



# **Surgery in Tuberculosis**



# Introduction

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- There is still a lot of tuberculosis around.
- Now we have ATT, DOTS, DOTS plus . . .



**What if it doesn't work?**



**Role of Surgery**

**So, what are the surgical options  
for tuberculosis for a patient?**

# Surgical Options

## Resectional Therapy:

### *“Remove it”*

#### ■ Pulmonary

- Wedge
- Segment/lobe
- Lung +/- pleura
- Sleeve
- Cavernostomy

#### ■ Pleural

- Decortication
- Drainage
  - Open
  - Closed

## Collapse Therapy:

### *“Shut it”*

- Artificial Pneumothorax
- Plombage
- Thoracoplasty
- Pneumonolysis
- Pneumoperitoneum
- Phrenic nerve paralysis

## Other

- Myoplasty
- VATS

# Introduction...

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- TB has affected mankind since time immemorial
- Surgery only therapeutic option till the middle of 20<sup>th</sup> Century
- MDR and HIV pandemic have brought about a renewed interest in surgery

# CAVERNOSTOMY ERA

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- Method of leaving open large tubercular cavities through chest wall
- 18<sup>th</sup> century and first half of 19<sup>th</sup> century
- Earliest mention in 1726
- In 1938 revived by Monaldi
- Crude procedure and invariably caused tubercular bronchopleuro cutaneous fistula that drained indefinitely

# BED REST THERAPY

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- First successful therapy widely used in T/t of TB
- Principle was to ↓FRC and thus ↓ the static tension on the walls of tubercular cavities allowing them to collapse
- Introduced in 1880 by Dettweiler in Germany and Turban in Switzerland and in 1900 in USA by E. L. Trudeau
- Abandoned because of poor response and a high relapse rate.

# COLLAPSE THERAPY ERA

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- Evolved concurrently with the bed rest therapy
- Used in 70% of sanatorium patients
- Purpose was relaxation of diseased lung so as to provide the scar tissue produced by natural healing process a better chance to contract.



# ARTIFICIAL PNEUMOTHORAX

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- In 1892 Forlanini first to introduce nitrogen in pleural space
- In 1898. Murphy of Chicago used the technique on a wide scale
- 1<sup>st</sup> half of 2<sup>nd</sup> Century used as an adjunct to bed rest
- Pneumothorax relaxed the lung producing contraction of scar tissue and approximation of cavity walls

# Artificial Pneumothorax(cont...)

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- Procedure had to be repeated till results were satisfactory
- PT could be maintained in only 25%.
- Empyema developed in 20%.
- 1/5<sup>th</sup> of patients were dead after 10 to 20 years.
- Abandoned to give way to better procedures

# PNEUMOLYSIS

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- Artificial Pneumothorax was ineffective in presence of adhesions
- Pneumolysis to break the adhesions was of 2 types intra and extrapleural
- Intrapleural: Jacobeus used a modified Cystoscope as a Thoracoscope and divided the lesions using cautery (applicable to thin adhesions only)

# Extrapleural Pneumolysis or Plombage

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- In 1900's Tuffrel created an extrapleural space which he filled with air (extrapleural pneumothorax) and later by Plomb (Paraffin, Lucite balls, gauze and oil)
- Problem of migration and infection
- Sloughing of cavity walls occurred as the blood supply was compromised resulting in BPF and Empyema.
- Renewed interest in Extrapleural Pneumothorax as Air was used as Plombage and peripheral cavities were excluded

# Pneumoperitoneum and Phrenic Nerve Paralysis

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- Both caused the diaphragm to elevate and compress the lung producing some effect on apical cavities
- ↓ in FRC just like bed rest
- Extensively used in 1930s
- Phrenic nerve paralysis caused mediastinal flutter that interfered with ventilation and fell into disuse.

