DM SEMINAR
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THORACOSCOPY (MEDICAL AND VIDEO ASSISTED SURGICAL)

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• INTRODUCTION
• MEDICAL THORACOSCOPY VS VATS
• INDICATIONS
• CONTRA-INDICATIONS
• COMPLICATIONS
• PROCEDURE OVERVIEW
• FUTURE DIRECTIONS
INTRODUCTION

• First introduced by Jacobaeus (internist, 1910, Stockholm) as diagnostic procedure in two cases of exudative (tuberculous) pleuritis

• Accumulated experience of thoracoscopy with:
  - Malignant PE (differentiate between 1° & 2° tumours of chest wall, pleura, lung & mediastinum)
  - Tubercular PE
  - Rheumatic and nonspecific parapneumonic effusions
  - Empyemas (esp nontubercular)
  - Pneumothorax (visualizing defect in idiopathic spont
INTRODUCTION

• Subsequent 4 decades → Thoracoscopy used worldwide almost exclusively for lysis of pleural adhesions by thoracocautery ("Jacobaeus’ Operation") – facilitate pneumothorax as Rx of TB

• Initiation of use for evaluation of pleural-pulmonary diseases
  Europe → MT came under scope of respiratory physicians

• Concurrent use of ST (VATS) by thoracic surgeons
## MT vs VATS

<table>
<thead>
<tr>
<th></th>
<th>MT</th>
<th>VATS</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Main</strong></td>
<td>Dx of Pl disease</td>
<td>Rx</td>
</tr>
<tr>
<td><strong>Indications</strong></td>
<td>LA/ Sedation</td>
<td>GA</td>
</tr>
<tr>
<td><strong>Anaesthesia</strong></td>
<td>No</td>
<td>Yes (Double lumen)</td>
</tr>
<tr>
<td><strong>Intubation</strong></td>
<td>No</td>
<td>Yes (Double lumen)</td>
</tr>
<tr>
<td><strong>Procedure Site</strong></td>
<td>Suite/Room</td>
<td>OT</td>
</tr>
<tr>
<td><strong>Ports of entry</strong></td>
<td>Single–Double</td>
<td>Multiple (≥3)</td>
</tr>
<tr>
<td><strong>Instruments</strong></td>
<td>Non-disposable</td>
<td>Disposable</td>
</tr>
<tr>
<td><strong>Invasiveness</strong></td>
<td>+</td>
<td>++</td>
</tr>
<tr>
<td><strong>Safety</strong></td>
<td>++</td>
<td>+</td>
</tr>
<tr>
<td><strong>Cost</strong></td>
<td>+</td>
<td>++</td>
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TREATMENT

DIAGNOSIS

Medical Thoracoscopy

VATS
WHEN TO DO?
**INDICATIONS**

**Pleural Effusion of Unknown Etiology**

- >20–25% of PE remain undiagnosed even after extensive diagnostic work-up of PF
- Dx by cytologic examination → Metastatic pleural involvement (60 to 80%)
- Dx by closed needle Bx ~ 45% (neoplastic inv)
- If facilities exist, MT should be performed (high sensitivity for malignancy and TB) → ~ 4% remain undiagnosed or truly idiopathic
INDICATIONS

Pleural Effusion of Unknown Etiology

- Initial Evaluation of PE nondiagnostic (esp if suspicion of neoplastic disease) → MT:
  - Exploration + parietal pleural Bx → Dx in 90–100%
  - Staging
  - Complete fluid removal → Re-expansion potential

- VATS ~ MT (more invasive & expensive, results similar) – reserved for cases where MT difficult or impossible e.g. severe pleuropulmonary adhesions (repeated therapeutic thoracenteses)
**INDICATIONS**

*Tubercular Pleural Effusion*

- Dx by closed needle Bx $\sim 70\%$ (30–90 %)
- Use of MT:
  - Visualization of grayish-white granuloma (parietal & diaphragmatic pl esp costovertebral gutter)
  - Multiple biopsies from selected sites (HP Dx in 94–98 %)
  - TB cultures more frequently positive (esp when fibrin production is significant)
- Dx by MT + Culture + HPE $\rightarrow 100\%$ (> Closed needle Bx + Culture of PE)
**INDICATIONS**

*Tubercular Pleural Effusion*

- Areas with low prevalence of TB, MT should be done when needle Bx are –ve
- Areas with high prevalence, MT not usually reqd for Dx since most cases Dx by needle Bx (HPE + AFB stain & C/S from each of 3 specimens).
  
