DM SEMINAR
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THORACOSCOPY (MEDICAL AND VIDEO ASSISTED SURGICAL)

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HEADINGS

- 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

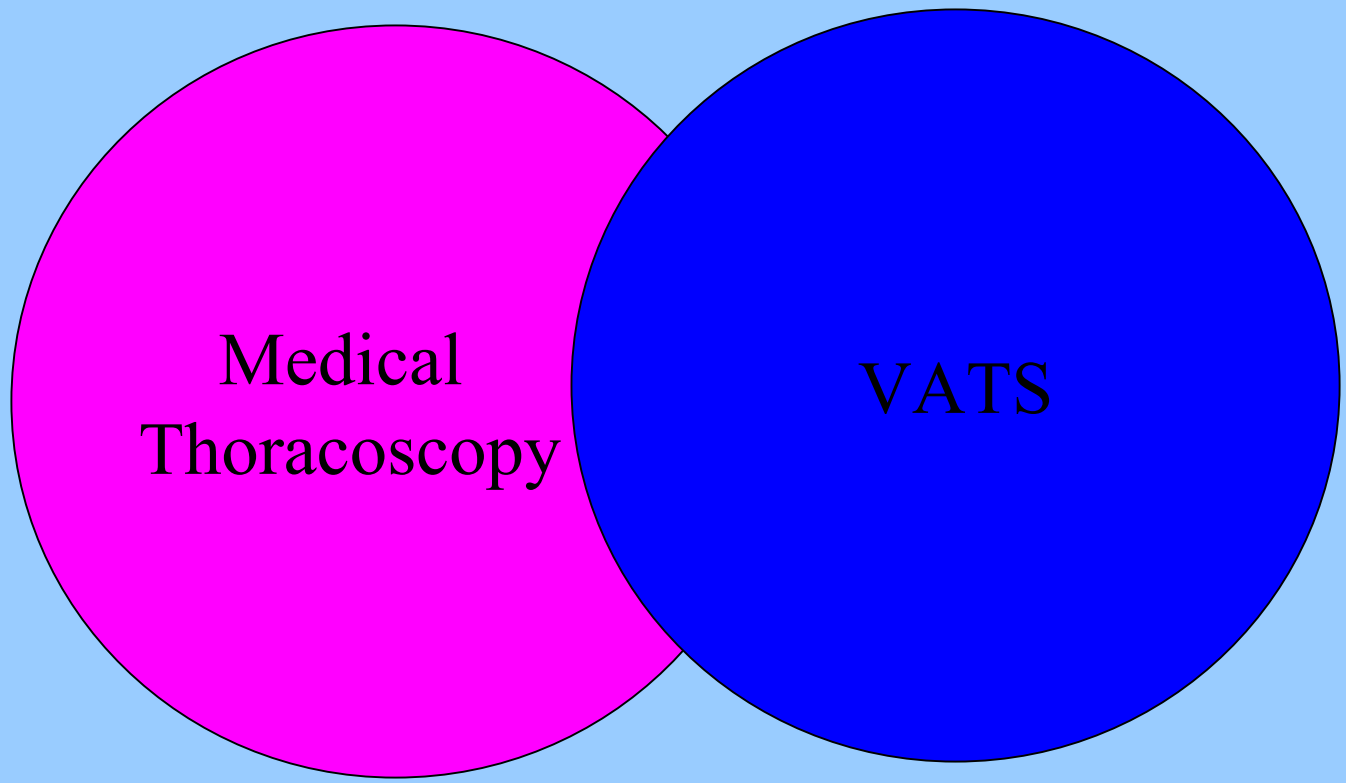
- Subsequent 4 decades → Thoracoscopy used worldwide almost exclusively for lysis of pl adhesions by thoracocautery ("Jacobaeus' Operation") – facilitate pneumothorax as Rx of TB
- Initiation of use for evaluation of pl-pul diseases

