Inflammatory lung disease

부산대학교병원
조 정 수

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Bacterial infections of the lungs and Bronchial compressive disorder

Surgical spectrum of bacterial infection of the lung and bronchial compressive disease

Spectrum of surgical infectious disease

- Bronchiectasis
- Lung abscess
- Organizing pneumonia
- Pulmonary infection in granulomatous disease of childhood
- Tuberculosis and fungal disease
- Thoracic empyema

Bronchial compressive pulmonary disorders

- Right middle lobe syndrome
- Broncholithiasis
- Inflammatory lymphadenopathy
- Congenital processes
- Sclerosing mediastinitis
- Cardiovascular disease

Bacterial infections of the lungs and Bronchial compressive disorder

- **Bronchiectasis**
  - Abnormal permanent dilatation of subsegmental airways
  - Etiology
    - **Congenital** - Congenital cystic bronchiectasis, Selective immunoglobulin A deficiency, Primary hypogammaglobulinemia, Cystic fibrosis, α1-antitrypsin deficiency, Kartagener's syndrome, Congenital deficiency of bronchial cartilage, Bronchopulmonary sequestration
    - **Acquired** – Infection, Bronchial obstruction(Intrinsic: tumor, foreign body Extrinsic: enlarged lymph nodes), Middle lobe syndrome, Scarring secondary to tuberculosis, acquired hypogamma globulinemia

Bacterial infections of the lungs and Bronchial compressive disorder

- Classification of Bronchiectasis
  - Saccular bronchiectasis
  - Cylindrical bronchiectasis
  - Pseudobronchiectasis
  - Post-tuberculosis bronchiectasis
  - Genetic-related bronchiectasis

Bilateral saccular bronchiectasis, Characteristic of the preantibiotic era, involving the lower lobes, lingula, and RML.

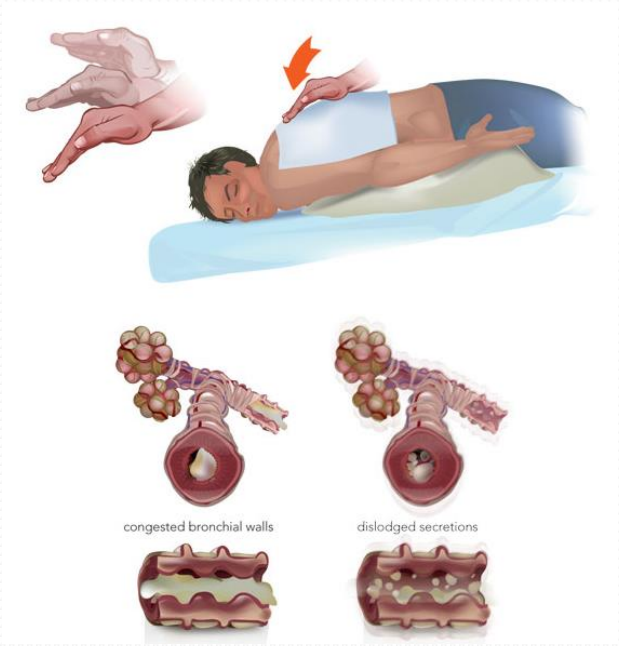
Bacterial infections of the lungs and Bronchial compressive disorder

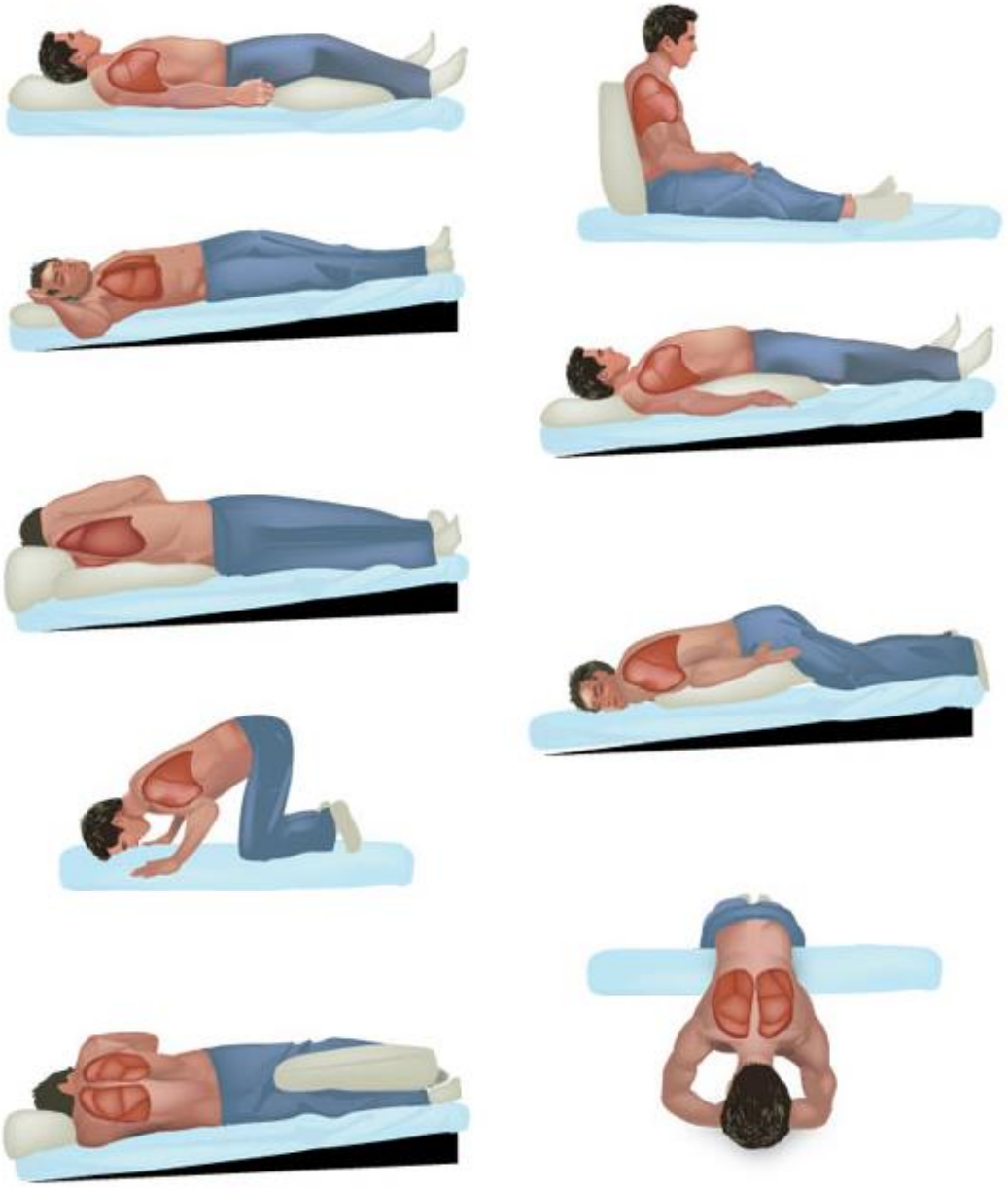
- Anatomic Distribution of Bronchiectasis in Order of Frequency
  - **Left lung** more often than right lung(9:7)
  - **Left lower lobe**, most frequently involved
  - **Right middle lobe and lingula**, next most frequently involved
  - Total left bronchiectasis, fourth most commonly involved
  - Right lower and total right are less often involved
  - Right upper lobe is involved more often than **left upper lobe**(4:1)

