9	<0.001
FEV1 (%)	54.4 ± 11.5	73.4 ± 12.1	<0.001
FEV1/FVC (%)	77.4 ± 14.8	78.4 ± 7.9	0.986
FEF 25-75 (%)	42.8 ± 14.0	57.0 ± 18.1	<0.001
PEF (%)	56.8 ± 14.8	69.1 ± 17.5	<0.001
Restrictive lung disease	31 (68.9)	14 (38.9)	0.034
Severity of restrictive disease			0.041
Mild	10 (32.3)	12 (85.7)	
Moderate	21 (67.7)	2 (14.3)	
Obstructive lung disease	12 (26.7)	3 (8.3)	0.023
Severity of obstructive disease			0.763
Mild	4 (33.3)	2 (66.7)	
Moderate	5 (41.7)	1 (33.3)	
Severe	3 (25.0)	0 (0.0)	

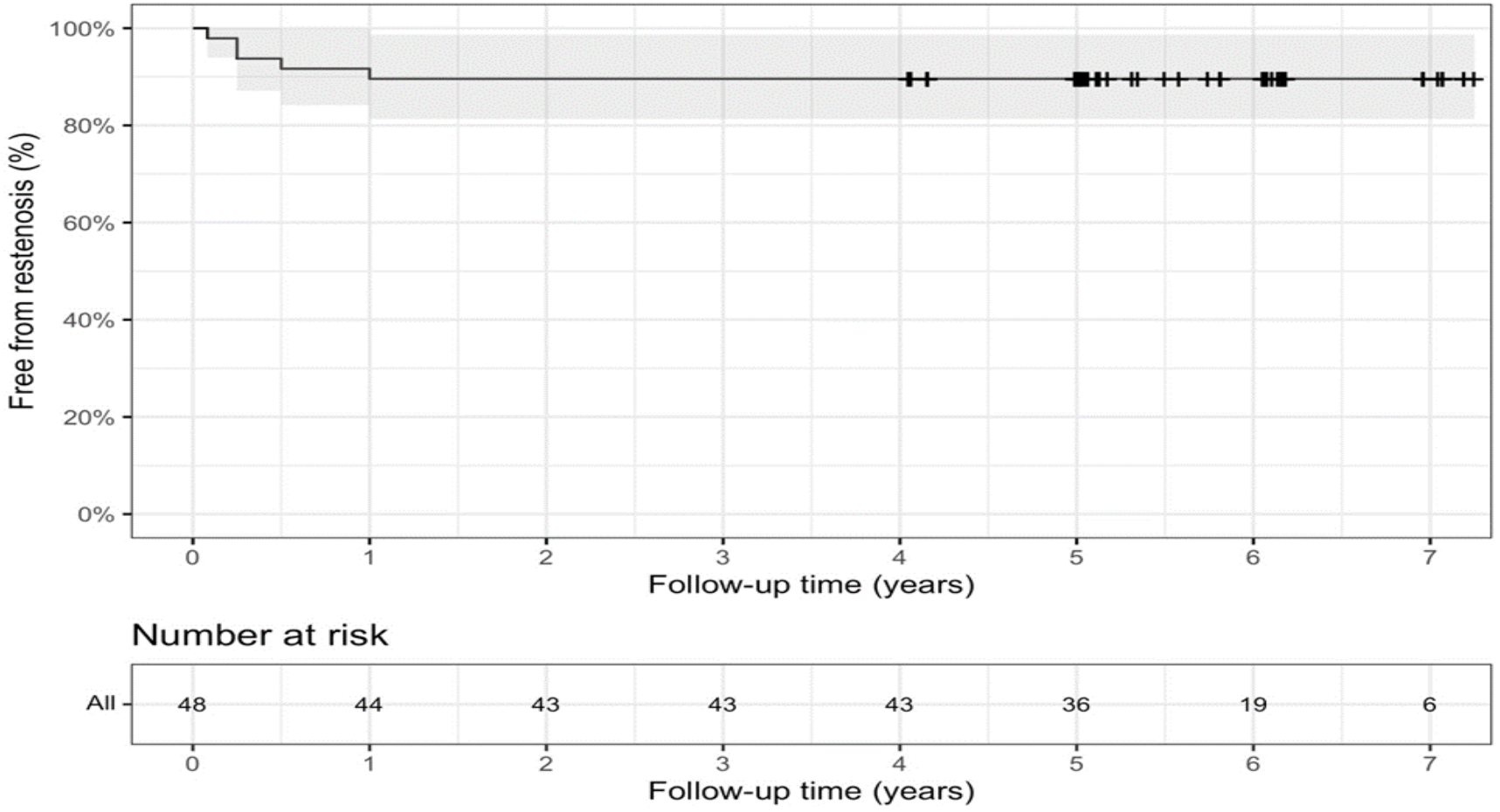
Diameter of lumina stenosis vs anastomosis before and after surgery