# Subcostal and Extraperiosteal Plombage

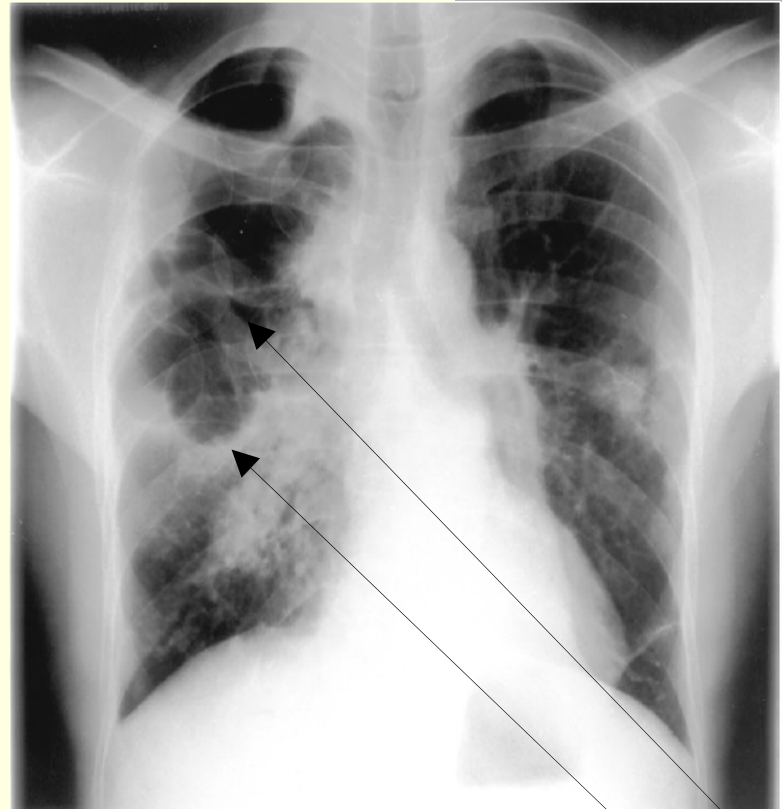
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- Some groups dissected the periosteum from the ribs and placed plastic balls in the pocket so formed.
- Compressed the underlying lung
- Avoided paradoxical motion of the chest wall