Bacterial infections of the lungs and Bronchial compressive disorder

- Treatment of Bronchiectasis
  - Medical
    - Prevention and control
    - Antibiotics
    - Postural drainage
  - Surgical
    - Unilateral, segmental, or lobar distribution
    - Persistent, recurrent symptoms when medication is discontinued
    - Recurrent infection and hemoptysis
  - Transplantation

Postural drainage





Bacterial infections of the lungs and Bronchial compressive disorder

- **Lung abscess**
  - Sub acute pulmonary infection in which the chest radiograph shows a cavity within the pulmonary parenchyma

- Classification of Lung abscess

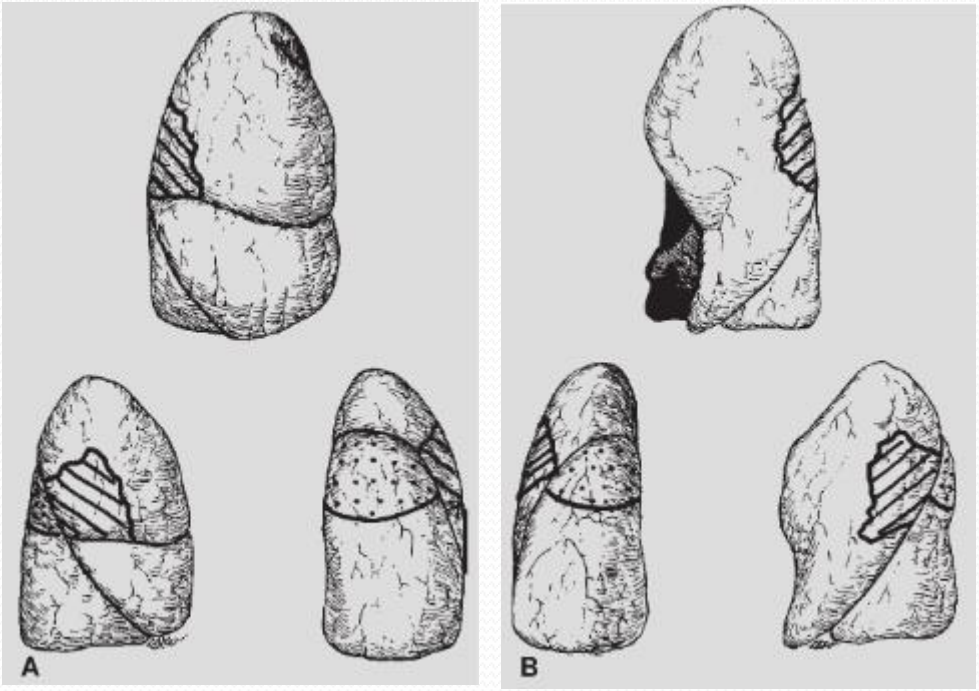
Primary lung abscess (acute or chronic)
Related to anaerobic aspiration
Related to specific pneumonia
Secondary lung abscess
With existing lung disease
Metastatic from extrathoracic source
Obstructing bronchial carcinoma
Bronchoesophageal fistula
Foreign body inhalation
Pulmonary infarction
Bullous emphysema

