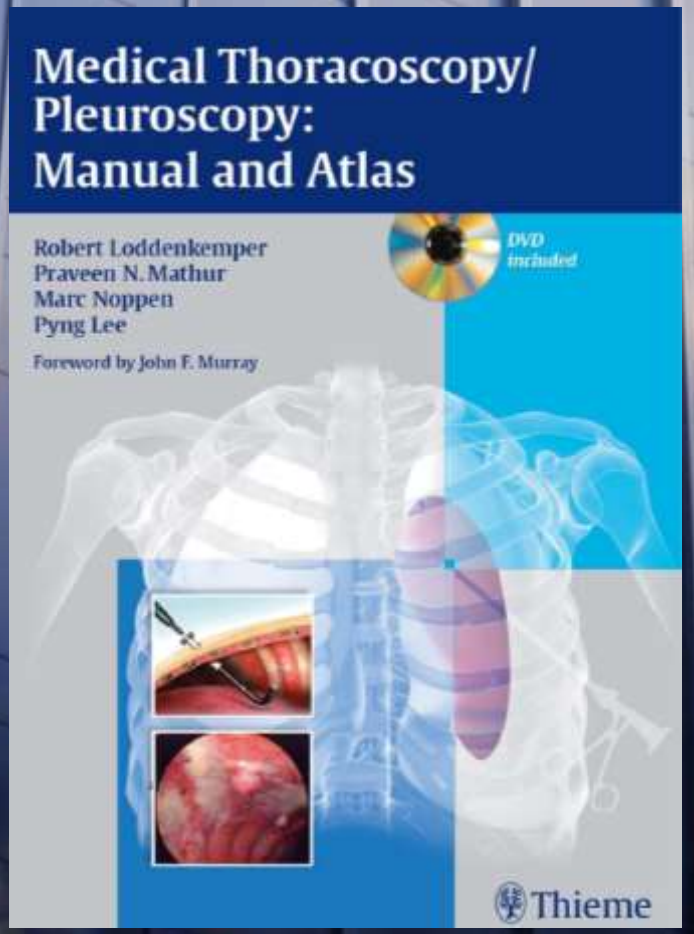
肋膜腔鏡概論

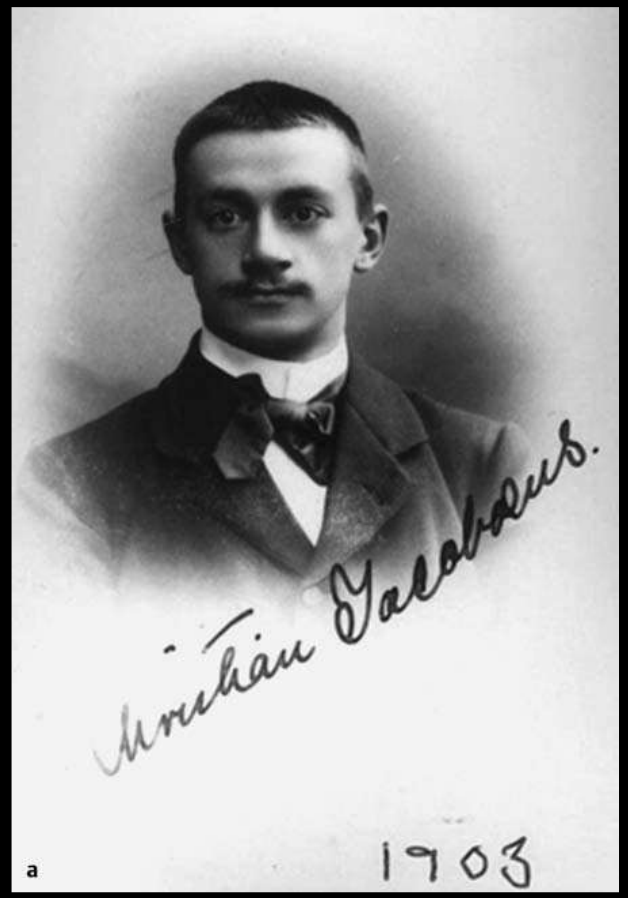
張哲嘉醫師

- 胸腔/肋膜鏡歷史
- 肋膜腔鏡適應症
- 肋膜腔鏡禁忌症
- 檢查前準備
- 肋膜腔鏡步驟
- 肋膜腔鏡併發症



Medical Thoracoscopy/Pleuroscopy: Manual and Atlas

胸腔鏡之父
Hans-Christian Jacobaeus (1879–1937)



胸腔鏡發展來自於三項技術

1. 人工氣胸
2. 內視鏡
3. 肋膜引流

Aus dem westlichen Krankenhause der Allgemeinen Fürsorge-anstalt in Stockholm (Oberarzt: Dr. G. Wilkens).

Ueber die Möglichkeit die Zystoskopie bei Untersuchung seröser Höhlungen anzuwenden.

Vorläufige Mitteilung.

Von H. C. Jacobaeus, Privatdozent in Stockholm.

Die mit der äusseren Körperfläche durch natürliche Oeffnungen in Verbindung stehenden Hohlräume des Organismus, war man seit langem instand gesetzt, mit verschiedenen Licht- und Spiegelanordnungen zu beleuchten und infolgedessen auch mit dem Auge zu untersuchen.

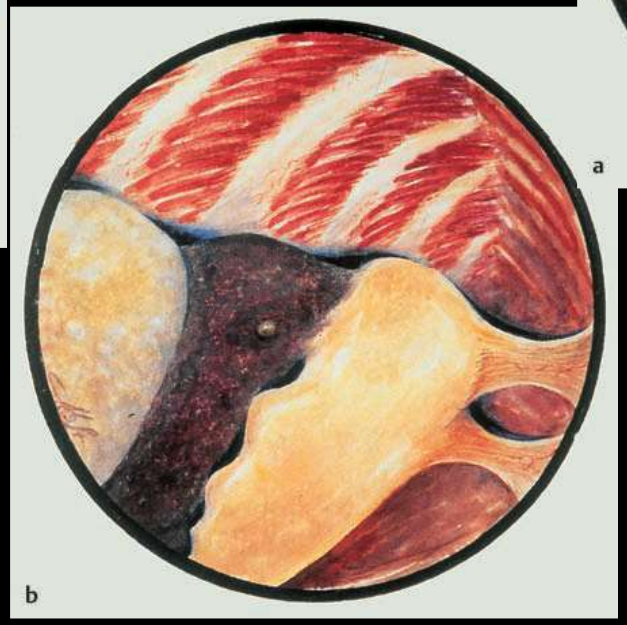
Muenchener Medizinische Wochenschrift

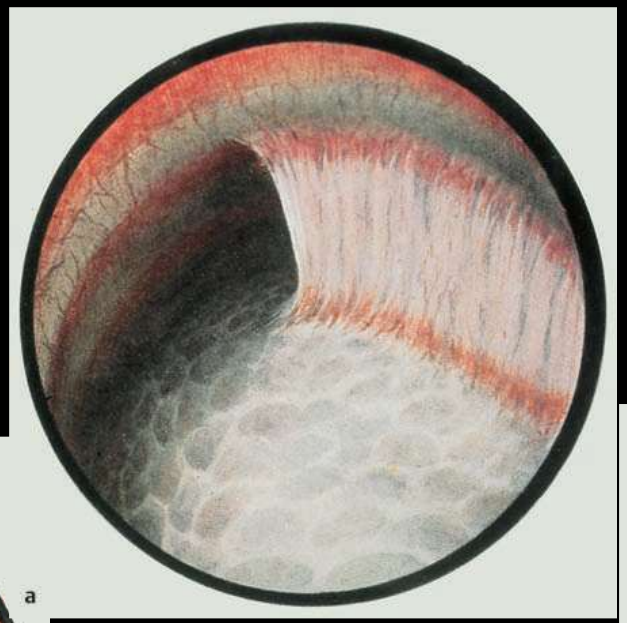
57: 2090 – 2092 (1910)

胸腔鏡歷史

- 1910
  - H.C. Jacobeus, 瑞典內科醫師，首次執行胸腔鏡來診斷發炎性肋膜炎
- 1921
  - H.C. Jacobeus, 發表肋膜腔鏡結核肋膜炎及惡性肋膜積水的個案系列
- 1970
  - Swierenga et al., Brant and Boutin et al. 證實了這些發表的價值

Original drawings of thoracoscopic situations by Jacobaeus





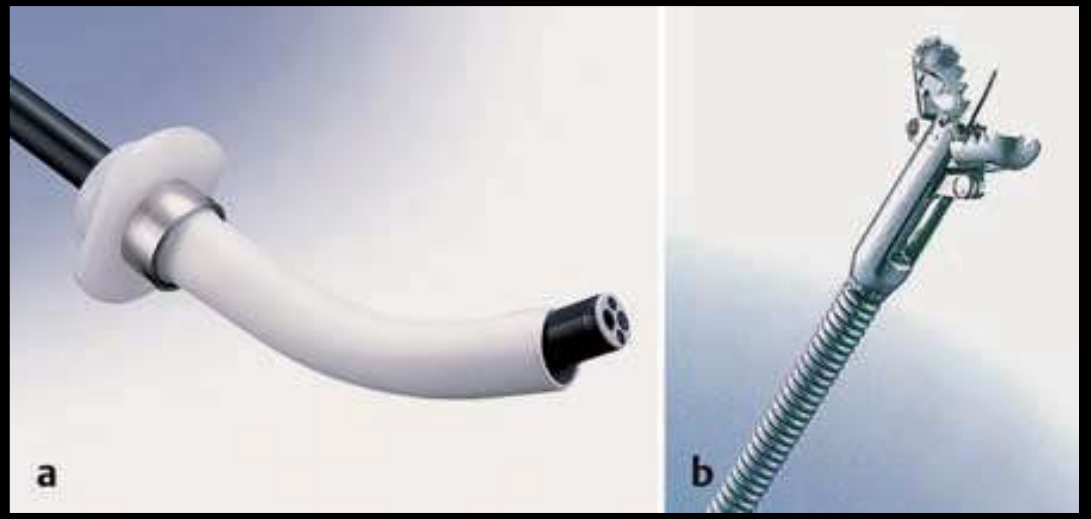
Jacobaeus operation

Historical photograph of Hans-Jürgen Brandt performing diagnostic thoracoscopy, assisted by Jutta Mai, who observes the procedure through a teaching optic.

半硬式胸腔鏡 (Semi-Rigid Thoracoscope)

- 1978
  - 日本外科醫師Takeno首先發展出半硬式可活動器械來治療氣胸
- 1989
  - Olympus公司首先製造2mm working channel的半硬式可活動的胸腔纖維內視鏡，首次由Maclean醫師執行來診斷肋膜積水
- 2002
  - Olympus公司發表第二代有2.8mm working channel影像內視鏡
- 2007
  - 首支可耐受高溫高壓消毒的半硬式可活動內視鏡

Takeno Y. Thoracoscopic treatment of spontaneous pneumothorax. Ann Thorac Surg 1993; 56: 688–690.
. McLean AN, Bicknell SR, McAlpine LG, et al. Investigation of pleural effusion: an evaluation of the new Olympus LTF semiflexible thoracofiberscope and comparison with Abram's needle biopsy. Chest 1998; 114: 150–153
. Ernst A, Hersh CP, Herth F, et al. A novel instrument for the evaluation of the pleural space: an experience in 34 patients. Chest 2002; 122: 1530–1534.
Munavvar M, Khan MA, Edwards J, et al. The autoclavable semirigid thoracoscope: the way forward in pleural disease? Eur Respir J 2007; 29: 571–574.