# Subcostal/ Extraperiosteal Plombage – the procedure



**PRE OPERATIVE**



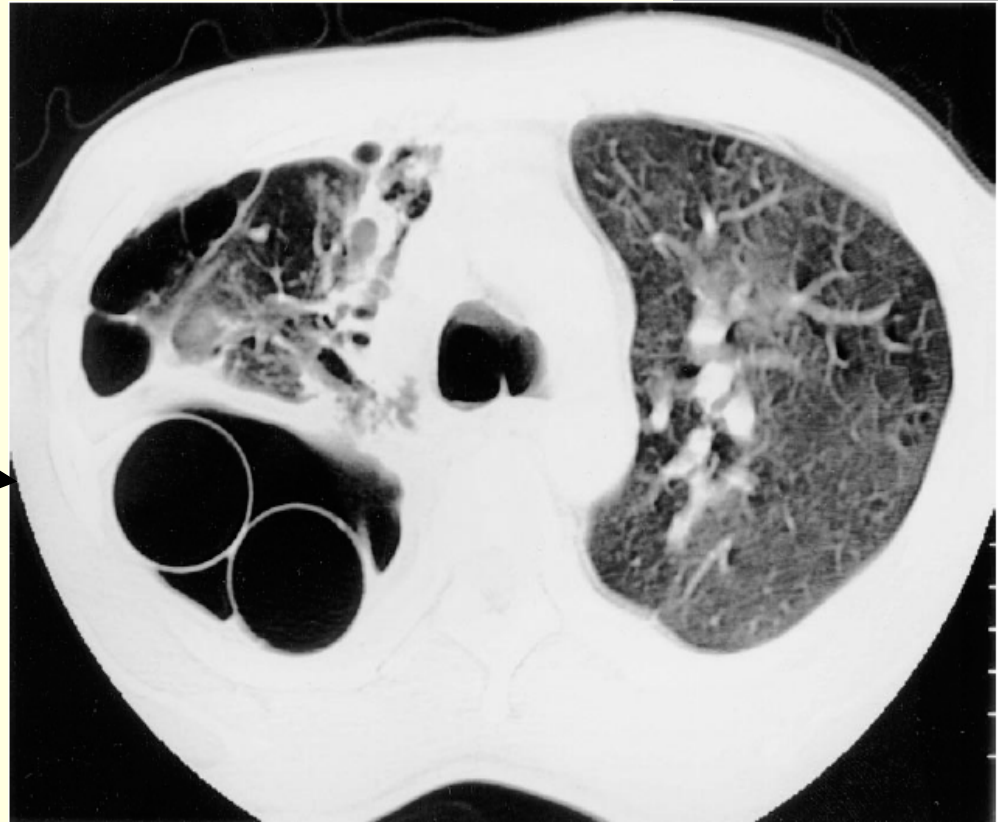
**POST OPERATIVE**

balls

**Jouvesshomme S et al.** Preliminary results of collapse therapy with plombage for pulmonary disease caused by multi drug resistant mycobacteria. **Am J Respir Crit Care Med** 1998; 157: 1609-1615.

# Subcostal/ Extraperiosteal Plombage – the procedure

Lucite Balls



**POST OPERATIVE**

**Jouvesshomme S et al.** Preliminary results of collapse therapy with plombage for pulmonary disease caused by multi drug resistant mycobacteria. **Am J Respir Crit Care Med** 1998; 157: 1609-1615.



# THORACOPLASTY

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- In 1885 Cerneville removed anterior portions of 2<sup>nd</sup> and 3<sup>rd</sup> ribs to collapse cavities
- Procedure was not sufficiently extensive
- In 1967 Brauer advocated extensive 2<sup>nd</sup> to 9<sup>th</sup> rib resections to collapse diseased lung
- High mortality (30%) and pendulum respiration were associated with this procedure.

# THORACOPLASTY (cont...)

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- In 1935, Alexander the father of thoracoplasty in USAS perfected the technique of Staged Posterior Lateral Thoracoplasty
- Operative mortality was only 2%
- Cavity closure and sputum conversion was achieved in 80%

# THE MODERN ERA

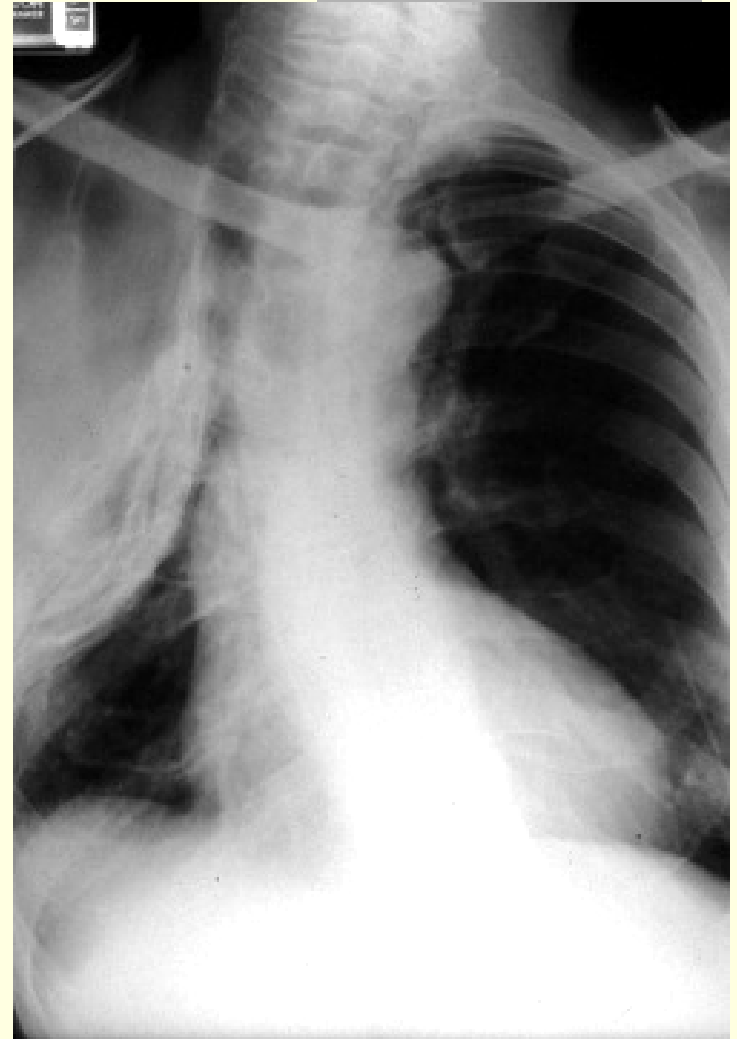
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- Started 1950's onwards
- Resections were the main operations during this era
- Resection of localized Tb in conjunction with
- Streptomycin produced excellent results
- By mid 1960's infections were treated satisfactorily with anti tubercular drugs surge became infrequent
- Recent increase in HIV, atypical Tb and drug resistance has resulted in resurgence in the number of operations being performed