Bacterial infections of the lungs and Bronchial compressive disorder

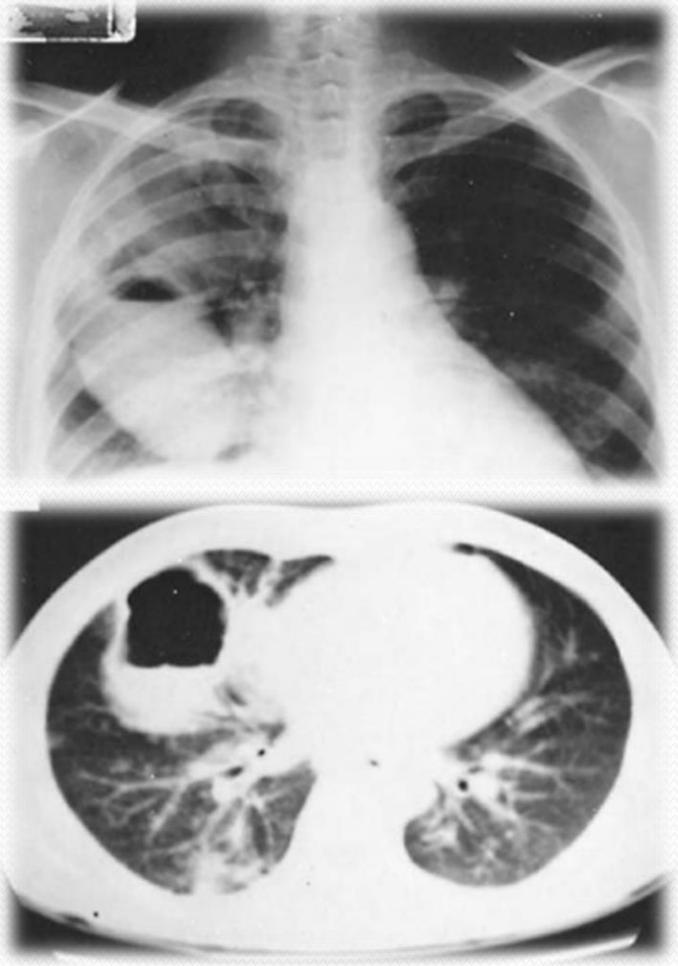
- Contributing Factors to Lung Abscess

Dental and periodontal disease
Anesthesia
Alcohol abuse
Seizure disorders
Immunosuppression
Neuromuscular disorders with bulbar dysfunction
Esophageal motor disorders
Bronchial obstruction

Lung abscess



- Axillary sub-segment of the posterior segment at the upper lobe and superior segment of the lower lobe.
  A: Right lung. B: Left lung.



A: AP view of a patient with a large aspiration abscess of the RML
B: CT examination

Differential diagnosis of cavitary lung lesions

1. Cavitating carcinoma, generally squamous cell
2. Tuberculous or other fungal diseases
3. Pyogenic lung abscess
4. Empyema with bronchopleural fistula.

- Patient's history is important.
- Absence of fever, lack of purulent sputum, and anormal white blood cell count should raise strong suspicion of an underlying neoplasm.

Bacterial infections of the lungs and Bronchial compressive disorder

- Principles of Therapy for Lung Abscess

Identification of etiologic organism

Prolonged antimicrobial therapy

Adequate drainage in acute stage

Chest physiotherapy

Bronchoscopy

Percutaneous catheter drainage

Emergency surgical treatment

Specific indication

External drainage (only in emergent situation)

Bacterial infections of the lungs and Bronchial compressive disorder

- Indications for Surgery in Lung Abscess

Acute stage (emergency)

Complications

- Bronchopleural fistula
- Empyema
- Bleeding

Chronic stage (definitive)

Persistent symptoms and signs

Recurrent complications (empyema, bronchopleural fistula)

Suspicion of carcinoma

Persistence of lung abscess larger than 6cm after 8weeks of treatment

Surgical intervention is now required in only about 10% of patients with lung abscess.

Bacterial infections of the lungs and Bronchial compressive disorder

- **Organizing pneumonia**
  - An occasional patient with pneumonitis, even with appropriate antibiotic therapy, does not follow the usual predictable course and develops an organized pneumonic process.
  - This also is seen in some patients who receive little or no therapy.
  - The course varies considerably, but the infectious process resolves into a protracted chronic course, and little or no resolution is seen on chest radiography.
  - Regardless of its cause, the area of organized pneumonia should be resected.
  - Outcome is satisfactory.

Pulmonary tuberculosis and other Mycobacterial disease of the lung

- Diagnosis of infection
  - Targeted tuberculin skin testing(TST)
  - Whole blood interferon-gamma release assays(IGRA)

- Diagnosis of active tuberculosis
  - Epidemiologic risk for infection
  - Clinical and radiographic presentation
  - Results of tuberculin skin testing
  - Results of microbiologic evaluation

Pulmonary tuberculosis and other Mycobacterial disease of the lung

Reported Sensitiviti Tuberculosis

Test
AFB smear
Culture of pleural fluid
Adenosine deaminase (>
INF gamma
Pleural biopsy AFB smear
Pleural biopsy culture
Pleural biopsy PCR
Pleural fluid PCR

Findings of Diagnostic Studies in Pleural Tuberculosis

Test	*Typical findings*[a]
Pleural fluid	
pH	7.30–7.40 (if lower, consider empyema)
Total protein	>3 g/dL
Cell count	>1,000/mm^3
Differential	>80% if subacute/chronic; PMN predominance if very early/acute
Lymphocytes	
Cholesterol	Elevated if chronic, with milky appearance to fluid
Glucose	60–100 mg/dL (if lower, consider TB empyema)
LDH	>500 IU/L
Sputum AFB	More likely positive if parenchymal disease is present. However, up to 55% of patients with isolated pleural TB (otherwise clear CXR) may have positive induced sputum cultures.[b]
PPD	Up to one-third initially false negative, but on repeat testing 2 months after diagnosis, almost all have positive PPD[c]

Pulmonary tuberculosis and other Mycobacterial disease of the lung

- Principles of therapy for active pulmonary tuberculosis
  - Use **multiple drugs** to which the organism is susceptible
  - Choice of initial therapy should be guided by local resistance patterns and modified by in vitro drug susceptibility tests when available
  - Drug therapy should be for a **sufficiently long period** of time (in most cases at least 6months) to provide durable cure of disease
  - Always **add more than one** drug to which the organism is believed sensitive to a potentially failing regimen
  - Use **directly observed therapy** whenever possible to reduce the chances for nonadherence
  - Promptly report each case to the local public health department

Pulmonary tuberculosis and other Mycobacterial disease of the lung

- Recommended regimens (1st line agents)