a
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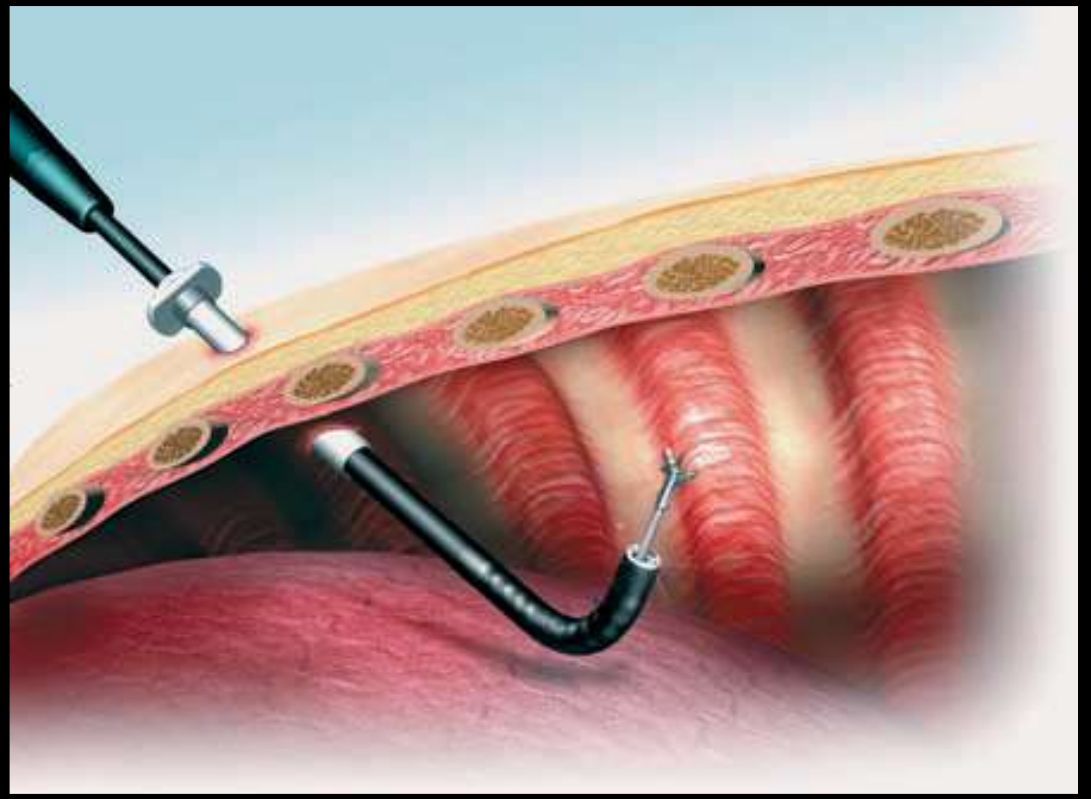
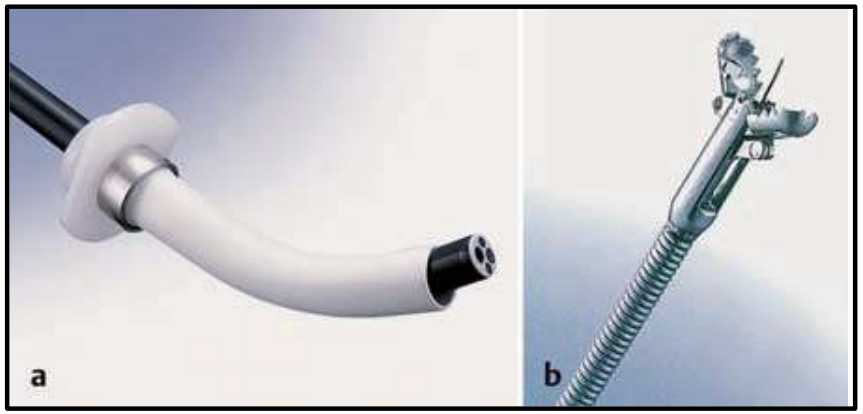


PLEUROSCOPY (MEDICAL THORACOSCOPY): SEMI-RIGID INSTRUMENT

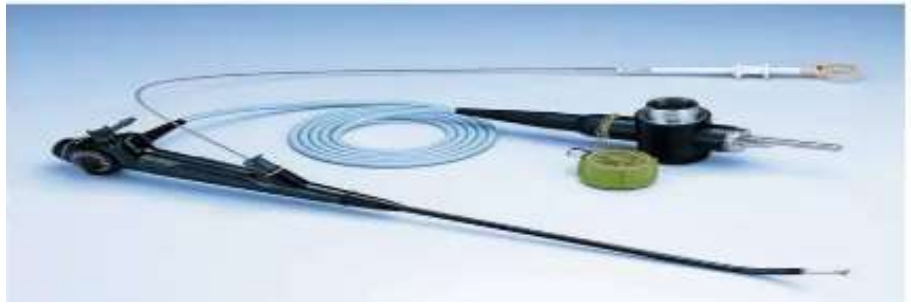
- **Handing ~ flexible bronchoscope**
- **One port of entry**
- **Flexible trocar**



- Distal 5 cm: 160˚ up/130 ˚ down
- Outer diameter: 7mm
- Working channel: 2.8mm

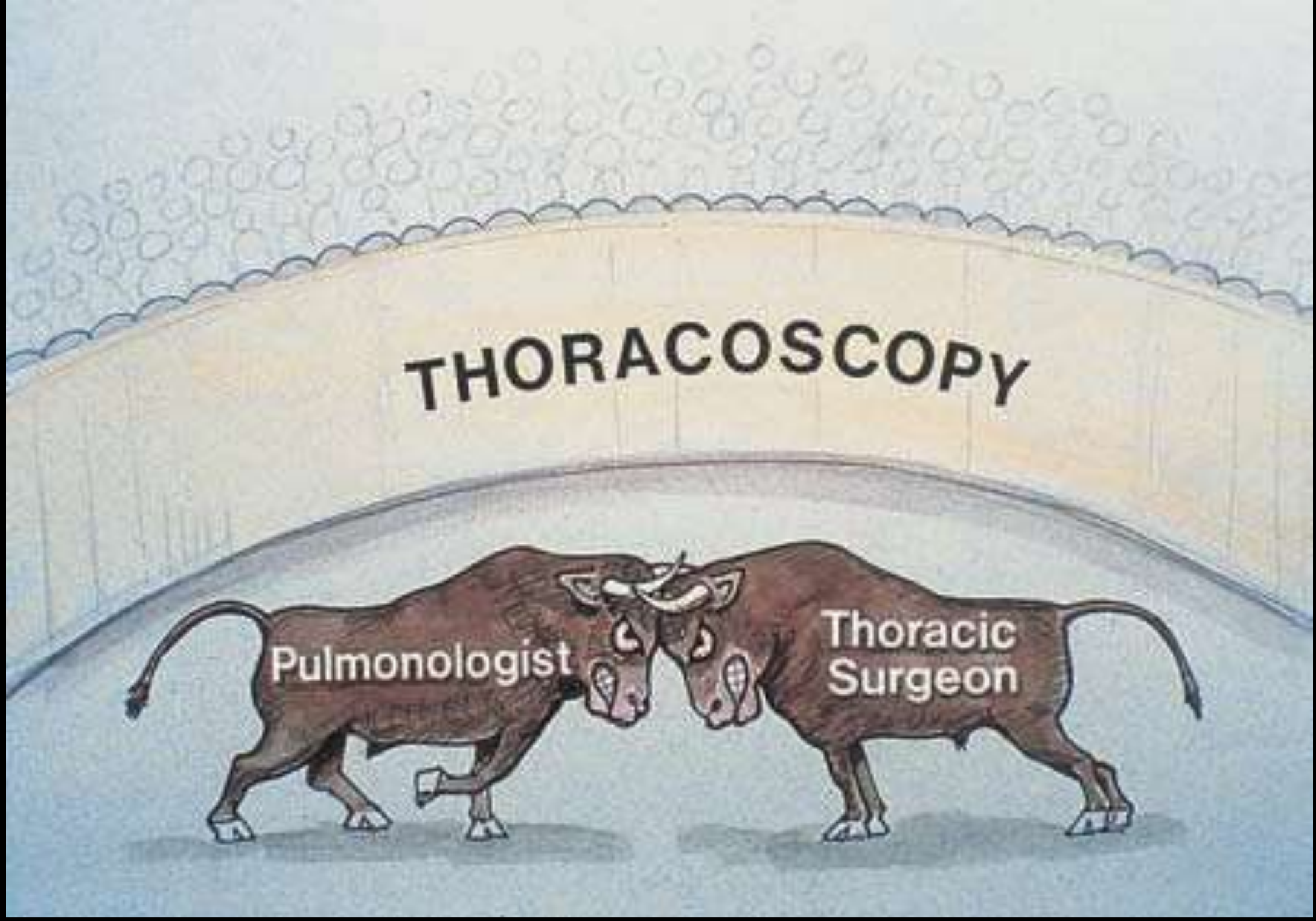
Semi-rigid Thoracoscope

- More flexibility.
- Ability to retroflex the pleuroscope to biopsy the parietal pleura adjacent to the insertion site
- Ability to be connected to the existing endoscopic processors and light sources with better image quality
- Small working channel with flexible biopsy forceps (2.4 mm) ,small biopsy specimens
- Diagnostic/Therapeutic



Rigid Thoracoscope

- Limited flexibility
- Inability to retroflex
- Needs a separate cold light source with a camera attached to the eyepiece of the telescopex
- Rigid biopsy forceps (5 mm) often facilitate bigger and deeper biopsies and are more efficient in breaking down adhesions
- Diagnostic/therapeutic


THORACOSCOPY
Pulmonologist
Thoracic Surgeon

肋膜腔鏡 **VS.** 外科胸腔鏡/**VATS**

	肋膜腔鏡	**VATS**
目的	診斷、肋膜沾黏	微創胸腔手術
執行地點	內視鏡室	手術室
麻醉	局部麻醉及中度鎮靜	全麻，單肺通氣
技術	單孔 (雙孔)	多孔
器械	切片夾等簡易器械	複雜各式功能器械

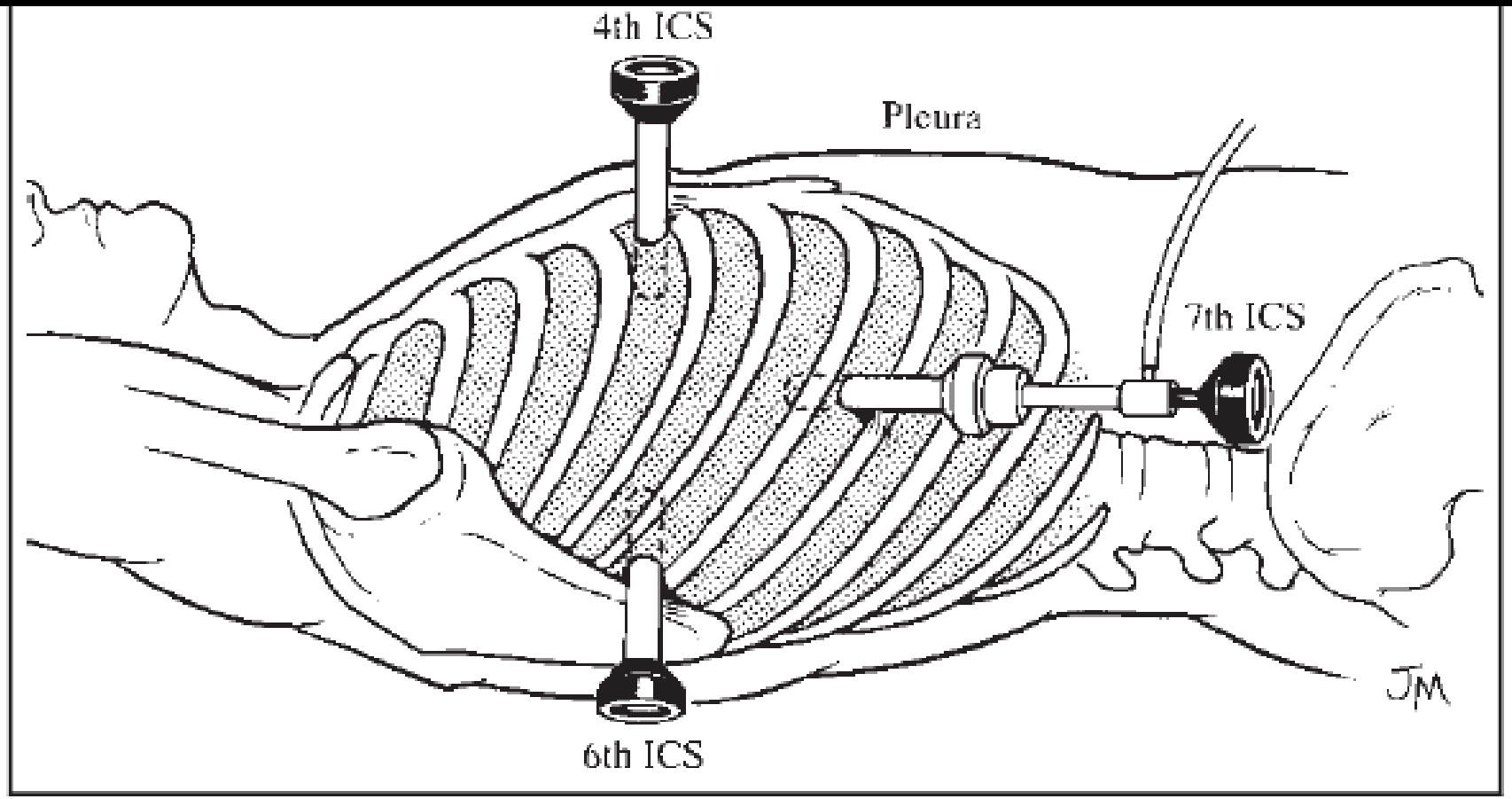


Fig. 2.1 Schematic drawing of the VATS access through three entry sites. (From Beamis JF Jr, Mathur PN, eds. Interventional Pulmonology. New York: McGraw-Hill; 1999. Reprinted with kind permission of McGraw Hill.)