	Before (N=48)	After (N=48)	P Value
Diameter (mm)/ CT	2,3 ± 2,1	9,8 ± 3,0	<0,001
Diameter (mm)/ Bronchoscopy	2,5 ± 2,1	9,0 ± 2,8	<0,001

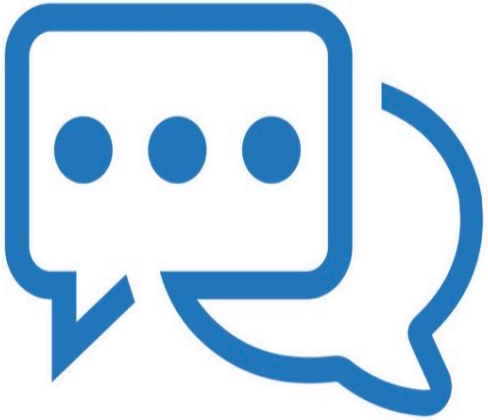
Anastomosis stenosis & intervention



Kaplan-Meier curves for restenosis



DISCUSSION



AGE AND GENDER

- Su (2018): Average age 38 (1 - 80), Female 55,1%.
- Kato (1993), Average age 35 (20 - 68), Female 83,3%.
- Kikuchi (1997): Average age 32 (22 - 53), Female 79,5%
- Ryu (2006): Average age 33 (14 - 73). Female 88,8%
- Our study, Average age 30,6. Female 91,7%.

The associations of young age and female sex with TBTB stenosis found in this study were consistent with previous reports

1. Kato R., Kakizaki T., Hangai N., et al. (1993) "Bronchoplastic procedures for tuberculous bronchial stenosis", J Thorac Cardiovasc Surg, 106(6): pp. 1118-21.
2. Kikuchi K., Kobayashi K. (1999), "Surgical treatment for tracheobronchial tuberculosis", Kekkaku, 72(1): pp. 43-8.
3. Ryu Y.J., Kim H., Yu C.M., Choi J.C., Kwon Y.S., Kwon O. (2006) "Use of silicone stents for the management of post-tuberculosis tracheobronchial stenosis", Eur Respir J, 28(5): p. 1029-35.
4. Su Z., Cheng Y., Wu Z., et al. (2019), "Incidence and Predictors of Tracheobronchial Tuberculosis in Pulmonary Tuberculosis: A Multicentre, Large-Scale and Prospective Study in Southern China", *Respiration*, 97(2): p. 153-159.

CLINICAL CHARACTERISTIC

- Kato (1993): cough (55%), sputum (40%), wheezing and dyspnea (25%)
- Low (2004): cough (86%), dyspnea
- Lei (2014) và Lee (2015): cough, sputum, dyspnea, wheezing
- V.H.Vĩnh (2020): dyspnea and cough
- We: 89,6% dyspnea, cough, sputum

Cough and shortness of breath were the most common symptoms.