If Cytology & closed needle Bx both –ve, probability of Dx by MT ~ 5-6%
**Tubercular Pleural Effusion**

- **Indications** – when requirement for:
  - Lysis of adhesions
  - Large amounts of tissue both for Dx and testing for drug resistance and susceptibility

- Initial complete drainage of PE during MT → greater symptomatic improvement ~ any other Mx strategy (inclusion of steroids)

- No studies to compare effect of MT (early Dx + complete drainage) + ATT with ATT alone.
**INDICATIONS**

*Mesothelioma*

- Dx by cytologic exam $\rightarrow$ < 20% (4 –77%)
- M.f. cause of false –ve cytology – Early MM
- Closed needle Bx – specimens small (size & no) $\rightarrow$ inadequate for all immunohistochemical stains & EM exam needed for definitive Dx
- Adv of MT:
  1. Specimens large & full-thickness from several areas (no req for open pl Bx by lat or mini thoracotomy) $\rightarrow$ Early Dx (accuracy by HPE upto 98% ) + Better H/P classification + More
**INDICATIONS**

*Mesothelioma*

2. If intrapleural CT or surgical Rx not under consideration \(\rightarrow\) Dx + Pleurodesis simultaneously

3. Benign asbestos-related PE (Dx of exclusion):
   - Fibrohyaline/calcified, thick, pearly white plaques
   - Pl ± pul Bx \(\rightarrow\) demonstration of asbestos fibres

• **Limitations:**
  - Inadequate visualization (extensive adhesions)
  - Tumor growth through thoracoscopic incision sites Radiation to area surrounding the incision sites?
  - Inherent difficulties in pathologic identification \(\rightarrow\)
Recurrent Pleural Effusion of Benign Etiology

- CCF, cardiac surgery, nephrotic syndrome, CT disorders
- Indicated for recurrent effusions causing symptoms & not controlled by repeated large-volume thoracentesis
- Pleural Bx → Exclude infectious or neoplastic etiologies → Pleurodesis
**INDICATIONS**

*Malignant Pleural Effusions*

- M.C. indication for MT (both Dx & Rx)
- Dx by PF Cytology $\Rightarrow \sim 60\%$
- Dx by Closed needle Bx $\Rightarrow \sim 45\%$
- Dx by PF Cytology + Closed needle Bx $\Rightarrow \sim 75\%$
- Dx by MT alone $\Rightarrow \sim 95\%$ *(Lung Ca, Diffuse MM, Extrathoracic primaries)*
- Dx by MT + PF Cytology $\Rightarrow \sim 96\%$ *(+ 1–2%)*
- Dx by all combined $\Rightarrow \sim 97\%$ *(+ 2–3%)*
INDICATIONS

Malignant Pleural Effusions

- Staging (esp Bronchogenic Ca ➔ Determine operability)
- Metastatic PE ➔ Large size Bx (direct vision) ➔ Determination of site of primary
- Metastatic PE (breast cancer) ➔ ER/PR status
- Lymphomas ➔ Better diagnostic yield + morphological classification
INDICATIONS

Malignant Pleural Effusions

1. Removal of max qty of fluid with min risk of pul oedema (immediate equilibration of pressures by direct entrance of air into pleural cavity)

2. Re-expansion potential of lung evaluated by visual inspection

3. Breaking up/removal of loculations & adhesions

4. Pleurodesis – chemical or by pleurectomy using standard dissection techniques or hydrodissection
**INDICATIONS**

*Chylothorax*

- M.C. cause – Trauma or malignancy (lymphoma)
- Exploration (MT/VATS) can precede/replace open thoracotomy
- If torn thoracic duct visualized (PO heavy cream 1 hr prior to procedure) → Clipped/ligated
- Anticipated Survival Time short (esp lymphoma) → Pleurodesis → Resolution of PE + prevention of Nutritional & Immunologic deterioration
Empyema

- Debridement of fibrinous adhesions + evacuation of loculated fluid/debris $\rightarrow$ ↓ duration of hospital stay + avoidance of open thoracotomy
- Timing of thoracoscopic intervention critical (? 3–5 d after ICTD ineffective)
- VATS $\rightarrow$ Success rate of >80%
  
- ? Thoracoscopy vs STK use vs OT + Decortication
**INDICATIONS**

*Pulmonary Diseases*

- **Indications for thoracoscopy:**
  1. Evaluation of single/multiple peripheral pulmonary opacities where TBLB/Percutaneous LB non-Dx
  2. DPLD with peripheral involvement (after simpler techniques unsuccessful) eg lymphangitis etc
  3. Bx of visceral pl + lung surface in pts with proven or suspected pl malignancy (mets/MM) for staging

- **Sensitivity + Invasiveness** → OLB > MT/VATS > TBLB
INDICATIONS

Pulmonary Diseases

- Adv over TBLB:
  1. Larger Bx size
  2. Ability to choose Bx site (direct visualization)
  3. Bleeding can be Mx with electrocoagulation/laser.
     Bx can be taken using endoscopic stapling device.