肋膜腔鏡臨床角色

非侵入性

診斷

侵入性

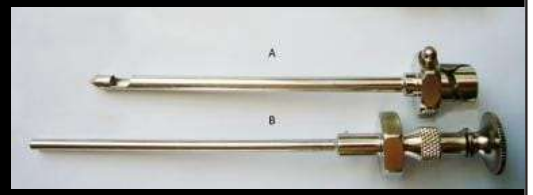
系統性

治療

局部性

肋膜腔鏡	肋膜腔鏡/VATS	VATS
肋膜積水	自發性氣胸	肺切片
不明原因肋膜積水	膿胸(第1、2期)	肺葉等切除
肺癌分期	胸壁或橫膈病灶	Decortication
惡性間皮瘤診斷分期	癌症分期	肋膜切除術
肋膜沾黏(TALC)		縱膈腔腫瘤等切除
		Pericardial Window
		食道手術

肋膜積水處理



Diagnostic approach to pleural effusions

Etiology unknown

Etiology probable (e.g., cardiac/renal)

Persistence with therapy

Improvement with therapy

1 Thoracentesis

Color? Protein?
Cells? Others?

Positive finding of
- Malignant cells
- Bacteria, fungi, etc.
- Other specific parameter, e.g., amylase (> serum)

Etiology unknown

2 Blind pleural biopsy

Histological finding of malignancy or tuberculosis

Etiology unknown

3 Thoracoscopy including biopsy

Follow-up

Etiology unknown (<10%)

In single cases open surgical biopsy

肋膜腔鏡在診斷肋膜積水的優勢

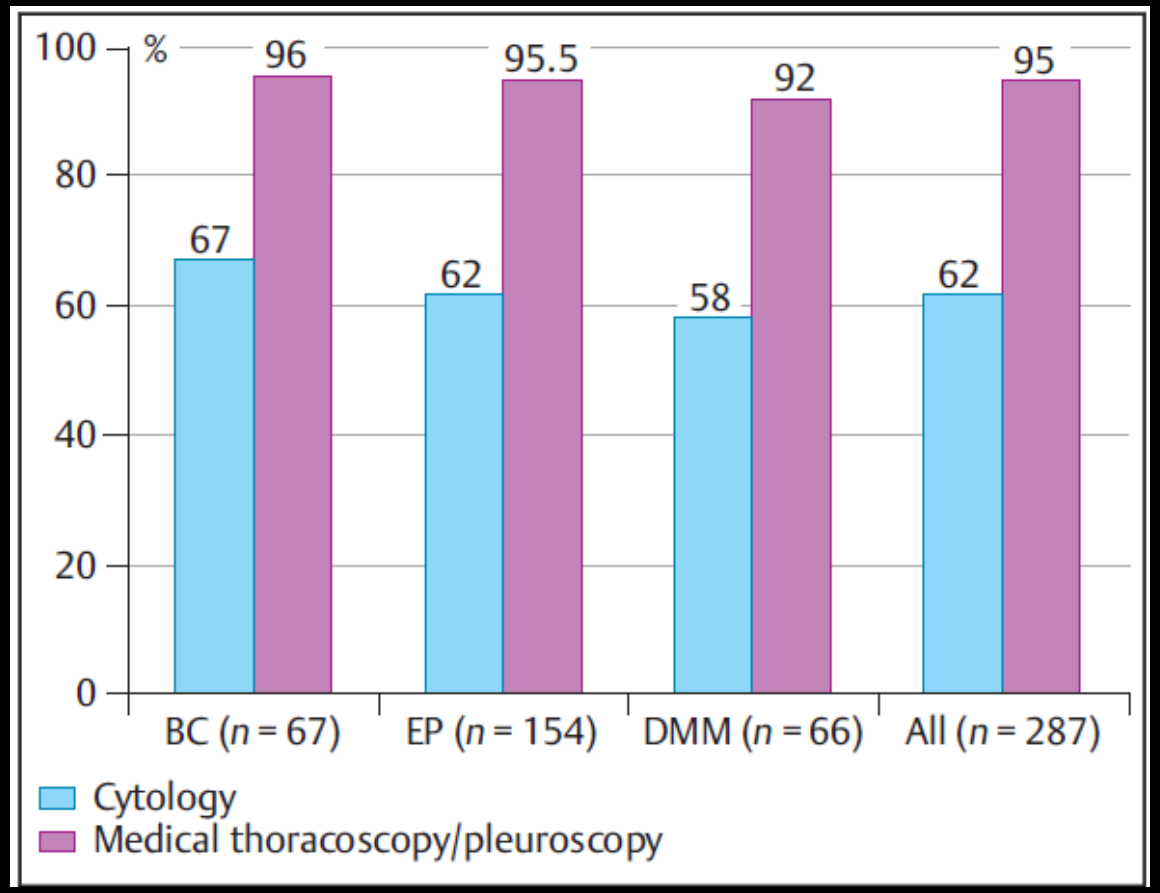
快速明確的活檢診斷，包括結核培養

活檢不僅來自胸壁胸膜，還來自橫膈膜，(可能可以來自肺和縱隔)

肺癌和瀰漫性間皮瘤的分期I 高概率排除惡性腫瘤和結核病

科學研究的黃金標準

肋膜腔鏡診斷惡性肋膜積水非常準確



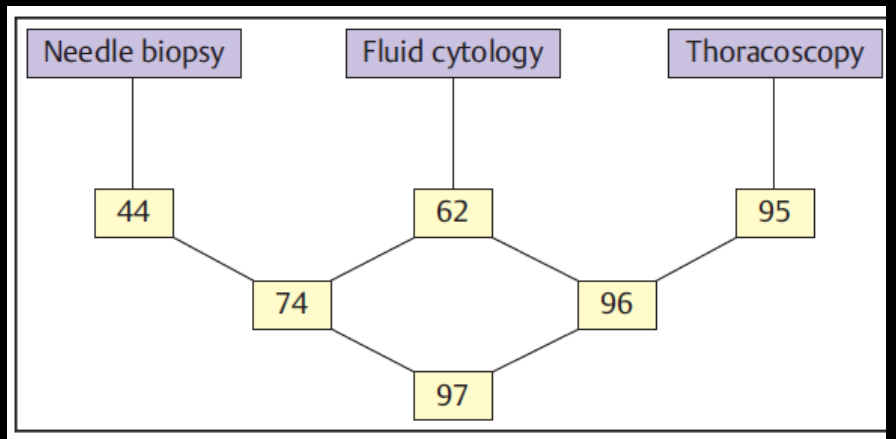


Fig. 3.8 Sensitivity (%) of different biopsy methods in malignant pleural effusions (prospective simultaneous comparison, *n* = 206 (Loddenkemper et al. 1983 b.)

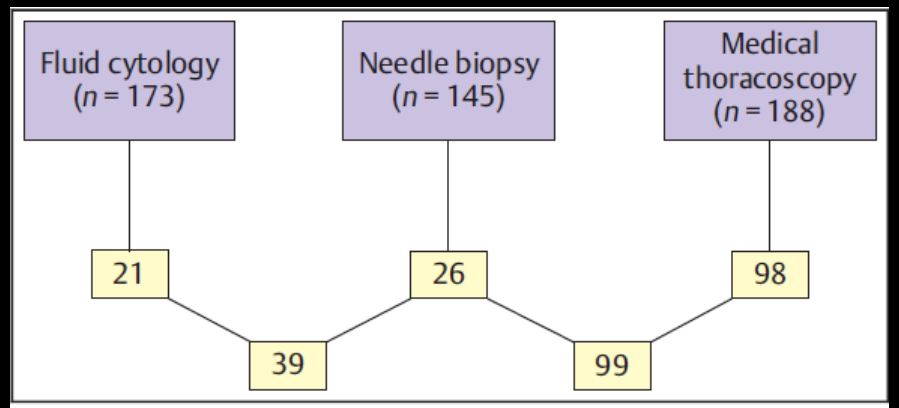
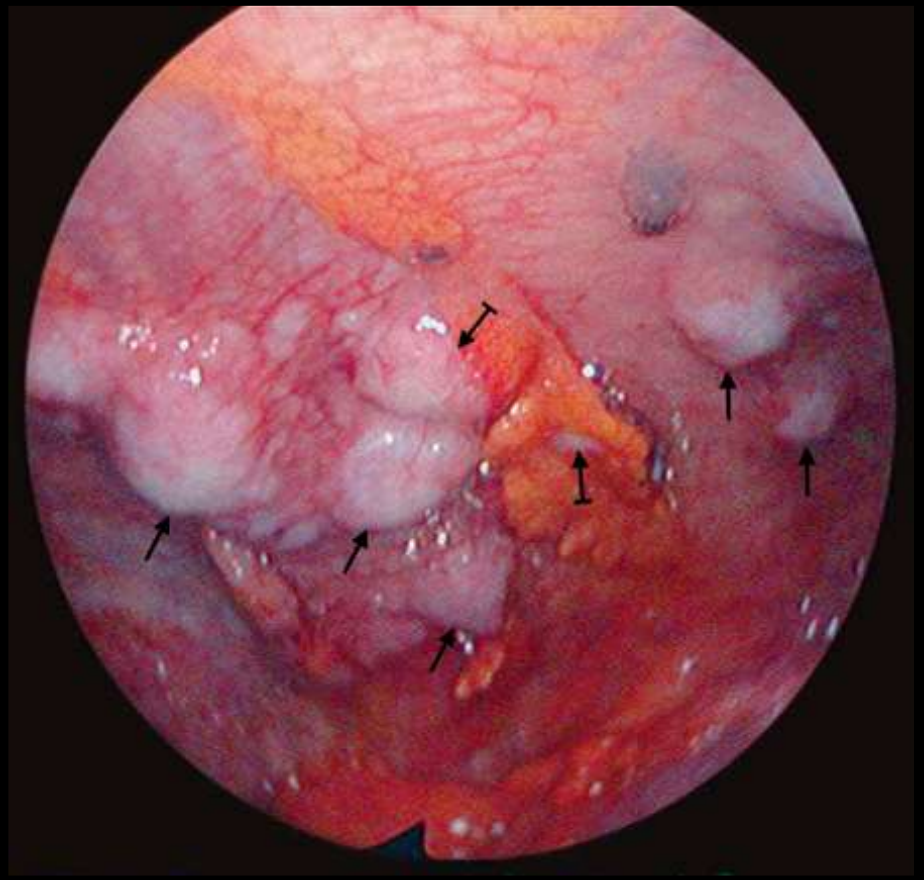
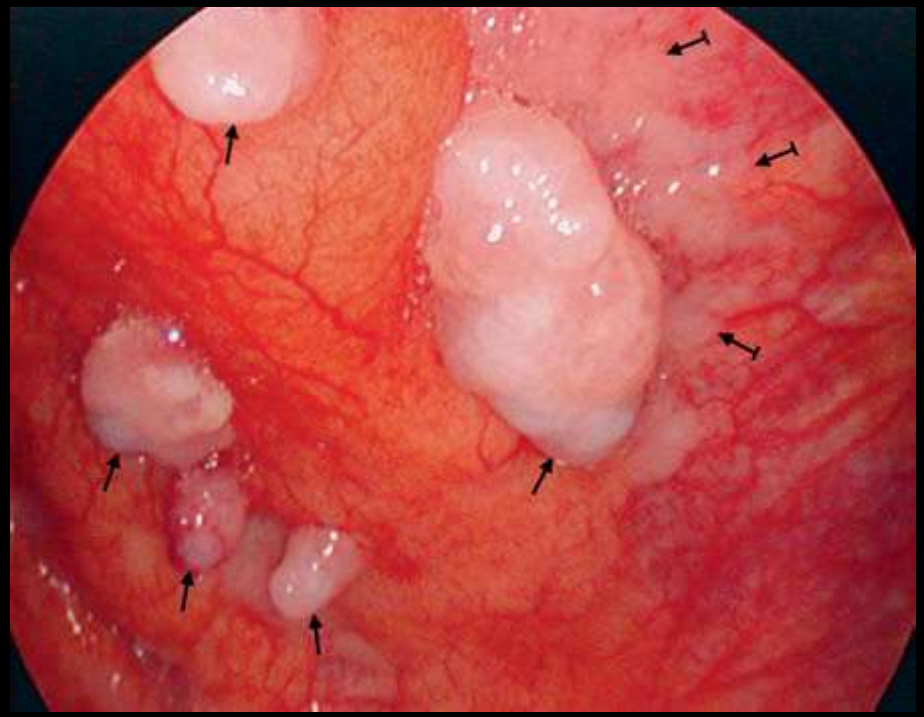


Fig. 3.10 Sensitivity (%) of different biopsy methods in diffuse malignant pleural mesothelioma. (Modified from Boutin and Rey 1993).