1. Kato R., Kakizaki T., Hangai N., et al. (1993) "Bronchoplastic procedures for tuberculous bronchial stenosis", J Thorac Cardiovasc Surg, 106(6): pp. 1118-21.
2. Lei Y., Tian-Hui Z., Ming H., Xiu-Jun C., Yong D., Fu-Gen L. (2014), A"nalysis of the surgical treatment of endobronchial tuberculosis (EBTB)", Surg Today, 44(8): pp. 1434-7.
3. Low S.Y., Hsu A., Eng P. (2004), "Interventional bronchoscopy for tuberculous tracheobronchial stenosis", Eur Respir J, 24(3): pp. 345-7.Su Z., Cheng Y., Wu Z., et al. (2019), "Incidence and Predictors of Tracheobronchial Tuberculosis in Pulmonary Tuberculosis: A Multicentre, Large-Scale and Prospective Study in Southern China", *Respiration*, 97(2): p. 153-159.
4. Tsukioka T, Takahama M, Nakajima R, Kimura M, Tei K, Yamamoto R. Surgical reconstruction for tuberculous airway stenosis: management for patients with concomitant tracheal malacia. General thoracic and cardiovascular surgery. 2015;63(7):379-85.
5. VinhV.H., Khoi N.V., Quang N.V.D., Khanh H.Q. (2020), "Surgical repair for post-tuberculosis tracheobronchial stenosis", Asian Cardiovascular and Thoracic Annals. 0(0): p. 0218492320963972, p. 1- 7.

Postoperative complications

- Pull (2021): 25% complications: Pneumonia 5%, Anastomotic dehiscence 5%, Surgical site infection 10%, Prolonged air leak (>7 days) 20%.

  Operative time (mean±SD) in minutes: 232±81

  Mean blood loss (mean±SD) in ml: 298±122

- Our study: 27.1% Complications: Prolonged air leak 12.5%, Atelectasis 4.2%, Hoarseness 4.2%, Cardiovascular complications 4.2%, Hemoptysis 2.1%, Pneumonia 2.1%.

  Operating time (mins): 160 (144; 180)

  Blood loss ml): 100 (100; 200)

1. Pulle MV, Asaf BB, Puri HV, Bishnoi S, Kumar A. Surgical intervention is safe, feasible, and effective in tubercular tracheobronchial stenosis. Lung India : official organ of Indian Chest Society. 2021;38(3):245-51.R., Kakizaki T., Hangai N., et al. (1993) "Bronchoplastic procedures for tuberculous bronchial stenosis", J Thorac Cardiovasc Surg, 106(6): pp. 1118-21.

MID-TERM RESULTS

CLINICAL FEATURES

- Tsukioka (2015), The performance status and Hugh-Jones classification improved postoperatively in all patients.
- Our study, Karnofsky > 90 improved in follow up period. 100% mMRC 0 from 6th month.

LUNG FUNCTION

- Kato (1993), FEV1 improved but VC and FVC did not improve.
- Kawamura (1999), FEV1 improved 67% ↑82%.
- Tsukioka (2015), FVC, FEV1 improved.
- Our study, FVC, FEV1, FEF25-75, PEF improved, FEV1/FVC did not improve.

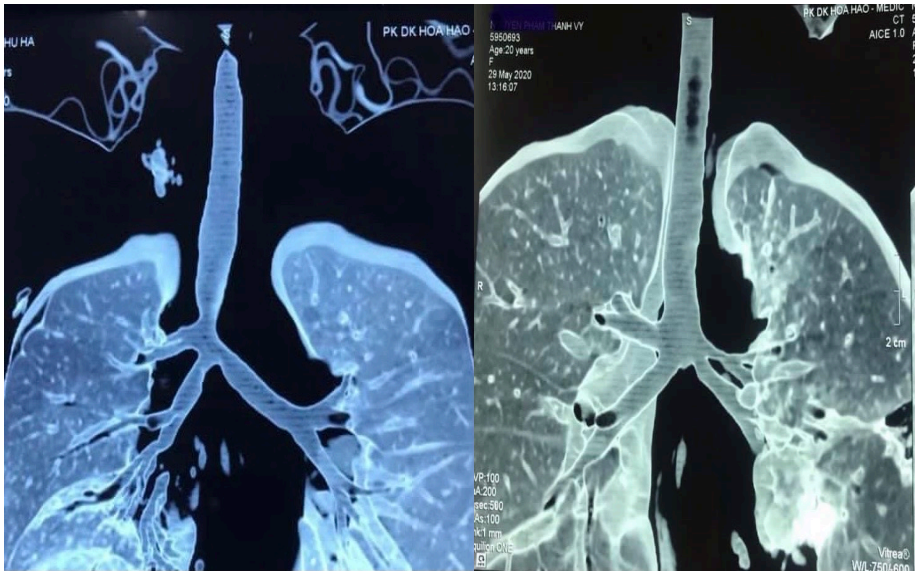
1. Kato R., Kakizaki T., Hangai N., et al. (1993) "Bronchoplastic procedures for tuberculous bronchial stenosis", J Thorac Cardiovasc Surg, 106(6): pp. 1118-21.
2. Kawamura M., Watanabe M., Kobayashi K. (1999), "Surgical treatment for tuberculous tracheobronchial stenosis", Kekkaku, 74(12): pp. 891-6.
3. Tsukioka T., Takahama M., Nakajima R., et al. (2015), "Surgical reconstruction for tuberculous airway stenosis: management for patients with concomitant tracheal malacia", Gen Thorac Cardiovasc Surg, 63(7): p. 379-85.