Regimen	Drugs	Initiation phase(doses)	Drugs	Continuation phase(doses)
1	I,R,P,E	$8(I_7P_7E_7R_7)$	I,R	$18(I_7R_7)$
		$8(I_5P_5E_5R_5)$		$18(I_5R_5)$
				$18(I_3R_3)$
2	I,R,P,E	$2(I_7R_7P_7E_7)$ then $6(I_2R_2P_2E_2)$	I,R	$18(I_2R_2P_2E_2)$
3	I,R,P,E	$8(I_3P_3R_3E_3)$	I,R	$18(I_3R_3)$
4	I,R,E	$8(I_7R_7E_7)$	I,R	$28(I_7R_7)$
		$8(I_5R_5E_5)$		$28(I_5R_5)$

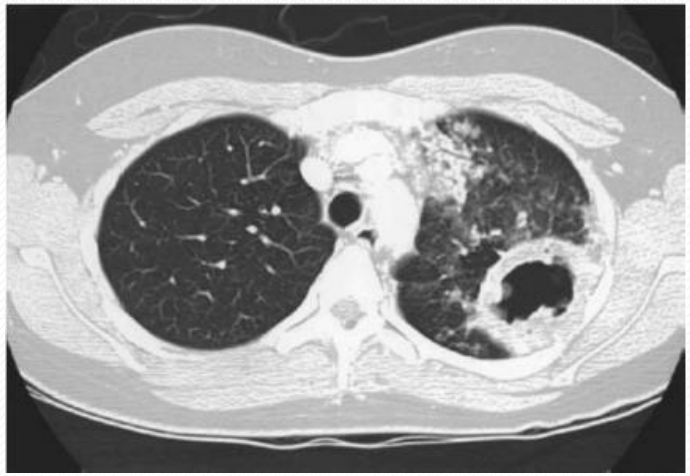
2HERZ/4HER(or 7HER)

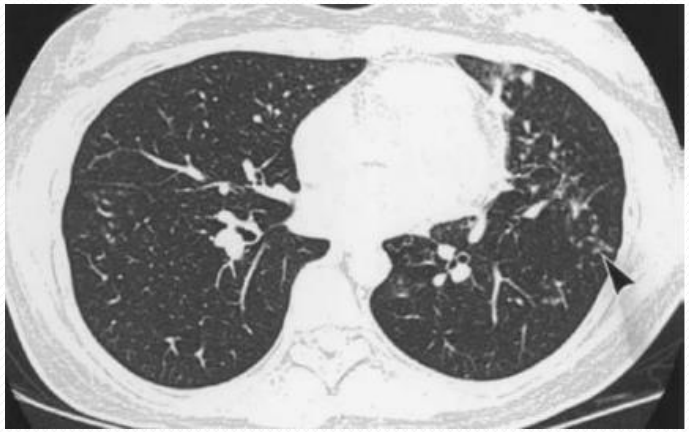
Pulmonary tuberculosis and other Mycobacterial disease of the lung

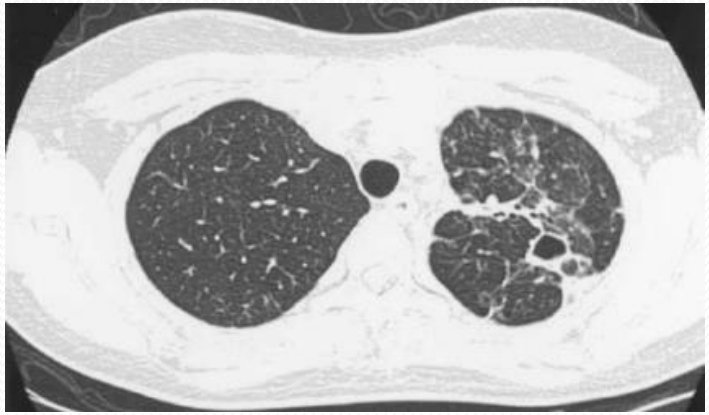
- Definition of multidrug-resistant(MDR) TB
  - Resistance to at least **isoniazid** and **rifampin**
  - Recommended regimens for MDR (2nd line agents)
    - **p-Aminosalicylicacid** (8–12g)
    - **Ethionamide** (15–20mg/kg)
    - **Cycloserine** (10–15mg/kg)
    - **Ofloxacin,** levofloxacin (400mg), Moxifloxacin (400mg)
    - Capreomycin (15–20mL/kg), **Streptomycin,** Kanamycin (15–30mg/kg)
    - Thiacetazone (150mg)
- Definition of extensively drug resistant(XDR) TB
  - MDR strains resistant to any fluoroquinolone and to at least one second-line injectable drug(amikacin, capreomycin, or kanamycin)

Pulmonary tuberculosis and other Mycobacterial disease of the lung

- Radiographic imaging







After 7 months of multiple-drug chemotherapy

Surgical role in the treatment of patients with TB

- Another treatment option for **MDR or XDR TB** that is anatomically localized, particularly in the face of limited medical therapy options, is **resectional surgery**
  - However, **no randomized studies** looking at the role of surgery in MDR TB.
  - Retrospective cohort studies have demonstrated success, both within developed and resource-poor countries.
  - If surgery is considered for a patient with MDR TB, it should ideally be performed only **after several months of chemotherapy** and should be followed by up to 18 months of chemotherapy