  Europe → MT came under scope of respiratory physicians
- Concurrent use of ST (VATS) by thoracic surgeons

MT vs VATS

	MT	VATS
Main Indications	Dx of Pl disease	Rx
Anaesthesia	LA/ Sedation	GA
Intubation	No	Yes (Double lumen)
Procedure Site	Suite/Room	OT
Ports of entry	Single-Double	Multiple (≥3)
Instruments	Non-disposable	Disposable
Invasiveness	+	++
Safety	++	+
Cost	+	++

DIAGNOSIS → TREATMENT



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 ~ 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 → ~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%

INDICATIONS

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

INDICATIONS

Mesothelioma

- Dx by cytologic exam → < 20% (4–77%)
- M.f. cause of false -ve cytology – Early MM
- Closed needle Bx – specimens small(size & no) → 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) → Early Dx (accuracy by HPE upto 98%) + Better H/P classification + More

INDICATIONS

Mesothelioma

2. If intrapleural CT or surgical Rx not under consideration → Dx + Pleurodesis simultaneously
3. Benign asbestos-related PE (Dx of exclusion):

- Fibrohyaline/calcified, thick, pearly white pl plaques
- Pl ± pul Bx → 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 →

INDICATIONS

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 → ~ 60%
- Dx by Closed needle Bx → ~ 45%
- Dx by PF Cytology + Closed needle Bx → ~ 75%
- Dx by MT alone → ~ 95% (Lung Ca, Diffuse M M, Extrathoracic primaries)
- Dx by MT + PF Cytology → ~ 96% (+ 1-2%)
- Dx by all combined → ~ 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 pl 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

INDICATIONS

Empyema

- Debridement of fibrinous adhesions + evacuation of loculated fluid/debris → ↓ duration of hospital stay + avoidance of open thoracotomy
- Timing of thoracoscopic intervention critical (? 3-5 d after ICTD ineffective)
- VATS →Success rate of >80%
  Cassina PC et al. J Thorac Cardiovasc Surg 1999; 117:234-238
- ? Thoracoscopy vs STK use vs OT + Decortication

INDICATIONS

Pulmonary Diseases

- Indications for thoracoscopy:
  1. Evaluation of single/multiple peripheral pul 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
- Senst + 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.
- Senstivity – overall ≥90%:
  1. Sarcoidosis stage II/III → ~ 98%
  2. Diffuse malignant lung diseases → ~ 90%
  3. Fibrotic lung disease → ~ 85%

INDICATIONS

Pulmonary Diseases

- Dis adv – Parietal/visceral pl seeding of tumor cells after thoracoscopic removal of lung nodules/masses.
- 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

Spontaneous Pneumothorax

- Blebs/bullae – ligated/removed by APC, electrocautery, Nd:YAG laser or stapling device
- Wedge resection of blebs/bulla ↓ LA 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

  NETT Research Group N Engl J Med 2003; 348: 2059-2073
- Short term: ↑ Pulf$_x$ 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 pl 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 arrythmias, 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 invtervention ~ 0.5–1.5%

HOW TO DO?

PROCEDURE

Single Puncture:

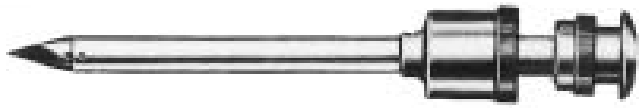
- Rigid thoracoscope (W.C.=3-5 mm), Trocar (Obturator + Sheath/Cannula = 10 mm dia)

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

a)