MID-TERM RESULTS

STENOSIS AFTER SURGERY

Author	Patients	Restenosis(%)
Kato	36	19,4
Kikuchi	39	10,3
Kawamura	39	7,8
Li	12	0
Nakajima	10	20
Tsukioka	12	8,3
Vũ Hữu Vĩnh	7	0
Pulle	14	7,1%
Our study	48	10,4%

RESULTS OF CHEST CT



1. Kato R., Kakizaki T., Hangai N., et al. (1993) "Bronchoplastic procedures for tuberculous bronchial stenosis", J Thorac Cardiovasc Surg, 106(6): pp. 1118-21.
2. Kawamura M., Watanabe M., Kobayashi K. (1999), "Surgical treatment for tuberculous tracheobronchial stenosis", Kekkaku, 74(12): pp. 891-6.
3. Kikuchi K., Kobayashi K. (1999), "Surgical treatment for tracheobronchial tuberculosis", Kekkaku, 72(1): pp. 43-8.
4. Li Z, Mao G, Gui Q, Xu C. Bronchoplasty for treating the whole lung atelectasis caused by endobronchial tuberculosis in main bronchus. J Thorac Dis. 2018;10(7):4000-5.
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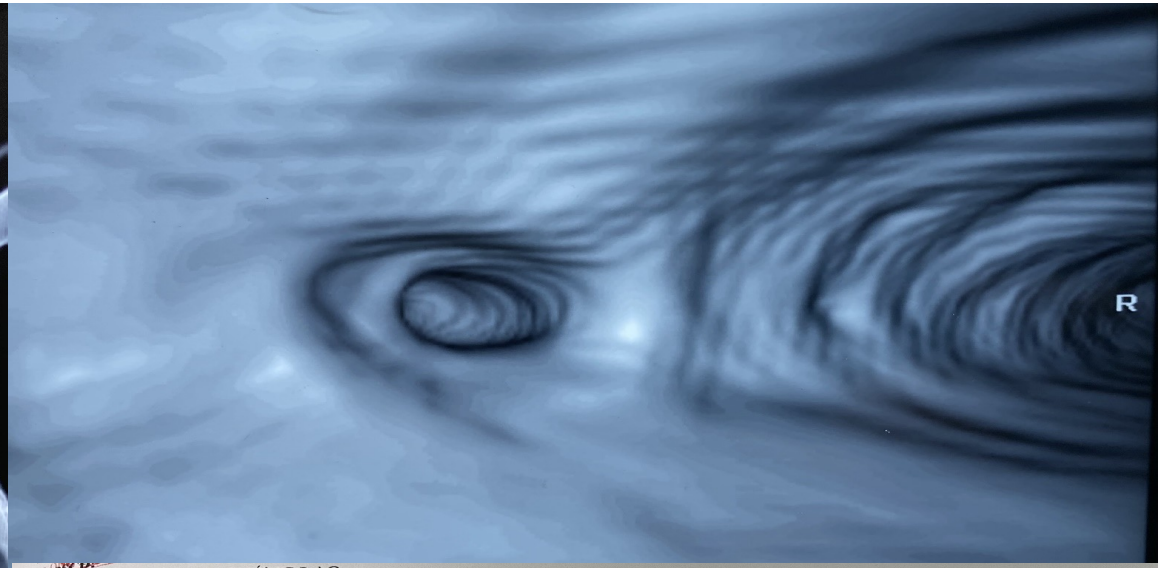