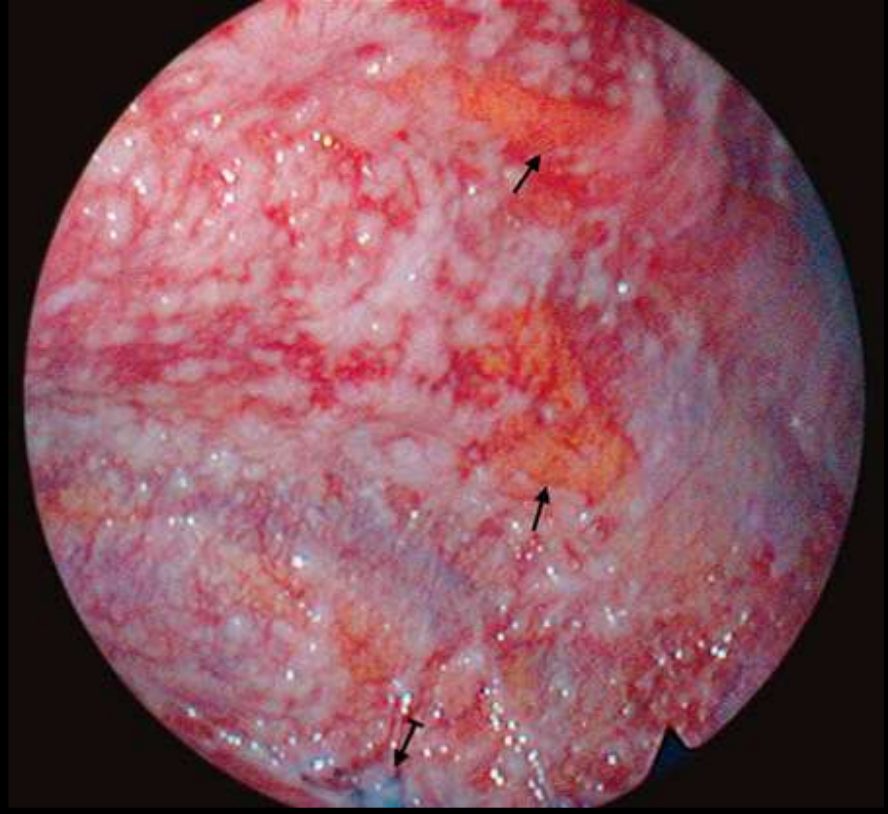
Malignant pleural effusion due to small-cell lung cancer: several small to middle-sized tumornodules (→) on the anterior chest wall and in the fatty tissue (↦).



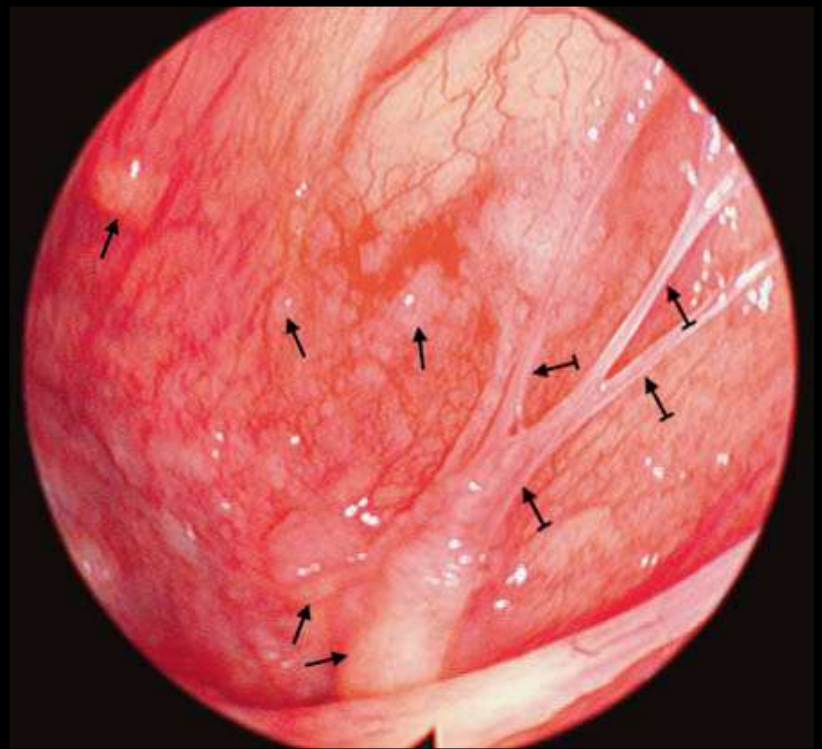


Malignant pleural effusion due to small-cell lung cancer, there is ubiquitous tumor growth on the right visceral and parietal pleura; here middle-sized nodules (→) and flat infiltrations (↦) on the posterior chest-wall pleura.

Medical thoracoscopy/pleuroscopy : manual and atlas



Progressive malignant pleural effusion due to adenocarcinoma of the middle lobe: diffuse patchy whitish nodular tumor infiltrations, here on the posterior chest wall, and only small areas of normal fatty pleura surface (→). One spot with anthracotic pigmentation (↦).



Malignant pleural effusion due to adenocarcinoma of the left
lower lobe : a thickened and red chest-wall tumor with tumor nodules of different sizes (→) and a few fibrinous bands (↦).

Medical thoracoscopy/pleuroscopy : manual and atlas

Cauliflower-like
Grapes-like

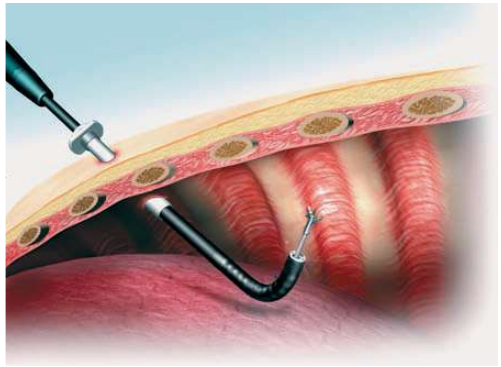
Malignancy

Sensitivity of Different Biopsy Methods in Malignant Pleural Effusions in CGMH Chiayi

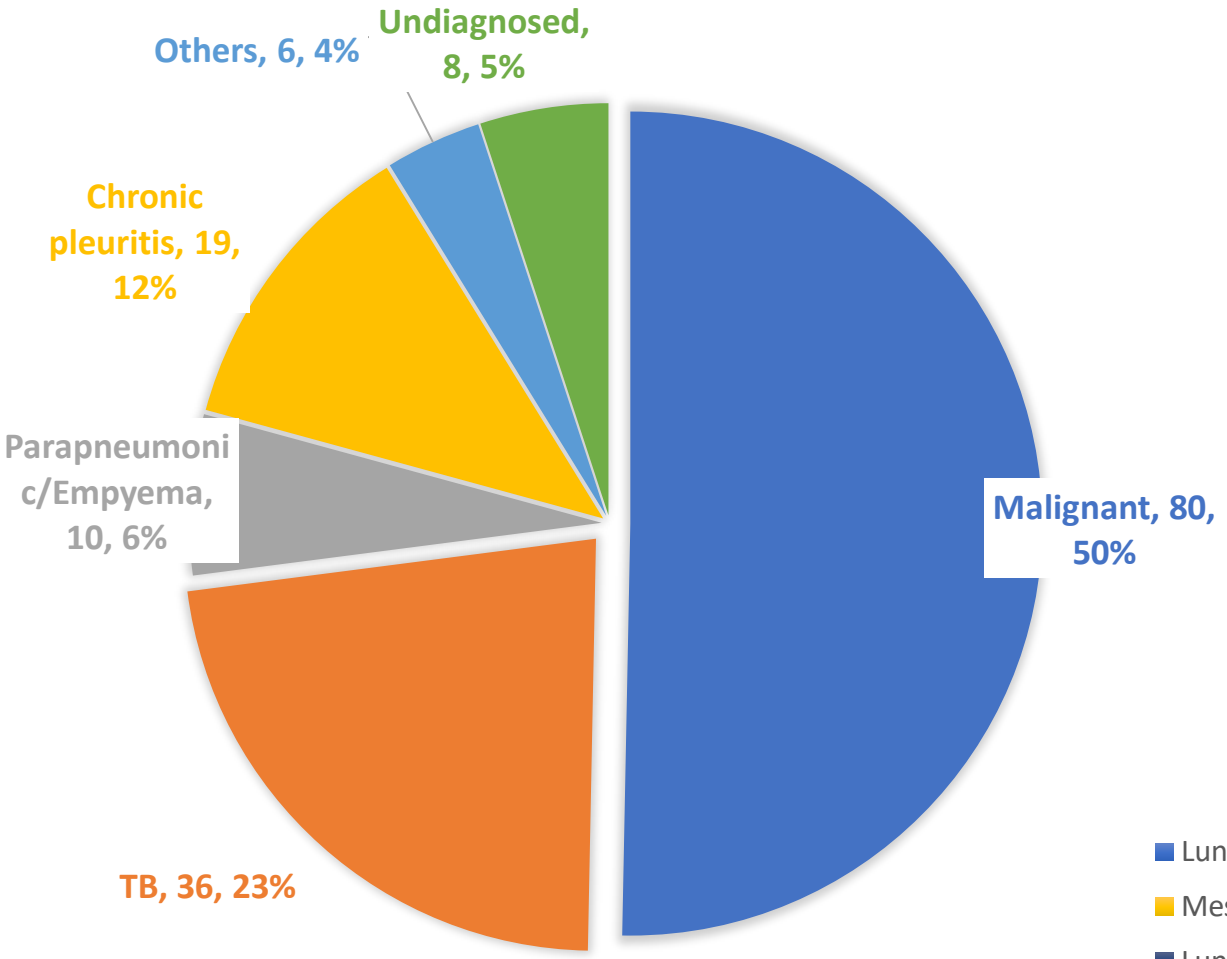
Closed pleural Biopsy	Fluid cytology	Thorocoscopy
41%	52%	93%
67%		95%

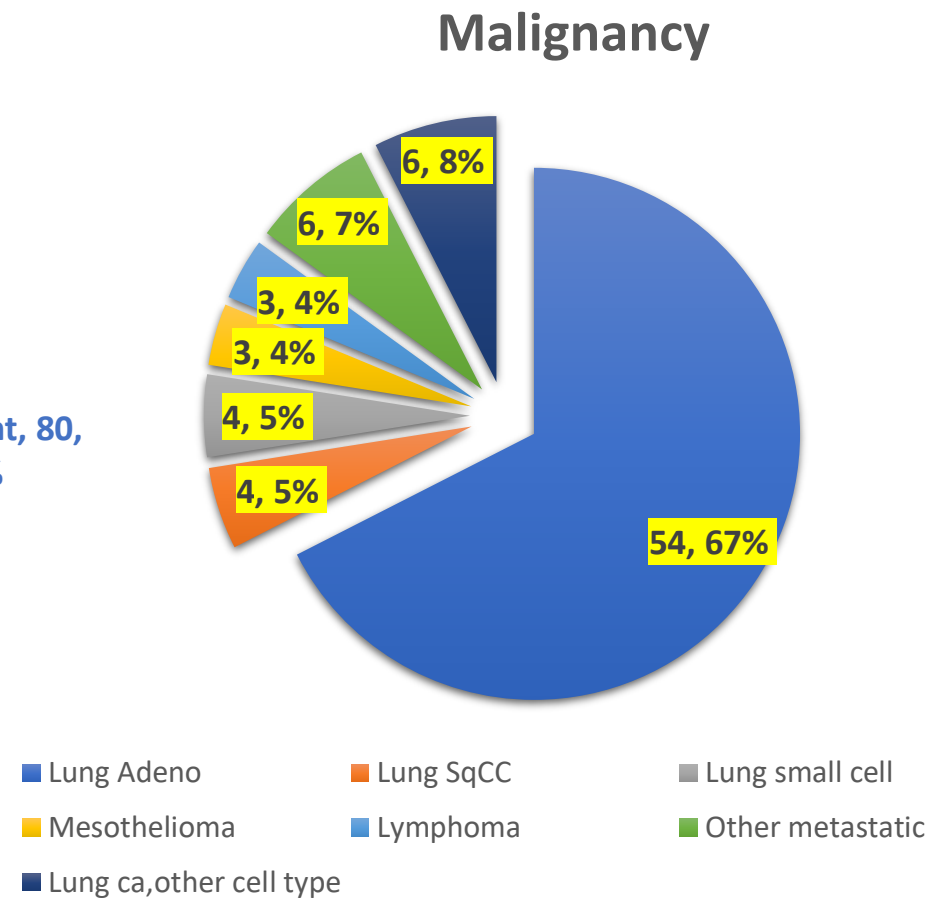
88 cases
2010~2014

85 cases s/p MP
80 cases dx by MP
2015~2020



159 PLEUROSCOPY DX IN CGMH CHIAYI





- **63 lung cancer cases sent for further examination, ex EGFR…**
- **2/63 (3%)tissue insufficient for all examination**

How Do Pleural Biopsy Techniques Perform at Providing Adequate Molecular Diagnostic Information in Malignant Pleural Effusions?