- Sensitivity – overall ≥90%:
  1. Sarcoidosis stage II/III → ~ 98%
  2. Diffuse malignant lung diseases → ~ 90%
  3. Fibrotic lung disease → ~ 85%
INDICATIONS

Pulmonary Diseases


- Morbidity rates minimal even in pts who are elderly, have poor lung function or reduced performance status. Postop/post-procedure stay in ICU rarely reqd. Usually pts D/S in < 3 days
INDICATIONS

Spontaneous Pneumothorax

- Pts with recurrent/prolonged (> 5 d) pneumoTx MT/VATS better~ repeated ICTD
- Thoracoscopic findings in PSP:
  - Type I (‘Normal appearance’)
  - Type II (Pl-Pul adhesions)
  - Type III (Small blebs or bullae < 2 cm)
  - Type IV (Large bullae > 2 cm)
- Airleaks localized by saline bathing of collapsed lung + Use of PPV
**INDICATIONS**

*Sppontaneous Pneumothorax*

- Blebs/bullae – ligated/removed by APC, electrocautery, Nd:YAG laser or stapling device
- Wedge resection of blebs/bulla ↓ IA described
- Results ~ OT ➔ Trade off b/w higher recurrence (5–10% vs 1–3%) AND lower morbidity. Can precede/replace OT
- Improved visualization techniques ➔ No Such Thing as Endoscopically Normal Lung (Type I) – Minor blebs (± small bullae) 1–2 mm – Too small for detection by CT or resection
INDICATIONS

Spontaneous Pneumothorax

- COPD + SSP:
  - Prospectively study of thoracoscopic talc pleurodesis
  - 41 pts with COPD and SSP
  - Mean FEV1 41% predicted
  - Maj of SPs 20–50% in size – 1/3 recurrent
  - Success rate of 95% after median F/U of 3 yrs
  - Mortality rare of 10% within 30 d of procedure
  - ‘Can be performed with acceptable mortality in patients with advanced COPD’

Lee et al, Chest 2004; 125: 1315–1320
INDICATIONS

Bullectomy/LVRS

- Endoscopic loop ligation + stapling > Endoscopic laser resection (Nd:YAG)
- B/L procedures > U/L procedures
- Results/morbidity/mortality ~ OT but costs < OT


- Short term: ↑ Pul fx exercise performance & QOL
- Long term: FEV1 ↓ (≈ preresection values within 2 yrs)
**INDICATIONS**

**Chest Trauma**

- Evaluation/Mx in blunt/penetrating trauma:
  1. Diaphragmatic injury
  2. Chest wall bleeding
  3. Traumatic pneumoTx/chyloTx/hemoTx
  4. Lung parenchymal lacerations
  5. Trapped lung (after prolonged HemoTx) → Removal of fibrous peel + loculations/adhesions → lung re-expansion → pleurodesis

- Difficulty (active bleeding/suboptimal single-lung ventilation/intense pleural infl) → Convert to OT
WHEN NOT TO DO?
CONTRA-INDICATIONS

• Uncommon, rarely absolute
1. Size of free pleural space <6-10 cm usually due to extensive adhesions
2. Others:
   • Intractable cough
   • Hypoxemia
   • Bleeding and coagulation disorders
   • Unstable cardiovascular status
   • Contraindications for GA (for VATS)
CONTRA-INDICATIONS

- Pul Bx avoided if:
  1. MPAP > 35 mm Hg
  2. End stage pul fibrosis with extensive honeycombing
  3. Suspicion of PAVM, hydatic cyst or vascular tumours
WHY NOT TO DO?
COMPLICATIONS

**MT:**

- **Mortality** 0.01–0.25 %

- **Morbidity:**
  - Transient hyperthermia (<38.5 C) x 12–24 hrs – 15%
  - Desaturation during procedure (↓ LA) – <2%
  - Persistent post op air leak (>7 d) – <2% (pts with spontaneous pneumothorax) → likely disease related
  - S/C emphysema ~ 0.5%
  - Negligible – benign cardiac arrhythmias, transient hypotension and seeding of path in pts with MM
COMPLICATIONS

VATS:

- Mortality <1% (~0.3%)
- Morbidity:
  - Anesthesia Related OR Instrument Related OR Procedure Related
  - Conversion to OT ≈1–5% (Adhesions, equipment failure, uncontrolled bleeding)
  - Persistent post op air leak (>7 d) ~4%
  - Post op bleeding req intervention ~ 0.5–1.5%
HOW TO DO?
**PROCEDURE**