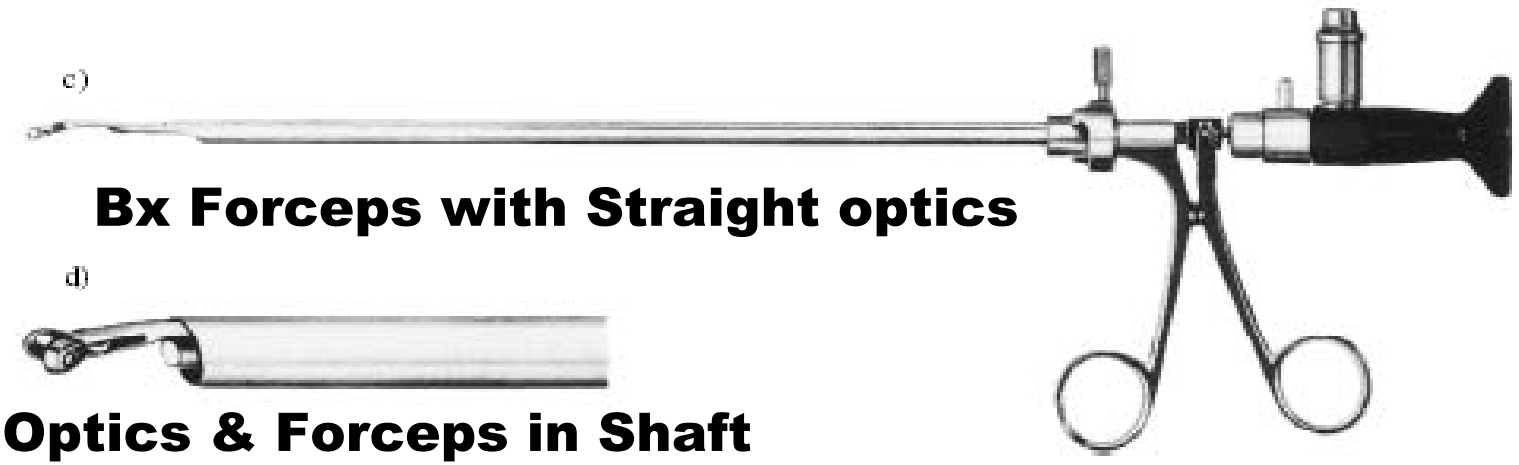


Trocar + Cannula with Valve

b)

Single Incision Thoracoscope

c)



Bx Forceps with Straight optics

d)