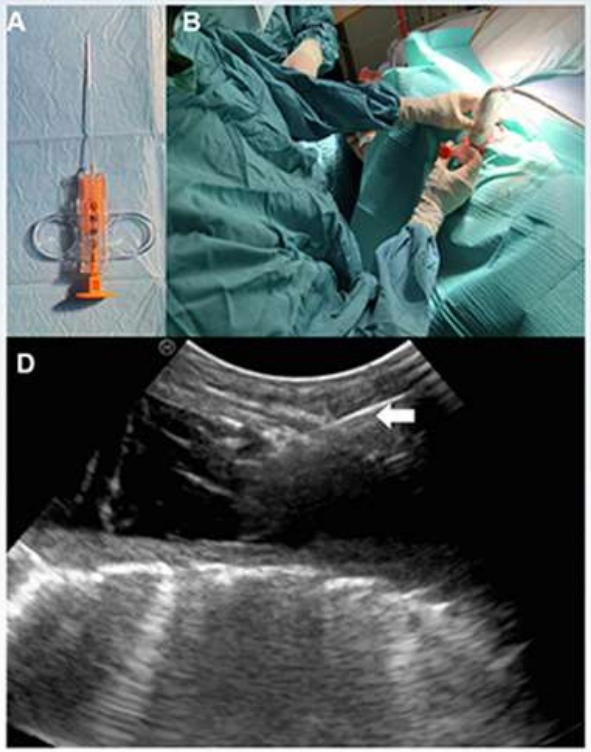
STUDY DESIGN

- 183 patients with confirmed malignant pleural biopsy and molecular profiling from four sites across three countries
- Compared local anesthetic thoracoscopy (LAT), CT-guided pleural biopsy, and ultrasound (US)-guided pleural biopsy

RESULTS

	LAT	CT-guided pleural biopsy	US-guided pleural biopsy
N (%)	105 (57%)	12 (7%)	66 (36%)
Yield of successful molecular marker analysis %	95%	95%	86%

Adjusted OR for successful diagnosis for LAT: 30.16 (95% CI, 3.15-288.56)



Although previous studies have shown comparable overall diagnostic yields, in the modern era of targeted therapies, LAT offered superior results to image-guided techniques at achieving molecular profiling and remains the optimal diagnostic tool.

Sundaralingam A, et al. *CHEST* May 2023 | @journal_CHEST | https://doi.org/10.1016/j.chest.2022.11.019

嘉義長庚紀念醫院

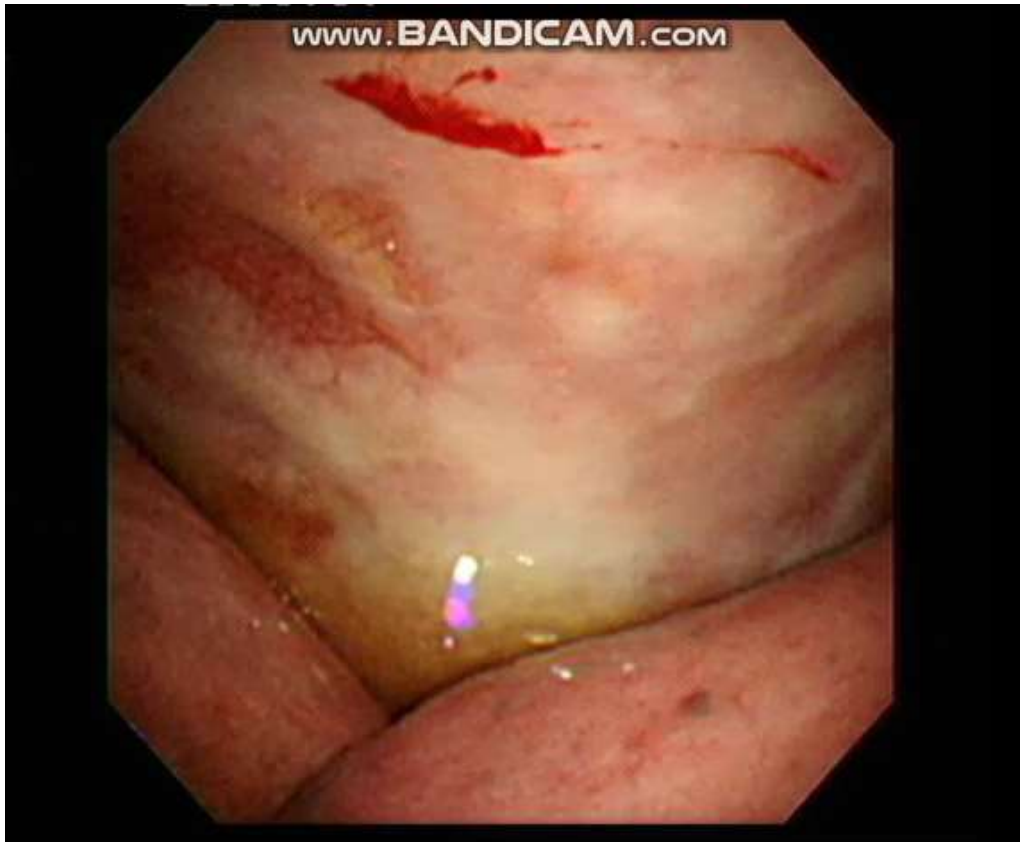
Dyspnea:
Thoracentesis Q2M, cytology all negative

Right lower flank pain, progression

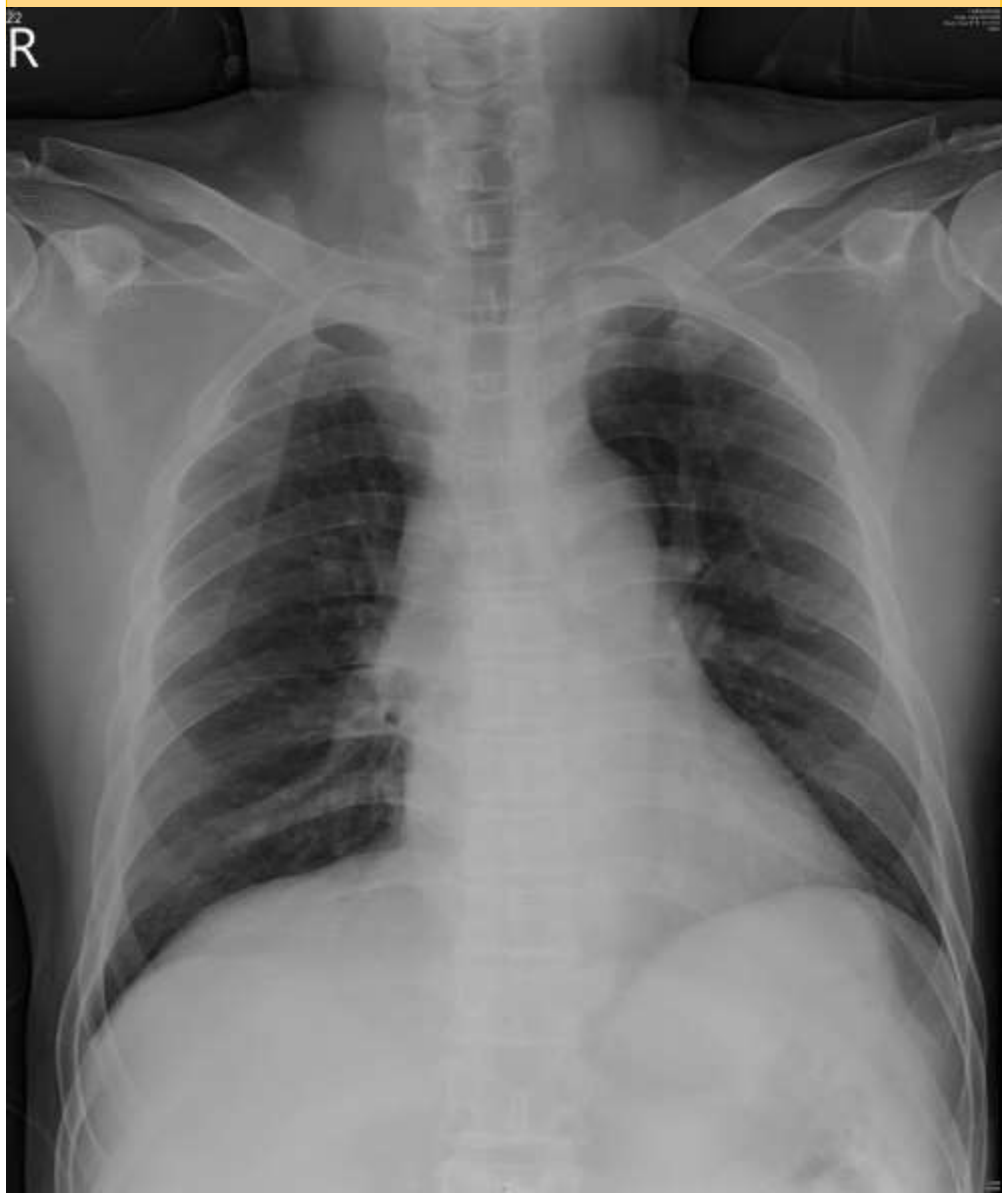
嘉義長庚紀念醫院

DX Pleura, right, biopsy----metastatic squamous cell carcinoma

PD-L1: High expression [Tumor proportion score (TPS) 99%]



- IO:Penprolizumab 200mg Q3W

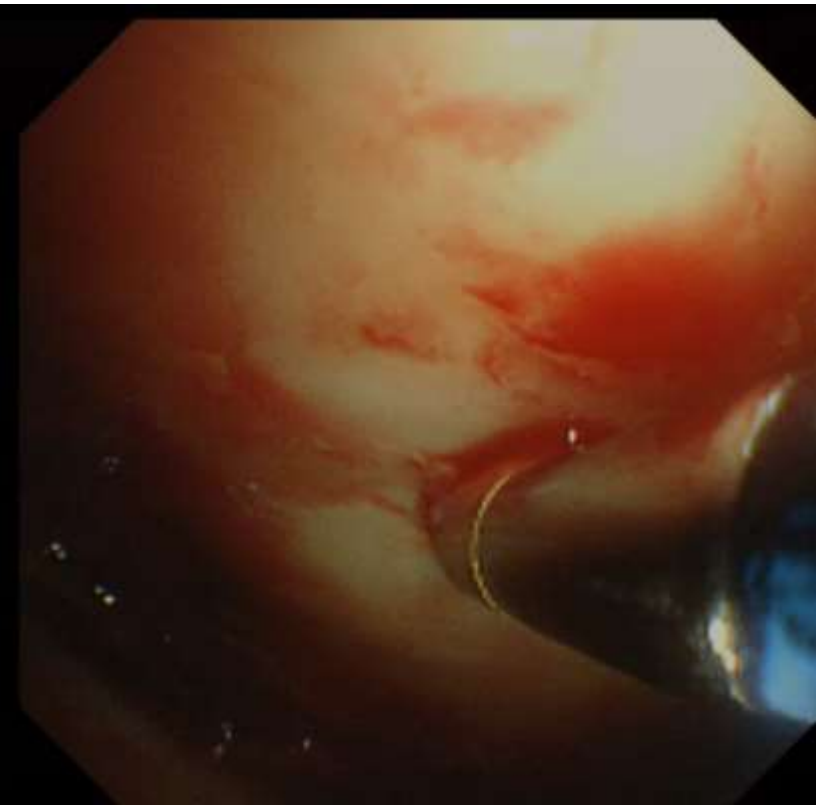


Re-biopsy by Pleuroscope

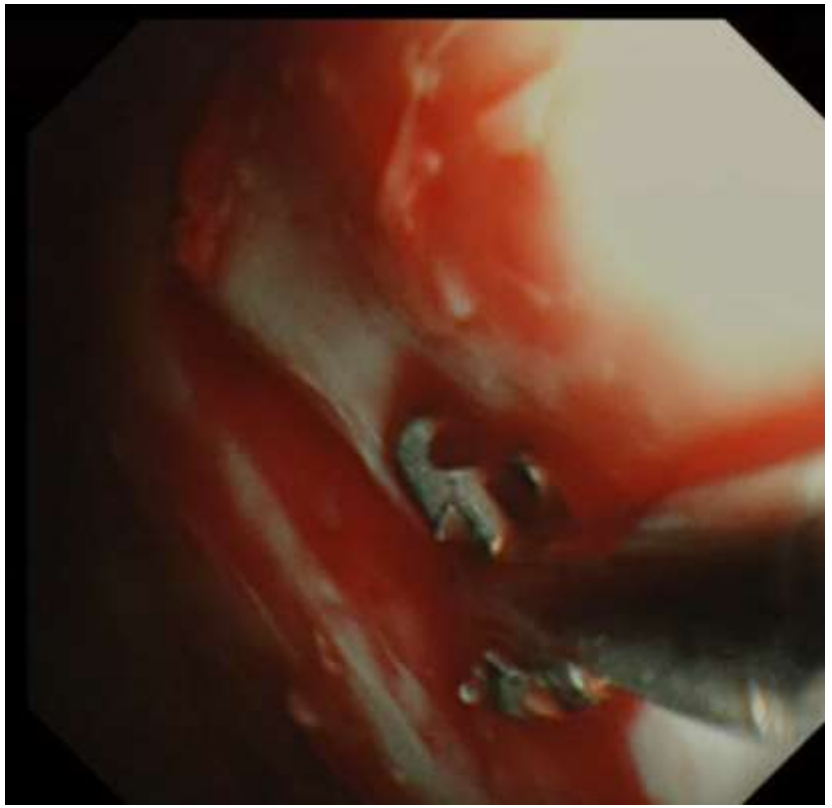
- 18 lung cancer with pleural effusion Re-biopsy
- Diagnostic yield : 16/18 (89%)
  - Non cancer cause: 1 TB pleurisy, 1 chronic pleuritis
  - Missing diagnosis: 1 atypia , 1 chronic inflammation
  - 14 pathology confirmed malignant pleural effusion,
    - Only 33% cytology positive
    - Pleuroscope finding:
      - Nodule lesions 3/14
      - Pleura fibrotic change 12/14
      - Adhesion 8/14