Surgical role in the treatment of patients with TB

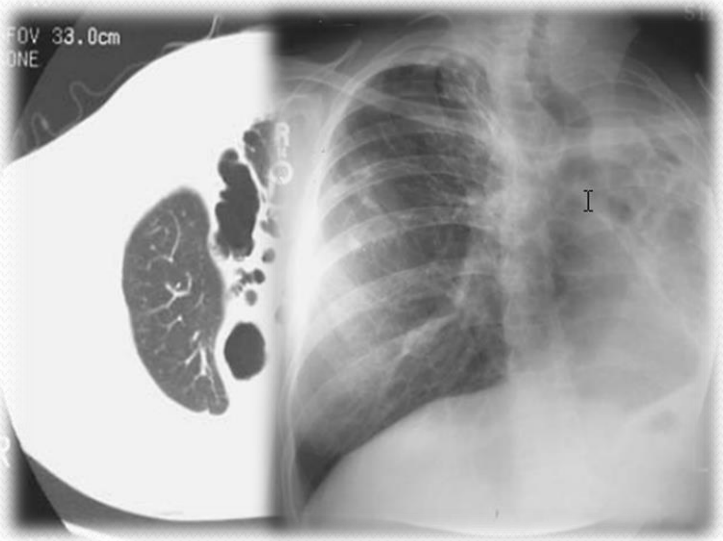
Indications for Surgery in Drug-Resistant Tuberculosis[a]

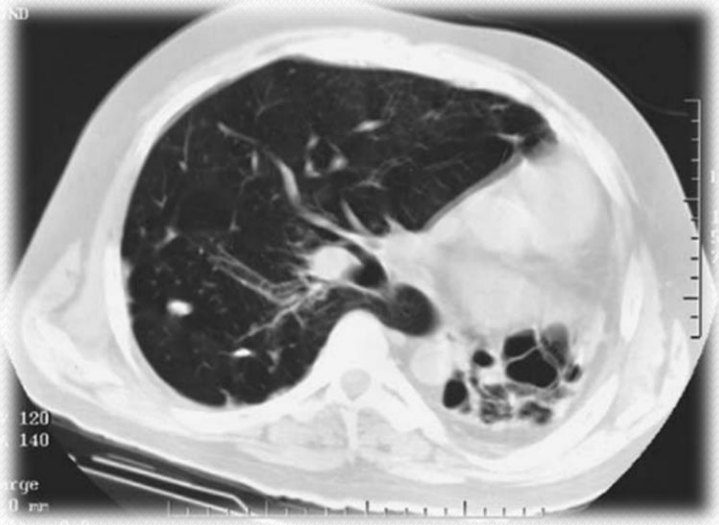
- Persistently positive AFB smear or sputum culture despite aggressive chemotherapy [65,66]
- High risk of relapse (based on drug resistance profile and radiological findings)[65,66]
- Localized lesion [65,66]
- Complications of tuberculosis including bronchiectasis, empyema, hemoptysis[65]
- Sufficient drug treatment available (to reduce bacterial burden and allow healing of bronchial stump

Grand Round Calling the Surgeon: The Role of Surgery in the Treatment of Drug-Resistant Tuberculosis ***Lancet Infect Dis. 2012 February ; 12(2): 157–166.***

Surgical role in the treatment of patients with TB

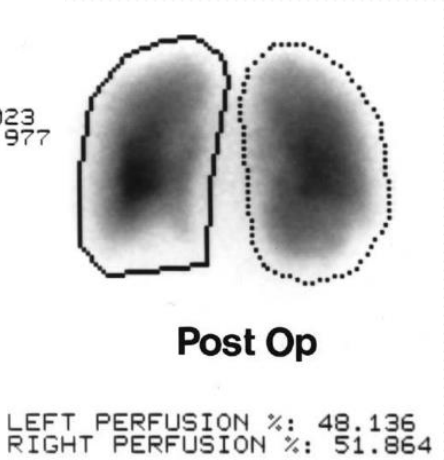
- Surgery plays a role in the treatment of patients with TB.
  - Patients with lungs destroyed by MDR(XDR) TB or cavitary disease with or without positive sputum smears.





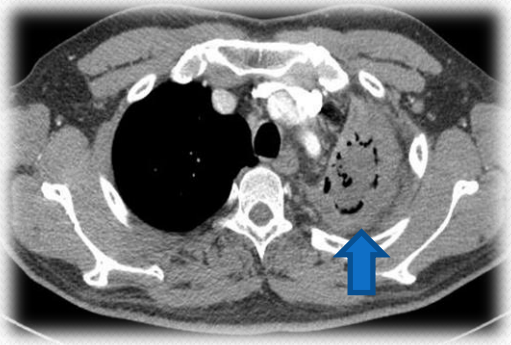
Surgical role in the treatment of patients with TB

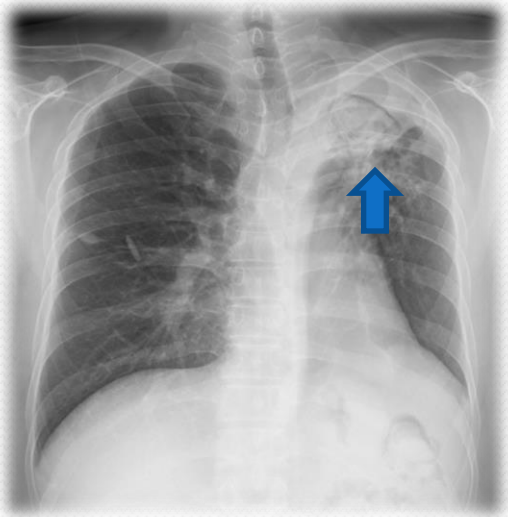
- Decortication alone for management of a trapped lung is sometimes indicated.