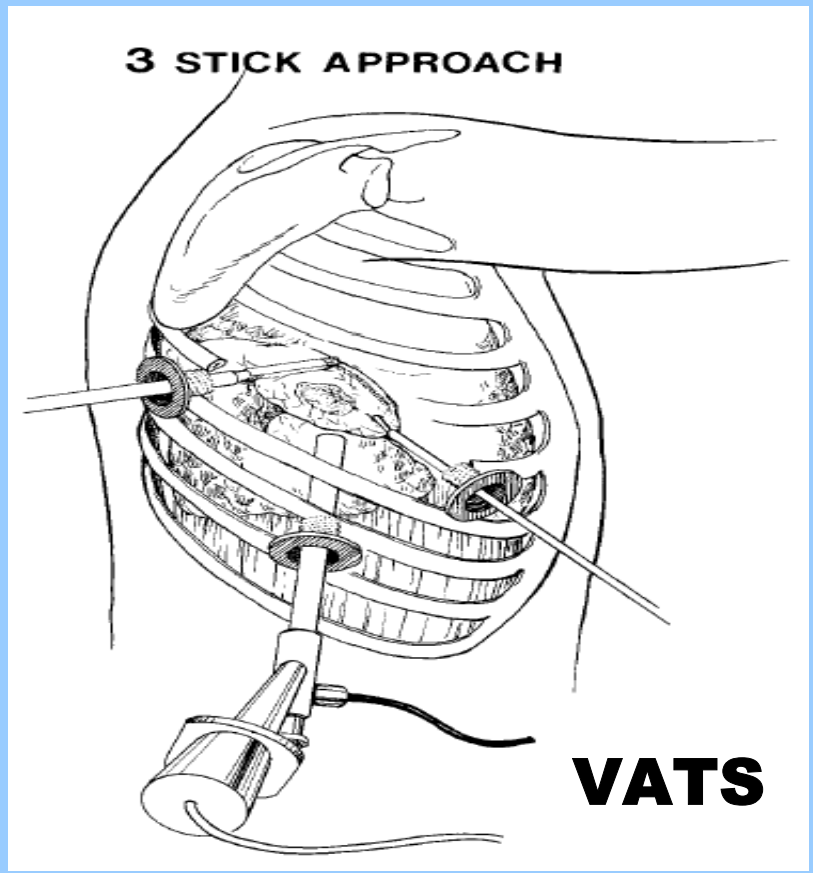
Optics & Forceps in Shaft

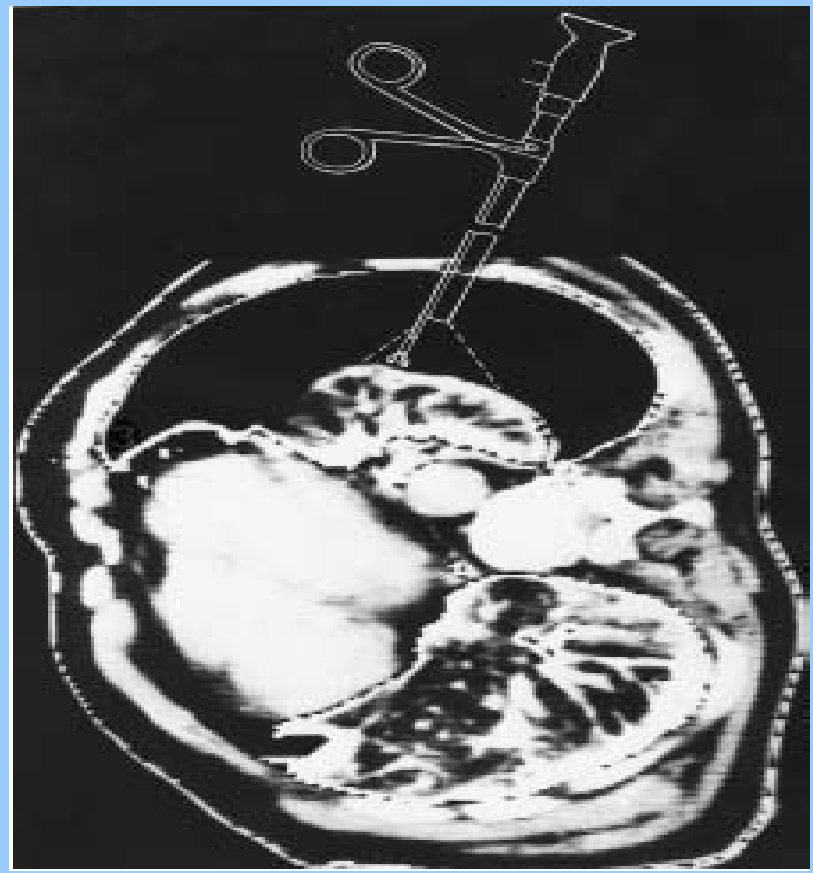
PROCEDURE

Points of Entry:

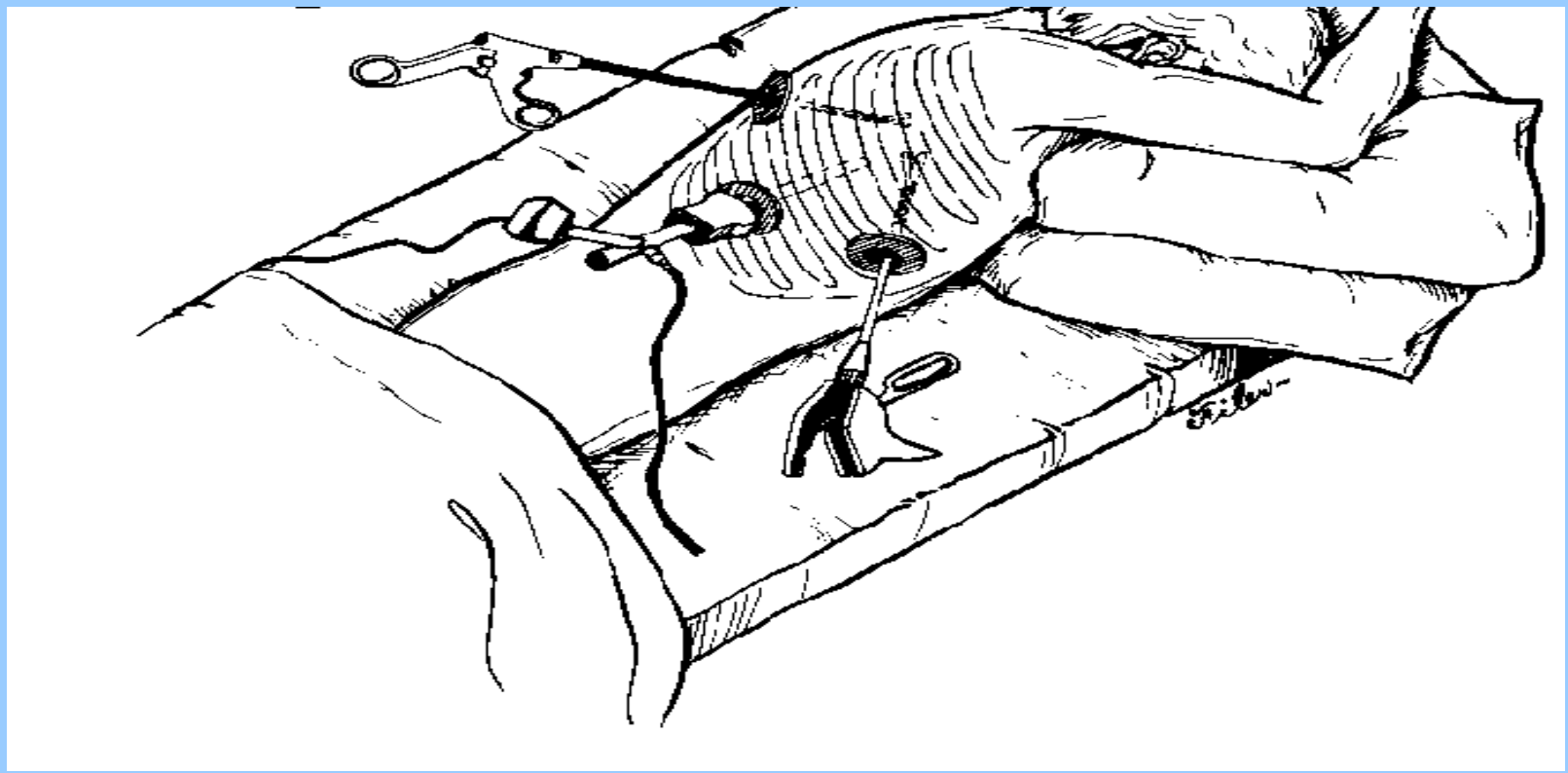
- First Point:
  - 3rd-4th ICS Axilla (SP → UL)
  - 6th-7th ICS Axilla (PE → Diaphragm/Costovertebral gutters)
  - 4th-5th ICS Axilla (Lung Bx → all lobes)
- Second Point:
  - Determined after visualization by a oblique viewing 50° telescope