*Single Puncture:*
- Rigid thoracoscope (W.C.=3–5 mm), Trocar (Obturator + Sheath/Cannula = 10 mm dia)

*Double Puncture:*
- Trocars:
  - Obturator (D = 7 mm & L = 10 cm – 1st entry point)
  - Obturator (D = 5 mm & L = 10 cm – 2nd entry point)
- Telescope: Direct/oblique visions ≈ 180°/50°
- Forceps:
  - 7 mm optical forceps (1st point of entry)
  - 5 mm coagulating forceps (2nd point of entry) – useful for Bx of thick hard fibrous pl lesions (esp plaques) & visceral pl + lung
PROCEDURE

Trocar + Cannula with Valve

Single Incision Thoracoscope

Bx Forceps with Straight optics

Optics & Forceps in Shaft
PROCEDURE

Points of Entry:

• First Point:
  - 3rd–4th ICS Axilla (SP → UL)
  - 6th–7th ICS Axilla (PE → Diaphragm/Costovertebral gutters)
  - 4th–5th ICS Axilla (Lung Bx → all lobes)

• Second Point:
  - Determined after visualization by a oblique viewing 50° telescope
PROCEDURE

3 STICK APPROACH

VATS
PROCEDURE
**PROCEDURE**

*Induction of Pneumothorax:*

- Req'd for introduction of scope into pleural cavity - enough space to move all instruments around easily & visualize all important areas

- Pleural trocar 2-3 mm dia/100 mm length - Pointed obturator (skin, I/C muscles) & blunt (parietal pl)

- Ordinary needles sharp \(\rightarrow\) risk of lung puncture

- Oscillations on manometer \(\rightarrow\) large & -ve (-8 to -2 cm H\textsubscript{2}O) - lung puncture (low ampl, \(\approx\)0)

- 300-500 ml air under T/T pressure still \(\approx\)0
PROCEDURE

_Chest Drain:_

- ICTD inserted at end of procedure
- Removed:
  - After 3–4 hrs – as soon as lung re-expanded (normal Dx procedure)
  - After 24–48 hrs (Lung Bx)
  - After 2–5 days when fluid output ↓ (Pleurodesis)
WHAT NEXT ?
Mediastinal Disease:

- Post & middle mediastinal tumors \(\Rightarrow\) convert to OT > 10% (poor access)
- Evaluation of hilar/ant mediastinal LNE (not accessible to PCNA, TBNA or TENA) \(\Rightarrow\) alt to cervical mediastinoscopy & ant mediastinotomy
- Resection of bronchogenic cysts
- Utility of VATS analyzed in 34 pts with mediastinal disease (LN, thymic, cystic & solid lesions) \(\Rightarrow\) Useful for small lesions

FUTURE DIRECTIONS

Vasospastic Disease:

- Sympathectomies indicated in Raynaud’s syndrome, causalgia or essential hyperhydrosis
- Thoracoscopic UL sympathectomy safe, effective


- Ablation of sympathetic ganglia by phenol injection, electrocoagulation or laser photocoagulation
- Done thru axillary/ant approach
FUTURE DIRECTIONS

CVS Diseases

1. Ligation of PDA
2. Harvest IMA in pts undergoing CABG
3. Drainage of pericardial effusions esp malignant
   • Significant reduction in postop pain
FUTURE DIRECTIONS

**USG guided MT**

- TT USG to locate safe entry site for trocar placement for MT without induction of a preprocedure pneumothorax
- USG could safely, reliably & successfully identify entry sites in all 20 pts (even in presence of pl adhesions)

  Hersh CP et al. Respiration 2003; 70:299-301

- USG Replacing practice of pneumothorax induction before MT?
FUTURE DIRECTIONS

Minithoracoscopy

• Smaller instruments used (3-mm)
• Usually 2 ports of entry
• 17 small loculated PE (not accessible with standard-sized MT) & 12 larger nonloculated effusions (could have been examined using conventional MT) → Diagnostic yield = 93.4%

Visualization equal to conventional MT

TREATMENT

DIAGNOSIS

Medical Thoracoscopy

VATS
CONCLUSIONS

- MT & VATS useful for Dx & Rx of variety of pleural and even pulmonary/mediastinal diseases
- MT (~ VATS) – adv of being done ↓ LA, in an endoscopy procedure room, using nondisposable instruments (Safer, less invasive & less expensive)
- Wherever available MT & VATS should be used for Mx of pleuropulmonary diseases