Surgical role in the treatment of patients with TB

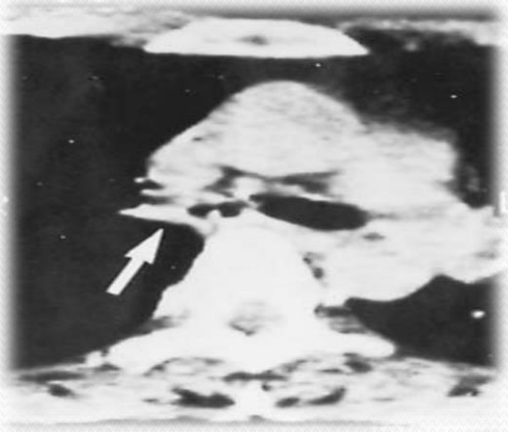
- Mycotic infection and life-threatening hemoptysis in patients with tuberculosis





- Tuberculous bronchial stricture

cough and exertional dyspnea



Bronchial stricture due to endobronchial tuberculosis

Environmental Mycobacterial infection (Nontuberculous Mycobacteria, NTM) of the lung

- Environmental mycobacteria (EM) are found free in water and soil.
- EM infections seem to be increasing in absolute numbers as well as in recognition as a major cause of pulmonary disease.
- Most frequently, EM infects patients with previously diseased lungs, and the infection has a more indolent course than in patients infected with M. tuberculosis.
- Lung damage due to previous TB, bronchiectasis, and chest irradiation is found in many patients with EM infections..
- EM infections, unlike TB, are not transmitted from person to person

Environmental Mycobacterial infection (Nontuberculous Mycobacteria, NTM) of the lung

- The most common EM infection is caused by the M. avium complex(MAC, M. avium and M. intracellulare).
- MAC is widespread and infection usually advances slowly
- Slow growing EM infections are caused by M. kansasii, M. xenopi, M. malmoense, and M. simiae.
- Rapid growing EM producing significant lung pathology includes M. abscessus and M.chelonae
- Patients infected with rapid growers are more difficult to treat because of poor bacteriocidal antibiotic effectiveness against these organisms.

Environmental Mycobacterial infection (Nontuberculous Mycobacteria, NTM) of the lung

Sheilds 7th chapter 83

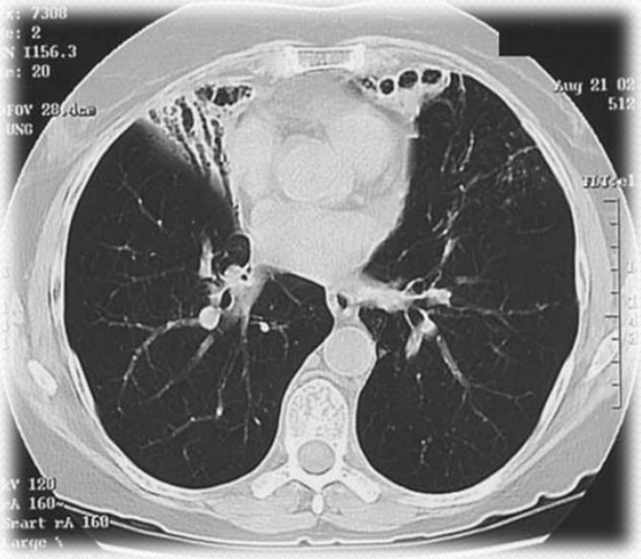
Diagnostic Criteria for Pulmonary Disease Involving Nontuberculous Mycobacteria (NTM)[a,c]

Clinical	*Microbiologic*
Pulmonary symptoms consistent with NTM Nodular or cavitary opacities on chest radiograph **AND/OR** HRCT with multifocal bronchiectasis with multiple small nodules **AND** Exclusion of other diagnoses	Positive culture from at least two separate sputum samples[b,d] **OR** Positive culture (≥1) from at least one bronchial wash or lavage[b] **OR** Transbronchial or other biopsy with granulomatous inflammation or AFB Positive culture (≥1) for NTM by sputum or bronchial wash or lavage[b]

[a]Patients suspected of having NTM pulmonary disease who do not meet the above criteria should be followed until the diagnosis is excluded or firmly established.
[b]Expert consultation should be sought with identification of infrequently encountered or suspected environmental contamination.
[c]The treatment of NTM pulmonary disease should be based on the risks and benefits of therapy.
[d]Sputum should be collected from three early morning samples before more invasive methods.
Source: Adapted from Diagnosis, treatment, and prevention of nontuberculous mycobacterial diseases. An official statement of the ATS/IDSA. *Am J Respir Crit Care Med* 2007;175:367–416. With permission.

Environmental Mycobacterial infection (Nontuberculous Mycobacteria, NTM) of the lung

- The medical treatment of EM infections, as with TB, is a multi-drug regimen based on specific culture data. Resistance and intolerance to antimycobacterial drugs are high.
- EM infections to involve the lingula, middle lobe, or both of slender older women.



Environmental Mycobacterial infection (Nontuberculous Mycobacteria, NTM) of the lung

- Surgical intervention for
  patients with MDR TB.
- After appropriate antibio
  destroyed lung, extensiv
  middle lobe or lingula.

Table 1 Indications for
statement)

A poor response to drug
The development of mac
The presence of signific hemoptysis

Table 2 Indications for NTM lung disease surgery (JST guidelines)

(1) When sources of bacterial discharge or major lesions being sources of bacterial discharge are clearly noted and, in addition, one of the following disease conditions is observed

a. Chemotherapy has failed to stop bacterial discharge

b. Bacteriological relapse is noted

c. Radiographically enlarged lesions or tendencies of lesion enlargement are either revealed or predicted

d. Even though bacterial discharge has been stopped, cavitary lesions or bronchiectatic lesions remain, suggesting that relapse or reactivation may occur

e. Acute exacerbation has repeatedly occurred due to lesions that are sources of massive bacterial discharge, leading to the rapid progression of disease

(2) In patients with hemoptysis, repeated airway infection or comorbid aspergillosis, responsible lesions are subject to resection irrespective of the status of bacterial discharge

Mycotic and Actinomycotic infections of the lung

- Mycotic infection
  - Fungal infections of the lungs have traditionally represented a very small component of the practice of most thoracic surgeons.
  - Most fungal pathogens are opportunistic, causing clinically significant infection only in the presence of **impaired host defenses**.
    - Histoplasmosis, Blastomycosis, Coccidioidomycosis, Aspergillosis, **Aspergilloma**,
    - Zycomycosis, Cryptococcosis, Candidiasis
- Actinomycotic infection
  - Actinomycosis is caused by the facultative an aerobic bacterium Actinomyces.
  - The pulmonary form is rare, making up 15% of reported disease and usually occurring as a secondary infection of a previously existing cavity or bronchiectasis.