# THORACOPLASTY

## THE PROCEDURE

1. Chest deformity
2. Scoliosis → physical therapy
3. Cavity closure and sputum negative in 80 – 90 % <sup>1</sup>



# Current Indications for Surgery in Pleuropulmonary TB

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- TO PROCURE TISSUE MATERIAL for confirmation of diagnosis
- MDR TB
- Complications of TB
  - Hemorrhage
  - BPF
  - Empyema
  - Bronchiectasis
  - Tracheal or bronchial stenosis
  - Broncholiths
  - Pulmonary aspergilloma

# DIAGNOSTIC INDICATIONS

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- Diagnosis of an SPN suspected to be due to TB
- Open thoracotomy or VATS may be used
- VATS can be used for pulmonary mediastinal or pleural sampling and can alleviate the need for open thoracotomy \*

\* *Kumar A et al. IJCD 1999; 41:5-13.*

# PREREQUISITES

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- Reasonably localized and amenable to surgical restriction
- Pt. should have adequate C-P reserve
- V/Q scan to confirm physiologic inertness of region to be resected
- Ideal is to give ATT to achieve sputum negativity or reduce bacterial load to minimum possible
- Preop bronchoscopy to exclude endobronchial disease

# Surgery for MDR TB

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- Resistance to R, H and other first line drugs as S, Z and E increase the likelihood of failure of medical therapy
- If the disease is localized and pt. has adequate CP reserve operation should be considered
- 3 months of intensive chemotherapy with drugs to which organism is susceptible to precede surgery
- ATT to continue for long periods (>1 yr.) after surge to prevent recrudescence of the disease.



# Surgery for MDR TB (cont...)

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- A series of 42 MDR patients received an avg. of 5.8 drugs preoperatively\*
- 29/42 were sp+ before and 3/42 after the surgery
- Overall mortality was 14<sup>0</sup> as compared to 22<sup>0</sup> in the medical group
- Only 1 case of *Mycobacterium tuberculosis* developed a BPF
- More liberal use of muscle flaps to reinforce bronchial stumps lowers the rate of BPF, empyema air leaks or residual space problems

\* Pomerantz M et al. *Ann Thoracic Surg* 1991; 52: 1108-1112.

# Bronchopleural Fistual and Empyema

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- BPF can be spontaneous or follow pulmonary resections
- Post resection BPF incidence is 2-3<sup>0</sup> and spontaneous BPF forms 27<sup>0</sup> of all tubercular BPF's.
- ICD – ATT suction form the primary modality of treatment
- If fails, open window thoracostomy can be done

# BRONCHOPLEURAL FISTULA

(cont...)

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- Post resection fistulae can be closed with ICD in only 20% of the cases
- Failure of these procedures, require a thoracotomy and decortication or a thoracoplasty
- If the underlying lung is incapable of expansion, lobectomy or extrapleural pneumonectomy (for destroyed lung) may be required.
- Suture ligation and use of pedicle muscle flaps have been recommended to fill the cavity and buttress the suture site
- Myoplasty can obviate the need for thoracoplasty and achieve a high closure rate

# HEMOPTYSIS

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- Moderate hemoptysis can be controlled with sedation bed rest and ATT
- Bronchoscopy to localize the site of bleed and cause of bleeding
- In massive hemoptysis, maintain the airway optimize oxygenation and stabilize the hemodynamic status
- Place bleeding lung in dependent position.