PROCEDURE

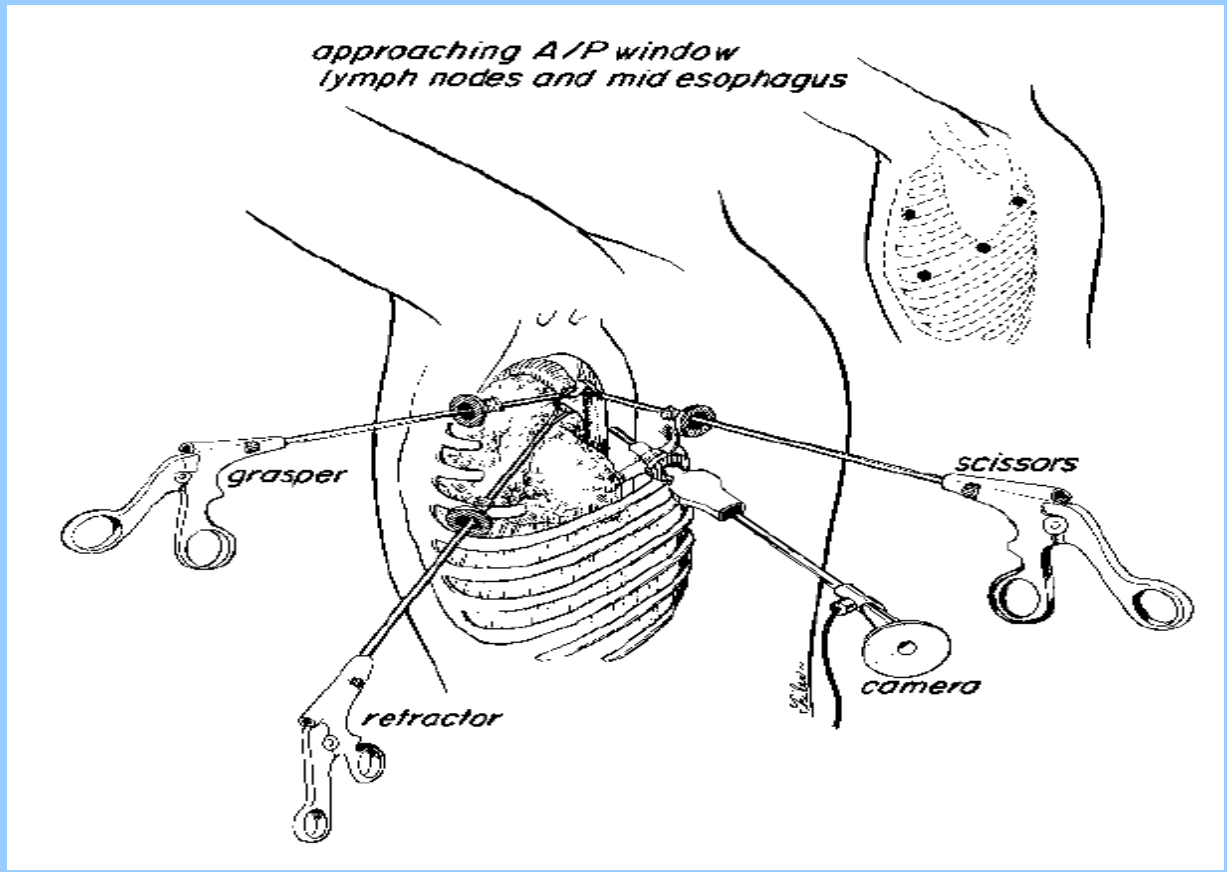




PROCEDURE



PROCEDURE


approaching A/P window
lymph nodes and mid esophagus
grasper
scissors
camera
retractor

PROCEDURE

Induction of Pneumothorax:

- Reqd for introduction of scope into pl cavity – enough space to move all instruments around easily & visualize all important areas
- Pl trocar 2-3 mm dia/100 mm length – Pointed obturator (skin, I/C muscles) & blunt (parietal pl)
- Ordinary needles sharp → risk of lung puncture
- Oscillations on manometer → large & –ve (-8 to –2 cm H_2O) – lung puncture (low ampl, ≈0)
- 300-500 ml air reqd (I/T pressure still –ve)

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 ?

FUTURE DIRECTIONS

Mediastinal Disease:

- Post & middle mediastinal tumors → convert to OT > 10% (poor access)
- Evaluation of hilar/ant mediastinal LNE (not accessible to PCNA, TBNA or TENA) → 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) → Useful for small lesions

Kitami et al Ann Thorac Cardiovasc Surg.