Re-biopsy by Pleuroscope

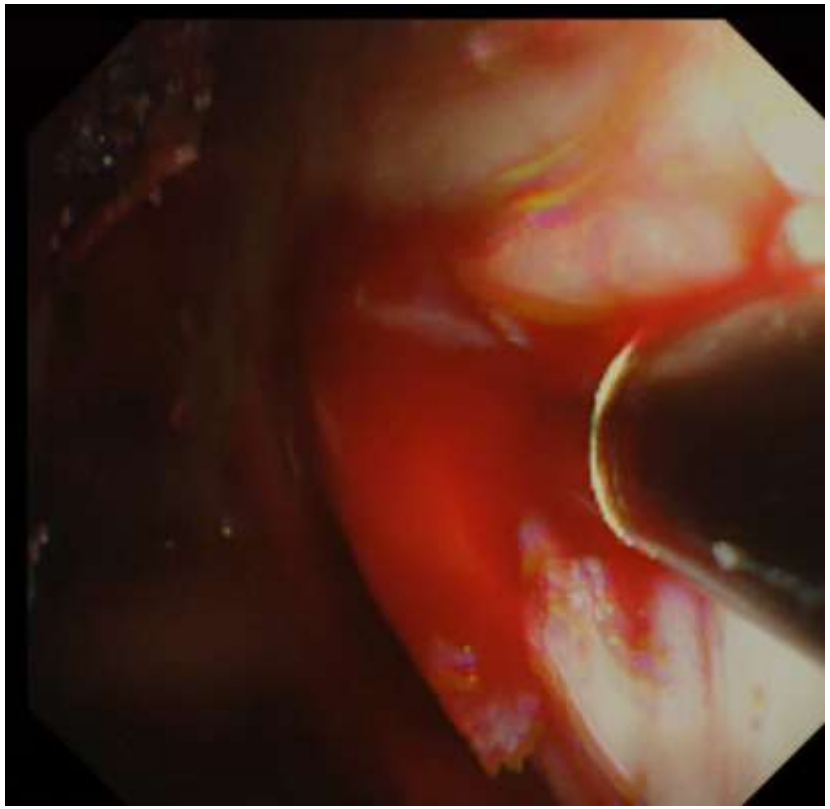
Failure Cryobiopsy attempt



Forceps Got tiny tissue



Acceptable tissue by cryoprobe



結核菌肋膜炎診斷方法

Table 1. – Accuracy of all methods for tuberculous pleurisy

	Positive (false) n	Negative (false) n	Sensitivity %	Specificity %	Positive PV	Negative PV
Bronchial wash	3 (0)	48 (39)	7	100	1	0.19
Pleural fluid						
Culture	3 (0)	48 (39)	7	100	1	0.19
ADA $\geq 50 U \cdot L^{-1}$	37 (1)	9 (2)	95	89	0.97	0.8
L:N ≥ 0.75	41 (4)	10 (5)	88	56	0.9	0.5
ADA $\geq 50\ U \cdot L^{-1}$ and L:N ≥ 0.75	33 (0)	13 (4)	89	100	1	0.69
Abrams needle						
Histology and AFB stain	28 (0)	23 (14)	67	100	1	0.39
Culture	20 (0)	31 (22)	48	100	1	0.29
Overall	33 (0)	18 (9)	79	100	1	0.5
Medical thoracoscopy						
Histology and AFB stain	42 (0)	9 (0)	100	100	1	1
Culture	32 (0)	19 (10)	76	100	1	0.47
Overall	42 (0)	9 (0)	100	100	1	1
Combined Abrams needle, ADA $\geq 50 U \cdot L^{-1}$ and L:N ≥ 0.75	39 (0)	12 (3)	93	100	1	0.75

PV: predictive value; ADA: adenosine deaminase; L:N: lymphocyte/neutrophil ratio; AFB: acid fast bacilli. ADA available for n=46.

Eur Respir J 2003; 22: 589–591

結核性肋膜炎診斷率高且可獲得培養結果

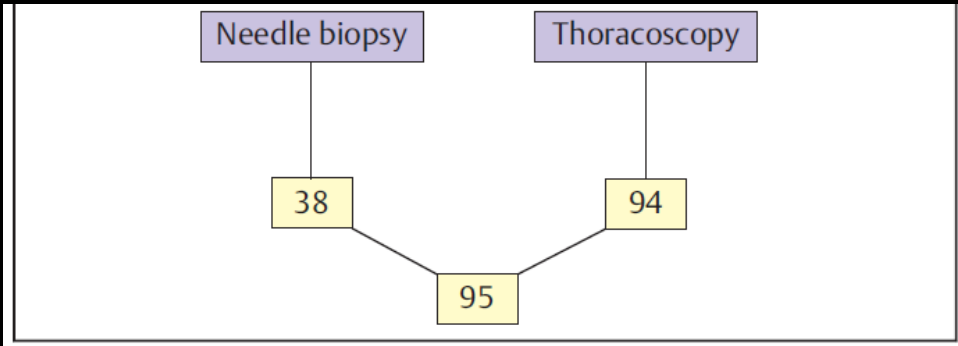


Fig. 3.11 Histological yield (%) of blind needle biopsy and medical thoracoscopy/pleuroscopy in tuberculous pleural effusions (prospective simultaneous comparison, $n = 100$). (Modified from Loddenkemper et al. 1983 b.)

Histological yield

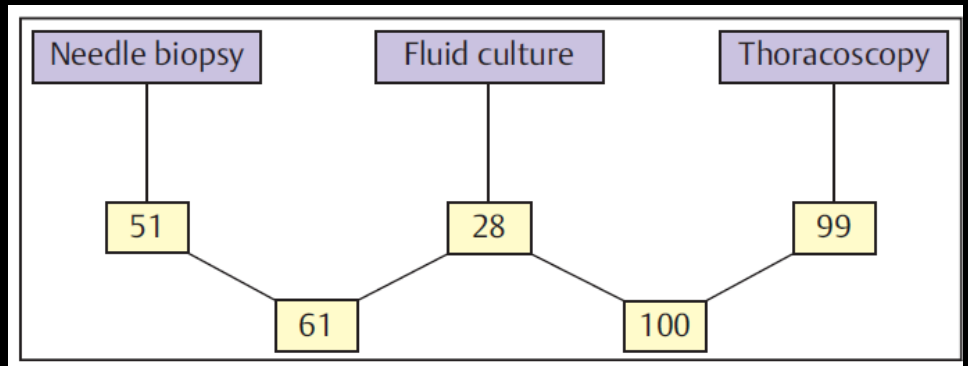


Fig. 3.12 Combined histological and bacteriological yield (%) of different biopsy methods in tuberculous pleural effusions. (Modified from Loddenkemper et al. 1983 b.)

Histological & culture yield

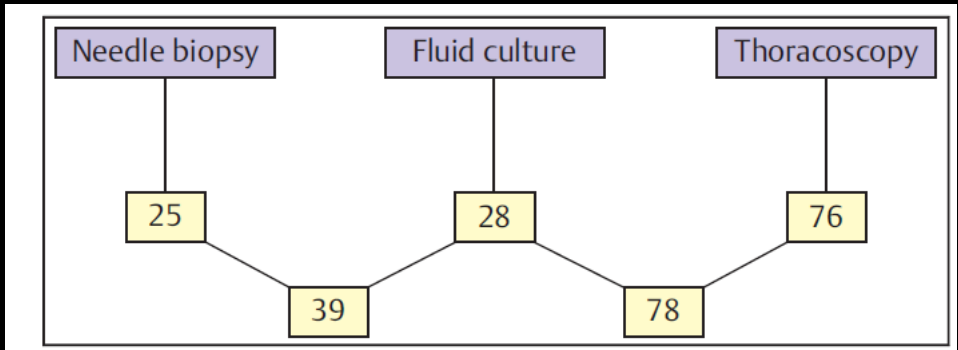


Fig. 3.13 Cultural yield (%) of different biopsy methods in tuberculous pleural effusions. (Modified from Loddenkemper et al. 1983 b.)

Culture yield

The percentage of **positive TB cultures** was **twice as high** from thoracoscopic biopsies

嘉義長庚 肋膜腔鏡&肋膜切片 診斷結核性肋膜炎

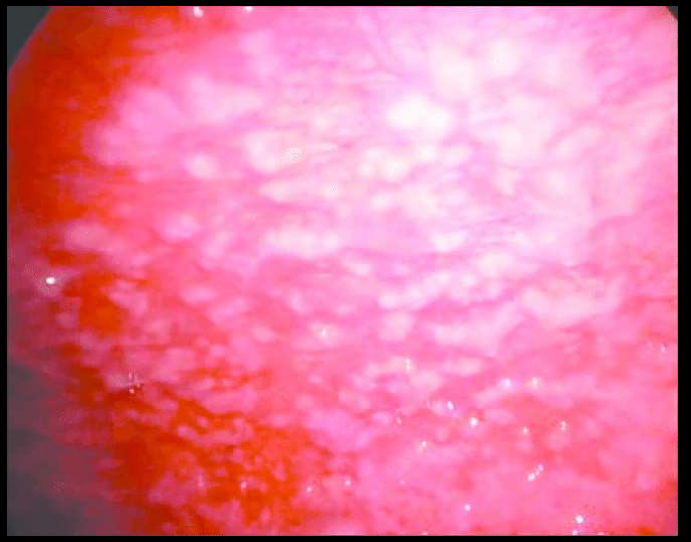
	肋膜腔鏡 (n=24)	傳統肋膜切片 (n=32)
肋膜切片組織		
細菌學診斷	63% (15)	
組織AFS陽性	33% (8)	6% (2)
組織培養陽性	63% (15)	N/A
病理診斷	95% (23)	91% (29)
肋膜積水培養陽性	37% (9)	22% (7)
痰液培養陽性	33% (8)	40% (16)
藥物敏感測試	92% (22)	59% (13)

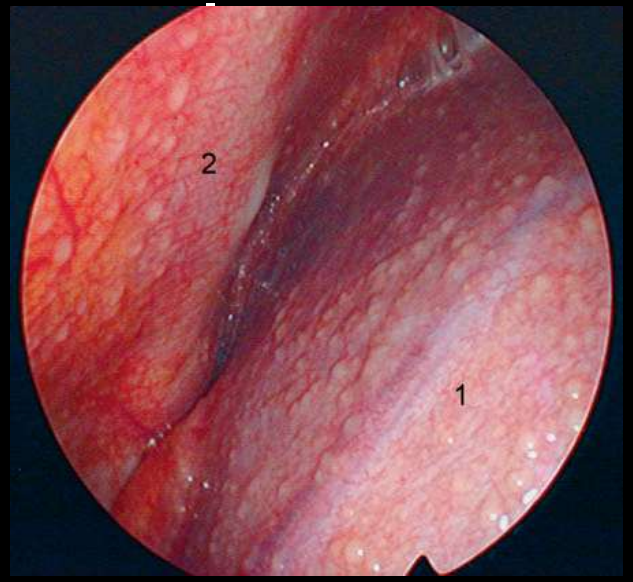
肋膜腔鏡診斷結核肋膜炎好處

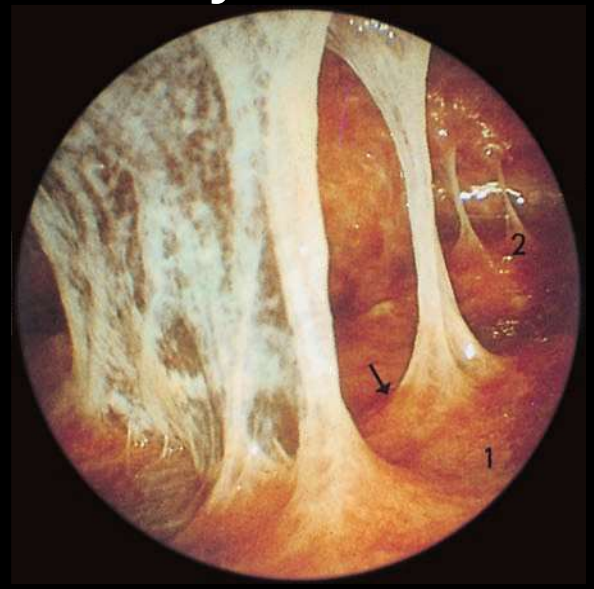
- 肋膜腔鏡可以證明或排除結核病低
  - ADA 案例 (12%)
- 胸腔鏡活檢更常產生陽性結核培養物
  - 獲得藥敏試驗的可能性增加
- 立即徹底引流，更直接的症狀改善