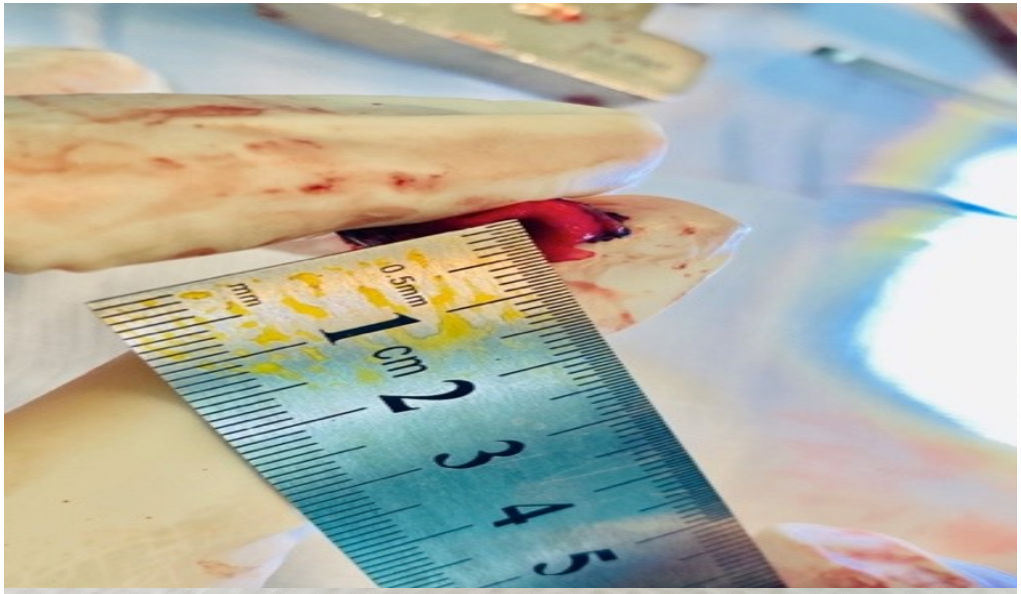
Chẩn đoán LS: DI CHỨNG LAO

Chỉ Định: NỘI SOI PHẾ QUẢN

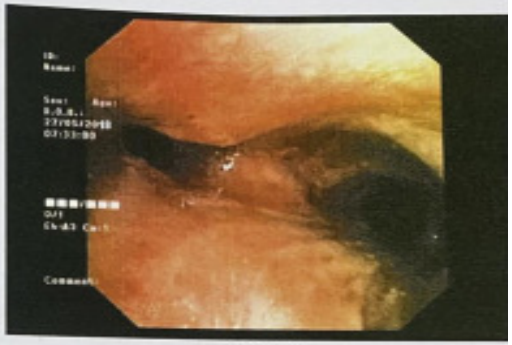
☑ Nội soi phế quản

MÔ TẢ

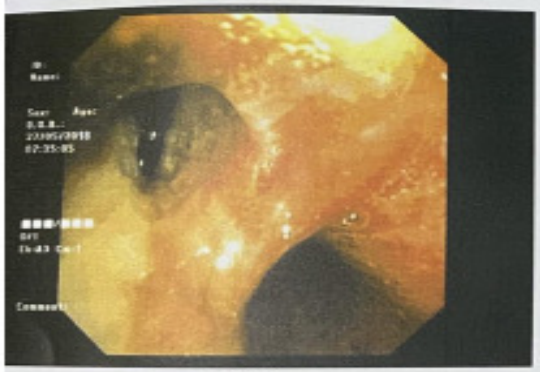
Vòm hầu:	Bình thường
Thanh quản:	Bình thường
Khí quản:	Bình thường
Cửa khí quản:	Bình thường
PHẾ QUẢN TRÁI:	
- PQ Gốc trái:	HẸP HƠN 1/2 LÒNG PQ NIÊM MẠC HỒNG TRƠN LÁNG, LÒNG ĐỌNG MỦ XANH LỢT
- PQ Thùy trên trái:	Bình thường
- PQ Thùy dưới trái:	MỦ XANH LỢT TRÀO RA TỪ LÒNG PHẾ QUẢN
PHẾ QUẢN PHẢI:	
- PQ Gốc phải:	Bình thường
- PQ Thùy trên phải :	Bình thường
- PQ Thùy dưới phải:	Bình thường
- *PQ Trung gian phải*:	Bình thường