Surgical outcome of inflammatory lung diseases

- Thoracoscpoic Lobectomy and Segmentectomy for Infectous Lung Disease. *Ann Thorac Surg 2012;93:1033– 40*

Table 2. Microbiology in 171 Patients With Chronic Bronchiectasis or Cavitary Lung Di

Organism
Mycobacterium avium complex (MAC)
Mycobacterium abscessus
Mycobacterium fortuitum
Mycobacterium simiae
Mycobacterium kansasii
Pseudomonas aeruginosa
Aspergillus/Scedosporium
Haemophilus influenzae
MRSA

MRSA = methicillin-resistant *Staphylococcus aureus*.

Table 4. Morbidity and Mortality After Thoracoscopic Lobectomy or Segmentectomy

Complication	n	%
Operative mortality	0	(0%)
Operative morbidity	19	(8.9%)
Prolonged air leak	12	(5.6%)
Atrial fibrillation	3	(1.4%)
Bronchial injury	1	(0.5%)
Pneumonia	1	(0.5%)
Wound infection	1	(0.5%)
Atelectasis	1	(0.5%)
Pleural effusion	1	(0.5%)

- Results of Surgical Resection for Bronchiectasis

Author	Patients	Mortality(%)	Morbidity(%)
Sealy,etal.(1966)	140	1.4	3
Sanderson,etal.(1974)	242	0.4	33
Annest,etal.(1982)	24	8.3	13
Dogan(1989)	487	3.5	11

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Author	Patients	Mortality(%)	Morbidity(%)
Kutlay H. et al (2002)	166	1.7	10.5
Eren S. et al (2007)	143	1.3	23.0
Zhang P, et al.(2010)	790	1.1	16.2
Caylak H. et al (2012)	339	0.6	12.7

Various articles

Results of Surgical Resection for drug resistant pulmonary tuberculosis

Case studies of drug resistant pulmonary tuberculosis patients undergoing surgical resection along with medical treatment

Author	Country	Years	Cohort size	Age[a]	MDR/ XDR	Perioperative Complication/ Mortality rate	Post op Treatment Duration (months)[b]	Postoperative culture negative rate (%)	Favorable Outcome Rate
Kang 2010[38]	Korea	1996–2008	72	31	46/26	15%/1.4%	- (18–24)	78%	90%[c]
Shiraishi 2009[39]	Japan	2000–2007	56	46	56/0	16%/0	18 (8–84)	100%	95%[d]
Dravniece 2009[54]	Latvia	1999–2005	17	42	0/17	18%/0	14.5 (7–28)	47%	47%[c]
Park 2009[40]	Korea	1998–2004	19	31	17/2	0/0	12 -	95%	79%[d]
Orki 2009[56]	Turkey	1997–2005	55	34	55/-[e]	29%/1.8%	24 -	95%	95%[d]
Wang 2008[41]	China	1995–2006	56	39	56/-[e]	25%/0	12 (6–18)	91%	75%[d]
Shiraishi 2008[42]	Japan	2000–2006	5	44	0/5	0/0	19 -	100%	100%[d]
Mohsen 2007[61]	Egypt	1995–2005	23	24	23/-[e]	35%/4.3%	- (18–24)	100%	91%[d]
Naidoo 2007[62]	South Africa	1997–2005	27	34	27/-[e]	26%/ 0	18 -	93%	93%[d]
Kir 2006[57]	Turkey	1993–2005	79	38	79/-[e]	39%/2.5%	-	96%	95%[c]
Kim 2006[43]	Korea	1993–2004	79	29	61/18	23%/1.2%	18 (9–48)	72%	72%[c]
Somocurcio 2006[60]	Peru	1999–2004	121	27	121/-	23%/5%	≥12 -	78%	63%[d]
Takeda 2005[44]	Japan	1998–2003	26	48	26/-[e]	23%/3.8%	- (18–24)	92%	89%[d]
Park 2002[45]	Korea	1995–1999	49	35	49/-	16%/0	18–24 -	94%	90%[d]
Chiang 2001[46]	Taiwan	1990–1999	27	44	26/1	11%/4%	15 (8–24)	92%	89%[d]
Pomerantz 2001[51]	USA	1983–2000	172	39	172/-[e]	12%/3.3%	24 -	98%	>90%[d]
Vanleuven 1997[63]	South Africa	1990–1995	62	34	62/-[e]	23%/1.6%	9 (0–26)	89%	80%[d]
Treasure 1995[52]	USA	1986–1993	19	39	19/-[e]	21%/0	-	89%	89%[d]

Grand Round Calling the Surgeon: The Role of Surgery in the Treatment of Drug-Resistant Tuberculosis ***Lancet Infect Dis. 2012 February ; 12(2): 157–166.***

- Results of Surgical Resection for pulmonary NTM

Table 2 Outcome of surgical treatment for pulmonary NTM disease in previous reports