FUTURE DIRECTIONS

Vasospastic Disease:

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

Satyapal et al Clin Anat. 2003; 16: 538-41.

  - 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

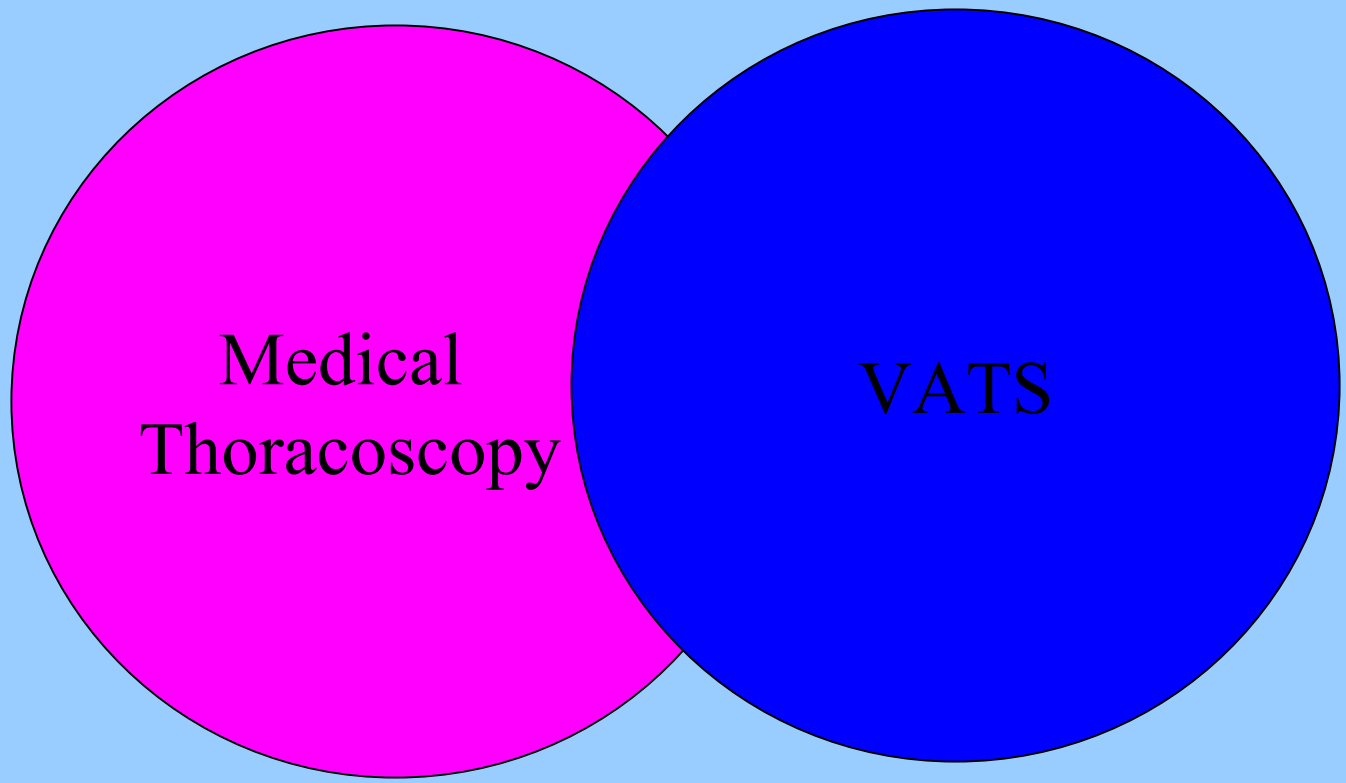
Minithoracoscopy