肋膜腔鏡下結核性肋膜炎

- **Diffusely thickened pleura,**
- **Multiple adhesions,**
- **Formation of encapsulating membranes with fluid loculations,**
- **“Sagolike” pleuritis with miliary tuberculous**



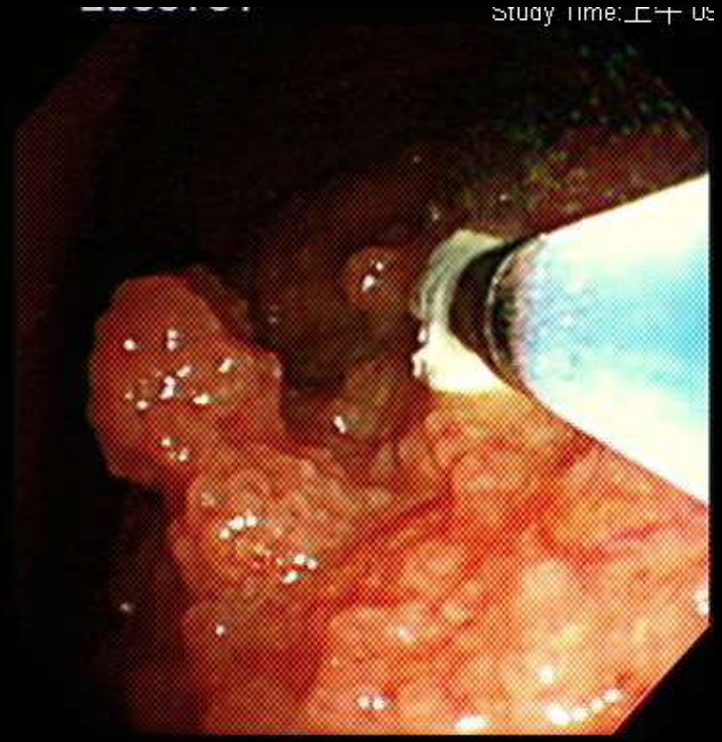




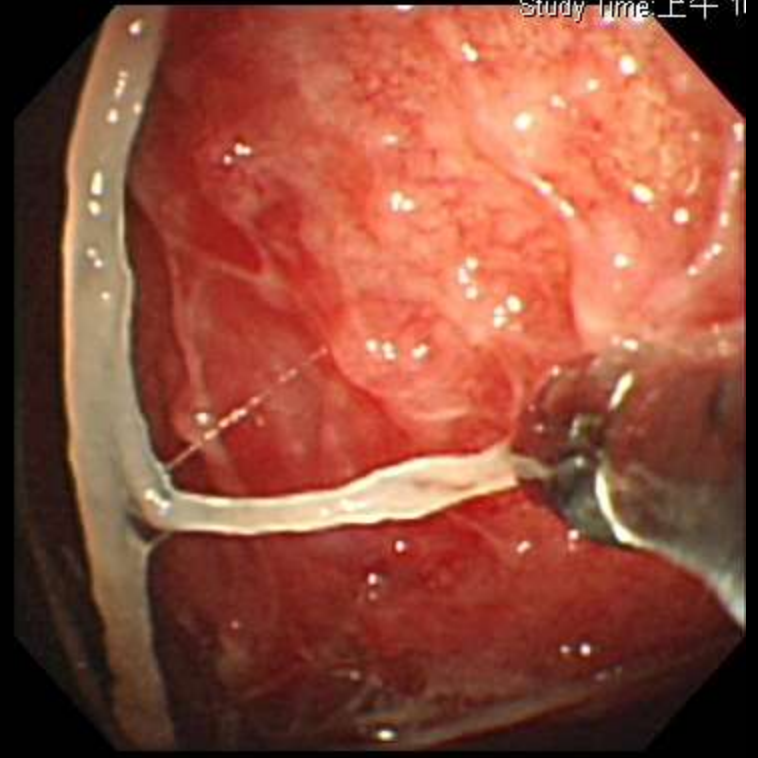
Medical Thoracoscopy/Pleuroscopy:Manual and Atlas, 2010, Robert Loddenkemper

Sago-like Pleuritis

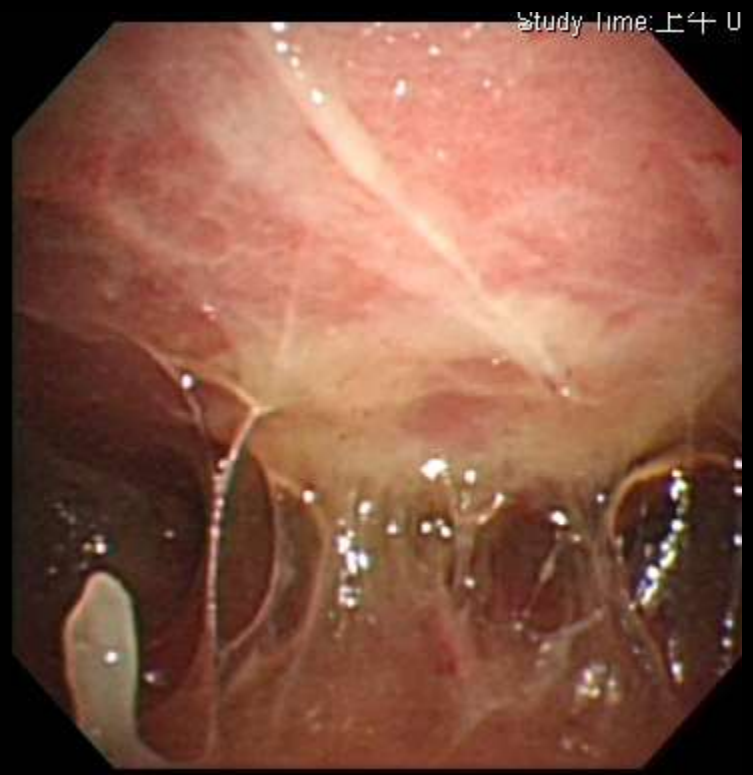
Sago-like nodule



Tubercle



Fibrin, adhesion



- **Encapsulating membranes with fluid loculations**
- **Multiple adhesion**

Fibrotic change, Adhesion

肋膜鏡在肺炎肋膜積水及膿胸好處

- 類似於胸管插入的技術
- 胸管放置位置的直接可視化
- 肋膜表面的檢查和表徵觀察
- 解開肋膜腔中間隔，製造一個單一引流空間

肋膜鏡在肺炎肋膜積水及膿胸

Table 3.6 Outcome (%) in parapneumonic pleural effusions in the management of complicated treatment

Outcome	D. Kaiser[a] ($n = 376$)	W. Frank[b] ($n = 66$)	Total ($n = 442$)
Complete remission	82	64	79
Partial remission	10	25	12
Failure	8	11	9
Surgery necessary	6	6.5	6
30 days mortality	3	10	4

From Loddenkemper et al. (2004) with permission from ERS Journals Ltd.
[a] Department of Thoracic Surgery, Lungenklinik Heckeshorn (1985–2000).
[b] Department of Pneumology, Treuenbrietzen (1995–2002).

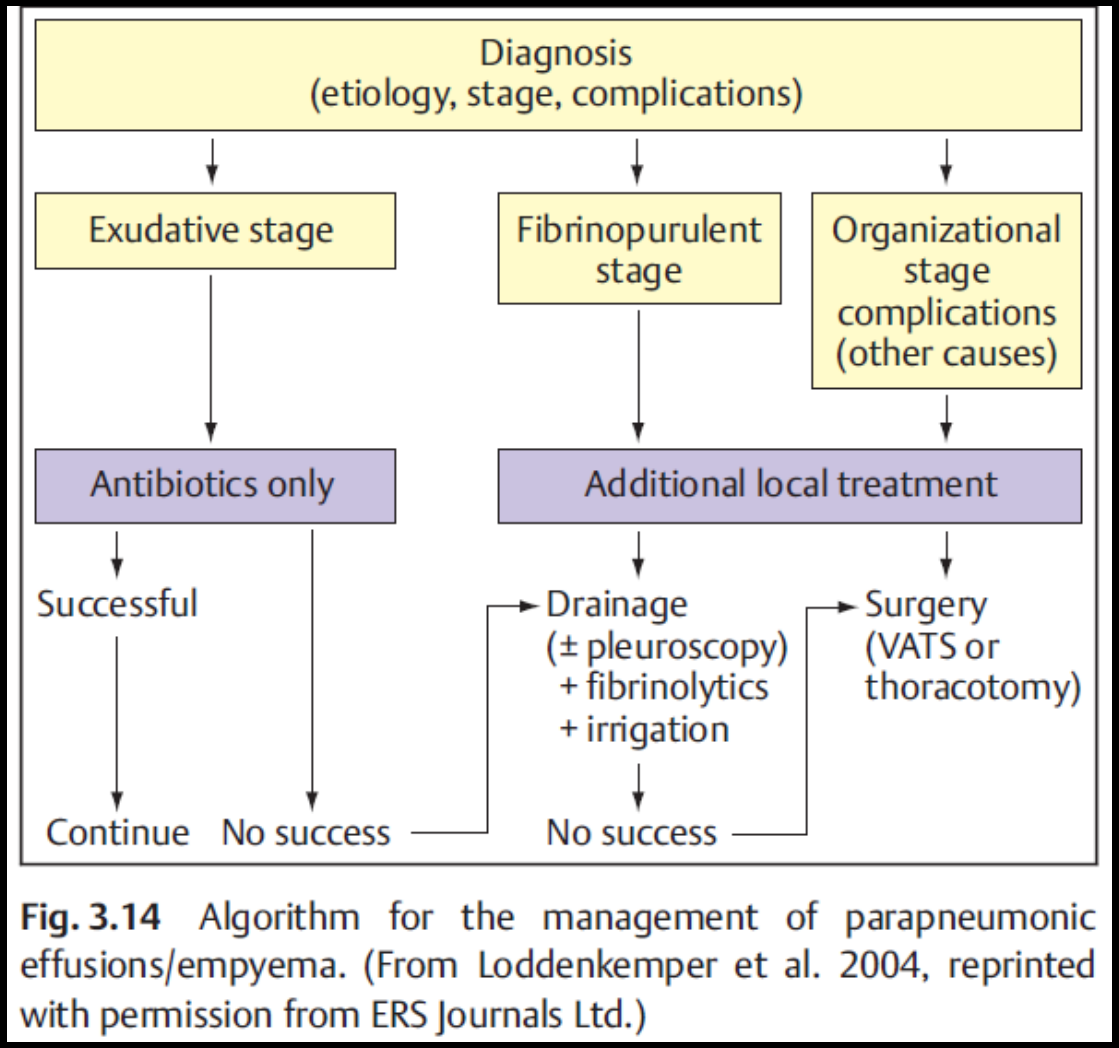
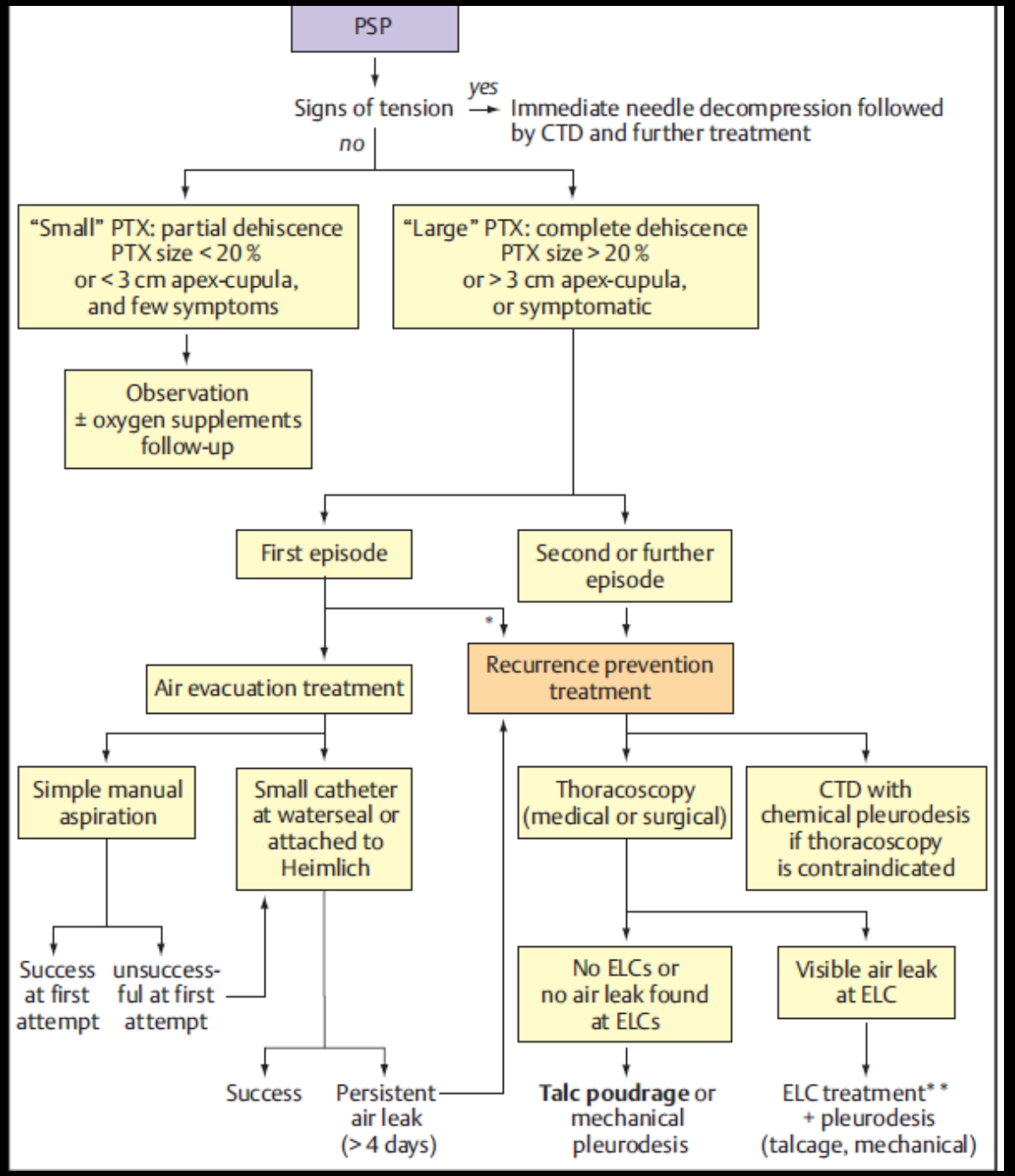