Publication author, year, reference	Patients *n*	Predominant species	Sputum culture conversion rate %	Long-term relapse rate %
Corpe et al. 1981[12]	124	*M. avium* complex	93	5
Moran et al. 1983[13]	37	*M. intracellulare*	94	5
Pomerantz et al. 1991[14]	38	*M. avium* complex*	84	0
Ono et al. 1997[15]	8	*M. avium* complex	100	13
Shiraishi et al. 1998[16]	33	*M. avium* complex	94	6
Nelson et al. 1998[17]	28	*M. avium* complex	90	4
Lang-Lazdunski et al. 2001[18]	18	*M. xenopi*	89	0
Shiraishi et al. 2002[19]	21	*M. avium* complex	100	10
Shiraishi et al. 2004[20]	11	*M. avium* complex*	100	9
Sherwood et al. 2005[21]	26	*M. avium* complex*	82	0
Watanabe et al. 2006[22]	22	*M. avium* complex	100	5
Mitchell et al. 2008[7]	236	*M. avium* complex*	100	0

Surgical treatment of non-tuberculous mycobacterial lung disease: strike in time ***INT J TUBERC LUNG DIS 2010, 14(1):99–105***

- Results of Surgical Resection for pulmonary Aspergilloma

Variable	Results			
	Simple (n = 13)	Complex (n = 47)	*p* Value	All (n = 60)
Postoperative complications, n (%)	3 (23.1)	15 (31.9)	0.736	18 (30.0)
Prolonged air leak	1 (7.7)	8 (17.0)	0.668	9 (15.0)
Prolonged ventilation (>48 h)	0 (0)	5 (10.6)	0.575	5 (8.3)
Pneumothorax	1 (7.7)	3 (6.4)	1.000	4 (6.7)
BPF	0 (0)	4 (8.5)	0.568	4 (6.7)
Pneumonia	1 (7.7)	2 (4.3)	0.526	3 (5.0)
Empyema without BPF	0 (0)	2 (4.3)	1.000	2 (3.3)
Ventricular arrhythmia/arrest	0 (0)	2 (4.3)	1.000	2 (3.3)
Reintubation	0 (0)	1 (2.1)	1.000	1 (1.7)
Mortality (30 d), n (%)	0 (0)	2 (4.3)	1.000	2 (3.3)

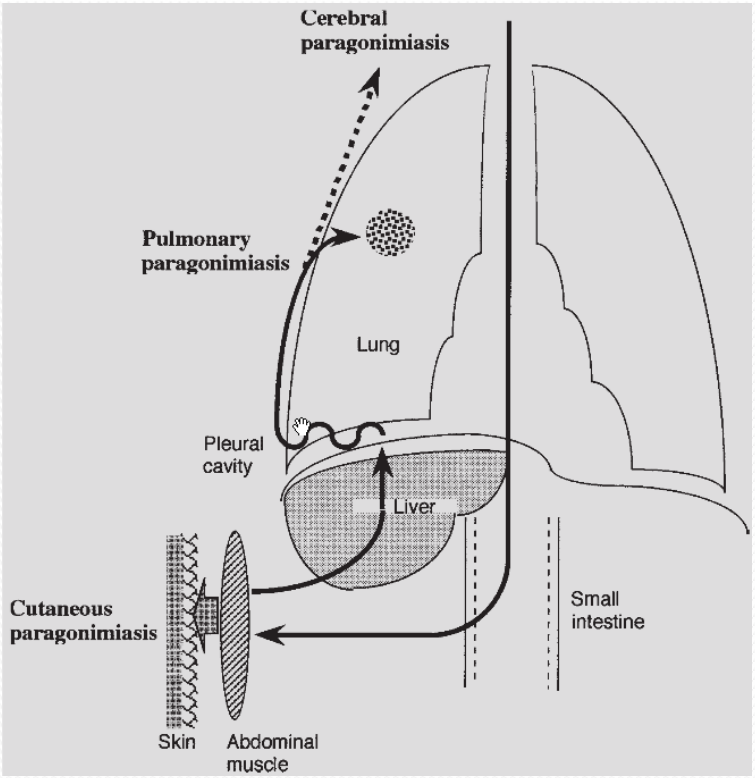
Surgical Therapy of Pulmonary Aspergillomas: A 30-Year North American Experience
Ann Thorac Surg 2014;97:432–8

Pulmonary paragonimiasis

- Paragonimiasis is a subacute to chronic inflammatory disease of the lung caused by lung flukes of the genus *Paragonimus*

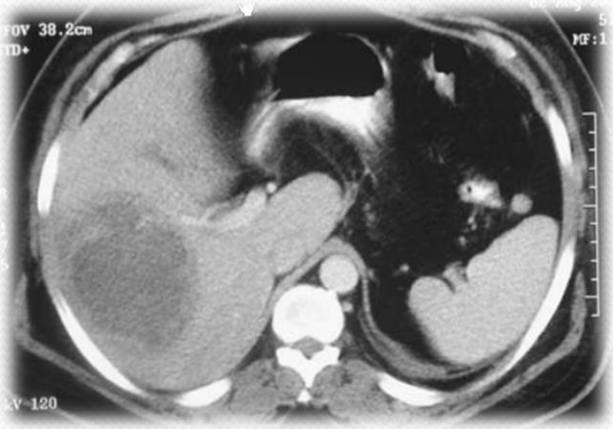
Migration route of Paragonimus in humans.
Paragonimiasis patients express various symptoms depending on the location of the worms.

Paragonimus Westermani egg isolated by bronchial brushing



Pleuropulmonary Amebiasis

- Pleuropulmonary amebiasis is almost invariably the result of perforation of an amebic liver abscess through the diaphragm.
- It accounts for 10% of all deaths from amebiasis.
- To understand its management, the nature of amebiasis and of the liver abscess it produces must be understood.



Hydatid disease of the lung

- Hydatid disease is caused by the *Echinococcus granulosus* tapeworm and is known as *echinococcosis* or *hydatidosis*.
- *Echinococcosis* remains a significant health problem in endemic areas.

Thank you for your attention!!