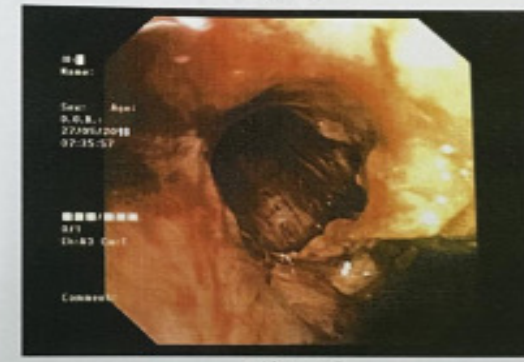
Thanh môn



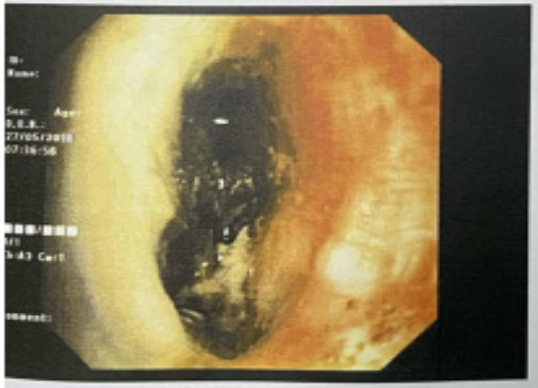
Carina



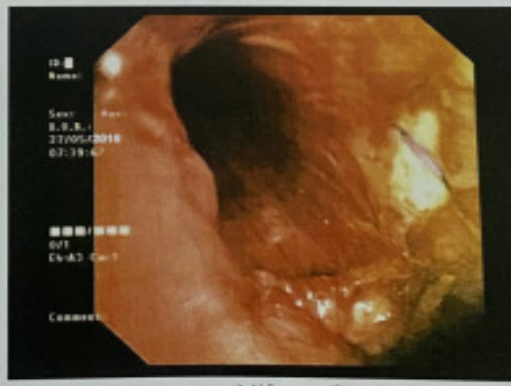
B6 (T)



Miệng nối

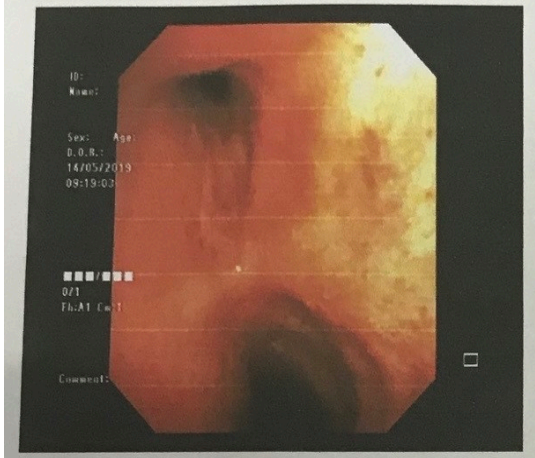


Bên trong B6



Miệng nối

Định Bệnh Trước Soi: kiểm tra sau phẫu thuật *Khoa:* PK *Giường:* 0



Mô tả: PQ gốc (T) d # 10mm, thùy dưới thoáng (thùy trên đã cắt bỏ). PQ(P) bình thường.

Kết luận: Sẹo mổ tạo hình PQ gốc (T) rộng, thoáng, d # 10mm.

Ghi chú:

Nội Soi lúc 09:23 Ngày 14/05/2019

BÁC SĨ NỘI SOI

Nguyễn Trần Phùng

CONCLUSION

Perioperative results

- Good results and There were no treatment-related deaths.
- Low Postoperative complications and only need to medical treatment.

Mid-term results

- Good surgical results with low anastomosis stenosis.
- Clinical findings and lung function improved.

Tracheobronchial reconstruction is safe, feasible and effective in post –tubertulosis patients

THANK YOU FOR YOUR ATTENTION