- 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%

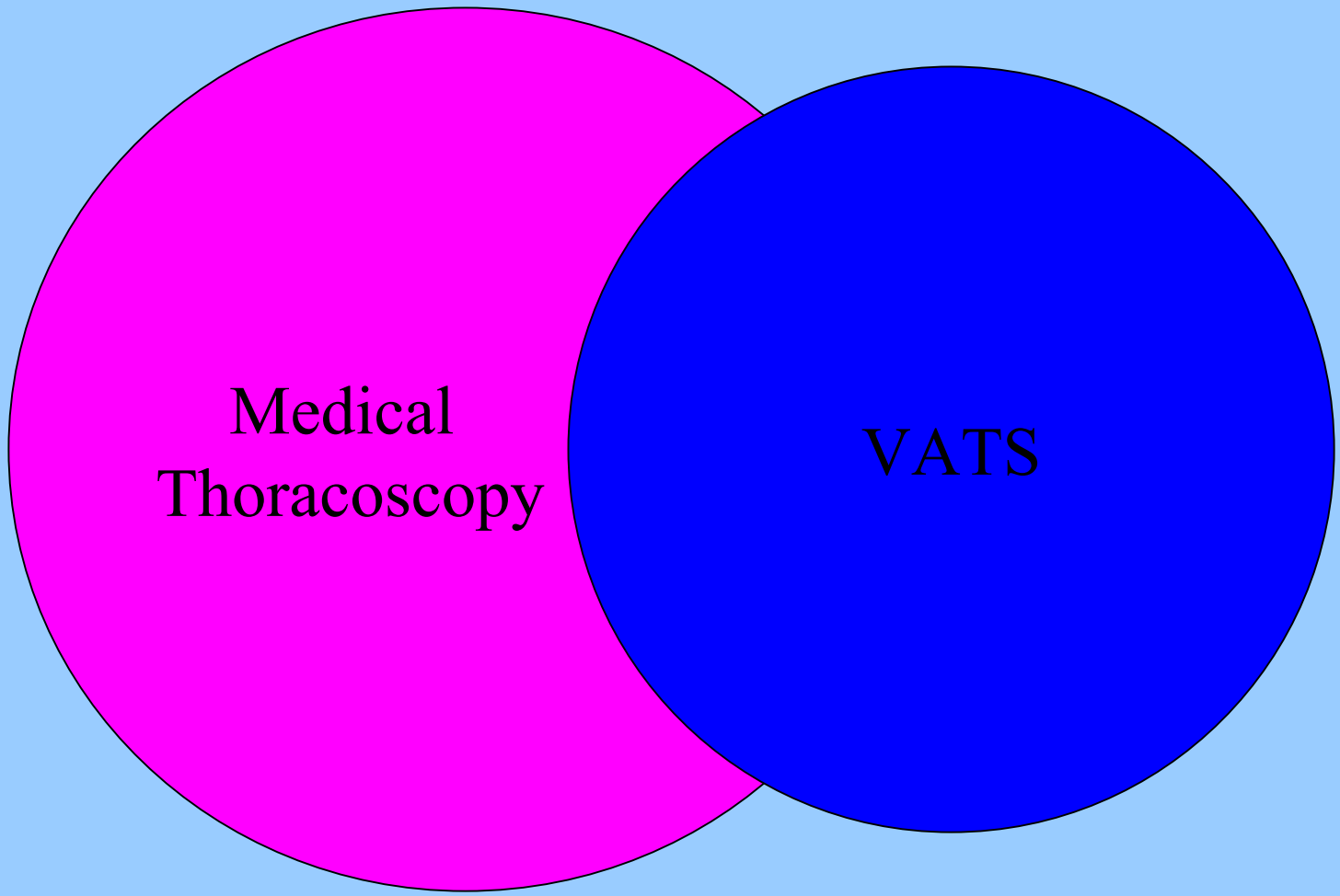
  Visualization equal to conventional MT

  Tassi et al Chest. 2003; 124: 1975-1977.

DIAGNOSIS → TREATMENT



DIAGNOSIS → TREATMENT



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