# HEMOPTYSIS (cont...)

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- Topical therapy with fibrin, thrombin, epinephrine endobronchial tamponade or double lumen intubation can be tried
- Arteriography and embolization should be used emergently for those who continue to bleed despite endobronchial therapy
- Surgery is the definite form of therapy when lesion has been localized, embolization is not available or has failed

# ASPERGILLOMA

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- Expectant attitude for uncomplicated asymptomatic aspergilloma.
- In symptomatics\* having hemoptysis (small, recurrent or massive and those with prior embolization which has a high recurrence rate). Chronic cough. Low grade fever, resection should be done
- In high risk patients cavernostomy can be done.

\* *Regnard Jf etal. Ann Thoracic Surgery 2000; 69: 898.*

# ASPERGILLOMA (cont...)

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- Medical treatment in form of intracavitary fungal agents intravenous or oral itraconazole have not shown any consistent benefit with regard to alleviation of symptoms of prevention of hemoptysis

# Bronchostenosis and bronchiectasis

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- In case of minimal parenchymal damage repeat dilation has been successful.
- Balloon dilatation for short structures
- Self expanding metallic stents have been tried
- Combination of dilatation with Co<sub>2</sub> laser
- Sleeve resection with end to end anastomosis



# Bronchostenosis and Bronchiectasis (cont...)

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- For extensive bronchiectasis secondary to bronchostenosis resection of diseased segment is indicated

# PREOP MANAGEMENT

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- Correct Anemia
- Correct Electrolyte Fluid Disorder
- Correct Infection and Arrhythmias
- Improve Nutrition
- Stop Smoking
- Appropriate Chest Therapy

# PATIENT SELECTION

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- Contraindications
  - Non ambulatory status
  - MI in last 3 months
  - FEV<sub>1</sub> less than 0.6 lts
- For pneumonectomy
  - MVV more than 55%
  - FEV<sub>1</sub> more than 2 lts
  - FEV<sub>25-75</sub> more than 1.6lts.

# PATIENT SELECTION (cont...)

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- Lobectomy
- $MVV > 40\%$
- $FEV_1 > 1\text{lt}$
- $FEV_{25-75} > 0.6\text{ Lt.}$
- Segmentectomy
- $MVV > 35\%$
- $FEV_1 < 1\text{lt.}$
- $FEV_{25-75} > 0.6\text{lt.}$

# General Principles: Post-operative complications

## Sputum retention <sup>1</sup>

- The most common problem post resection

### Anticipate in

- Extensive surgery
- Limited pulmonary reserve, phrenic nerve/recurrent laryngeal nerve resection

### Leads to

→ mechanical ventilation !!

- Retention pneumonia
- Hypoxemia, arrhythmias

### Management

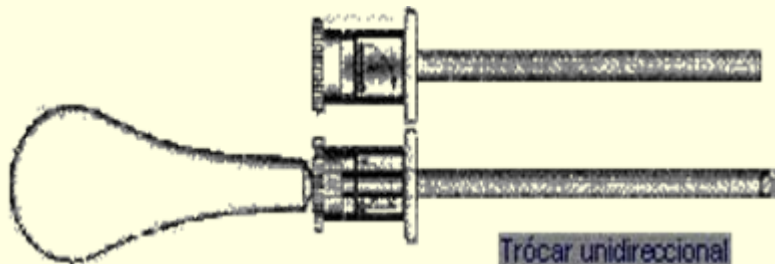
vigorous physiotherapy, Suction bronchoscopy, tracheostomy if recurrent

1. Jackson JW, Cooper DKC eds. *Rob & Smith's Operative Surgery, Thoracic surgery*, 4<sup>th</sup> ed. London: Butterworths; 1986

# Videoscope Assisted Thoracoscopic Surgery

## History

- 1806 – Phillip Bozzini – first endoscope equipment – “*Lichtleiter*”
- 1910 – HC Jacobeus
  - thorascopy good for TB
  - First thoracospy procedure - *pneumonolysis*



Trócar unidireccional



Hans Christian Jacobaeus (1879-1937)

# Videoscope Assisted Thoracoscopic Surgery

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- VATS for Tuberculosis
  - **Diagnostic**
    - Biopsy – pleura, lung
  - **Therapeutic**
    - Resectional surgery
      - Pulmonary
      - Pleural
    - Pleurodesis



**All the best..**