Fig. 3.14 Algorithm for the management of parapneumonic effusions/empyema. (From Loddenkemper et al. 2004, reprinted with permission from ERS Journals Ltd.)

肋膜腔鏡於氣胸


PSP
Signs of tension
yes
Immediate needle decompression followed by CTD and further treatment
no
"Small" PTX: partial dehiscence
PTX size < 20 %
or < 3 cm apex-cupula,
and few symptoms
"Large" PTX: complete dehiscence
PTX size > 20 %
or > 3 cm apex-cupula,
or symptomatic
Observation
± oxygen supplements
follow-up
First episode
Second or further episode
*
Air evacuation treatment
Recurrence prevention treatment
Simple manual aspiration
Small catheter at waterseal or attached to Heimlich
Thoracoscopy (medical or surgical)
CTD with chemical pleurodesis if thoracoscopy is contraindicated
Success at first attempt
unsuccess-ful at first attempt
No ELCs or no air leak found at ELCs
Visible air leak at ELC
Success
Persistent air leak (> 4 days)
Talc poudrage or mechanical pleurodesis
ELC treatment** + pleurodesis (talcage, mechanical)

肋膜腔鏡於氣胸

類似於胸管插入的技術（局部麻醉/鎮痛，無插管）

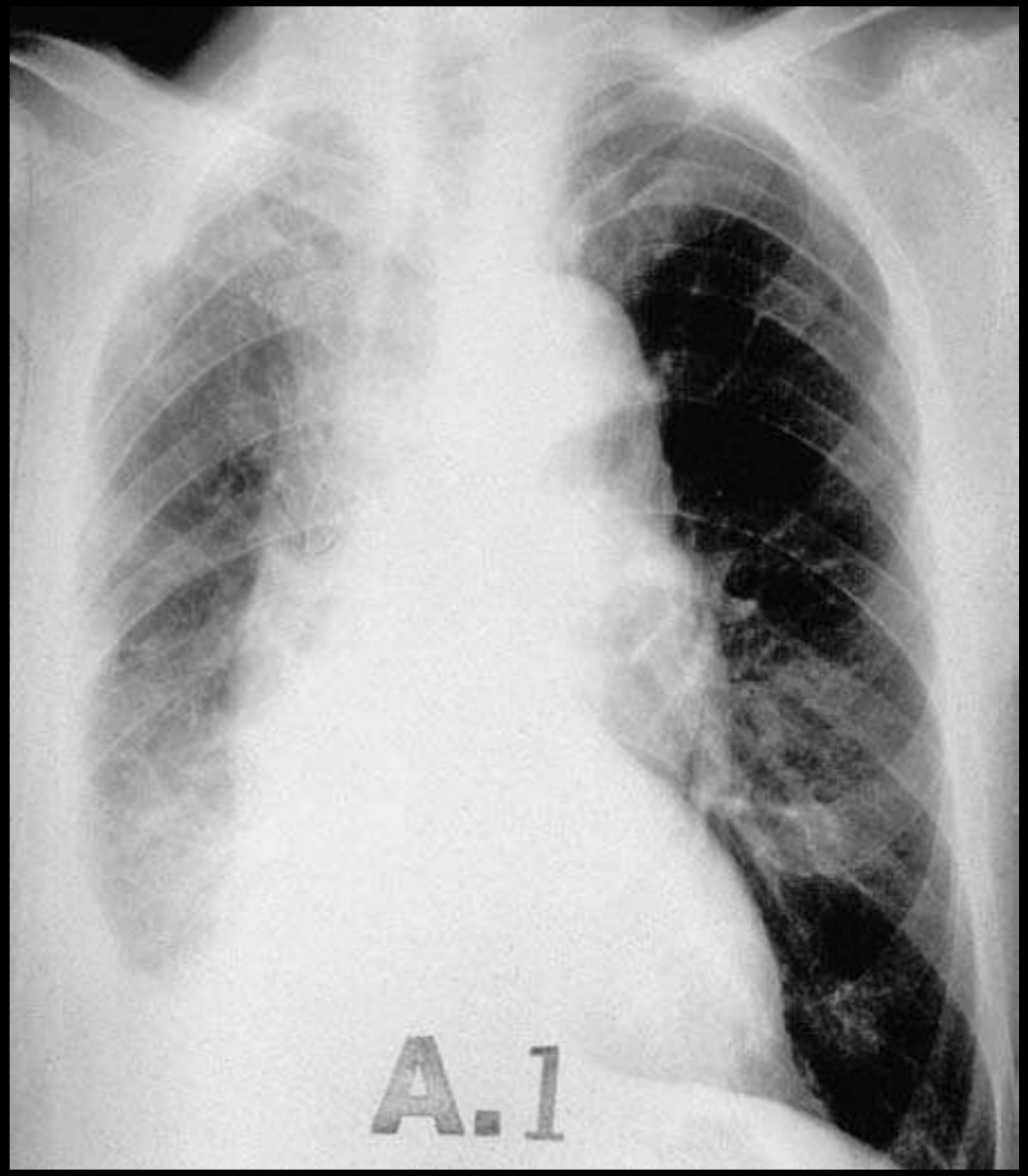
粘連、水皰、大皰、漏氣的可視化

初級治療的選擇（保守或手術方法）

其他保守治療選擇：凝血、滑石粉、fibrin sealant、機械性沾黏等。

絕對禁忌症

- 由於以下原因導致**肋膜腔空間不足**：
  - **晚期膿胸**
  - 不明病因胸膜增厚
  - 疑似間皮瘤臟層肋膜和胸腔壁層肋膜融合



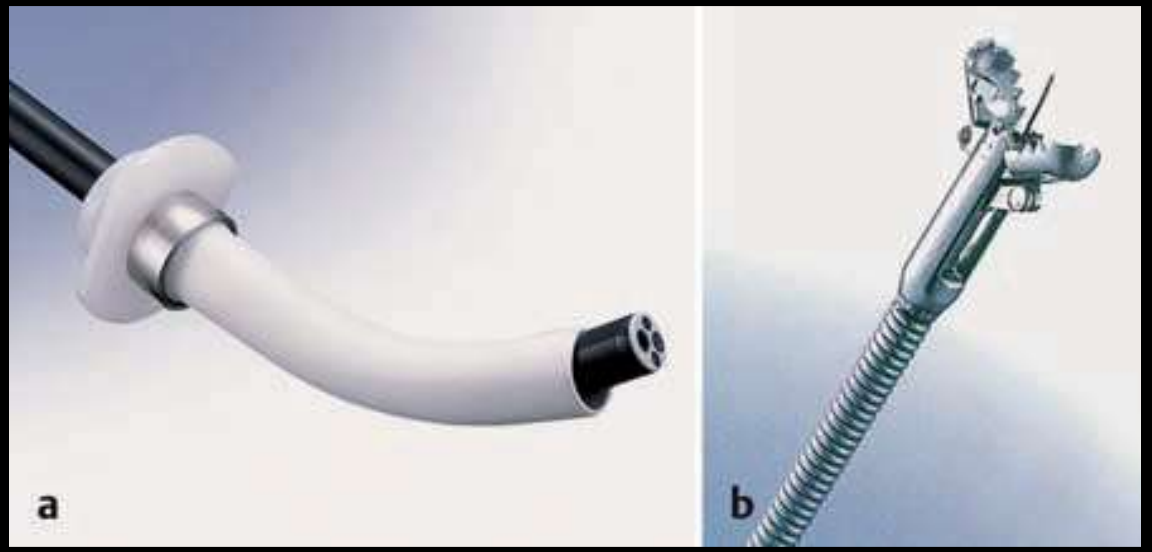
相對禁忌症

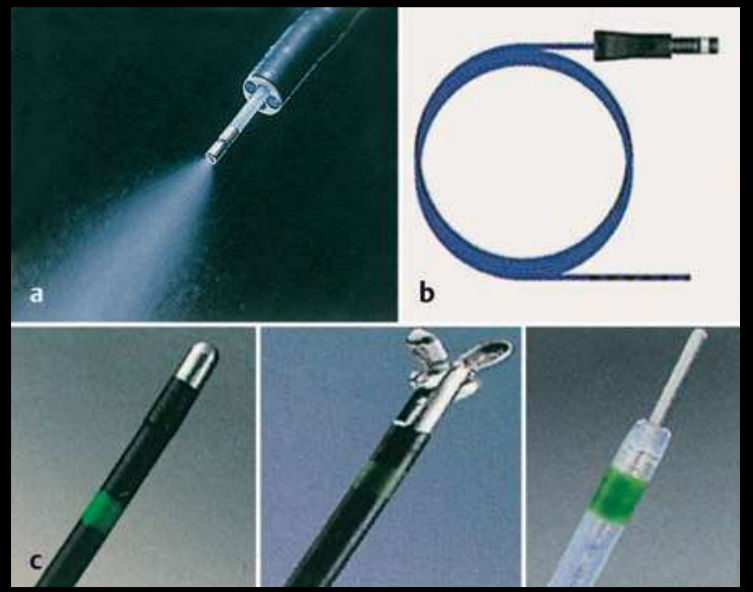
- 無法忍受側臥位
- 心血管或血流動力學不穩定
- 存在嚴重的、無法糾正的低氧血症
- 出血素質
- 肺動脈高壓
- 難治性咳嗽
- 藥物過敏
- 預期餘命過短

內視鏡室

- 胸腔鏡台：可以是一個簡單的手術台，理想是射線可透的，有高度調節和可升高操作的靠背。
- 在單獨的無菌台上放置胸腔鏡、套管針(Troca)、器械等所有配件
- 可調節胸腔積液抽吸設備，連接到負壓，2 升或更大的收集瓶
- 簡單的麻醉設備，帶有氧氣供給
- 可調亮度的頂燈
- 電燒設備
- 內視鏡光源機及影像設備
- 可調閱病人影像及病歷之電腦
- 超音波
- 急救車


a
b
c


a
b


a
b
c

無菌

- 必須在嚴格無菌的條件下進行：所有材料都仔細清洗後經過消毒
- 器械消毒、清洗、滅菌方法插管應根據感控規定。
- 消毒前清潔應在內視鏡上分泌物尚未乾燥之前浸沒在蛋白質溶解，含次氯酸鹽，消毒和清潔溶液；Working channel 應充滿消毒液，清潔應該繼續至少 15 分鐘。
- 也可以機械清潔應使用乾淨的軟化水。
- 最後消毒階段最好用含醛的溶液，例如 Cidex，其中添加市售活化劑。需要大容器和戴手套操縱儀。
- 然後應以軟化水沖洗器械。
- 也可在高壓釜中對光學器件進行高壓滅菌或通過環氧乙烷 (ethylene oxide)消毒

無菌

操作醫師和助手用標準的手術刷手技術，然後穿上無菌長袍/帽子/口罩和手套。

患者的皮膚進行大面積消毒，因此可能有不同的入口點

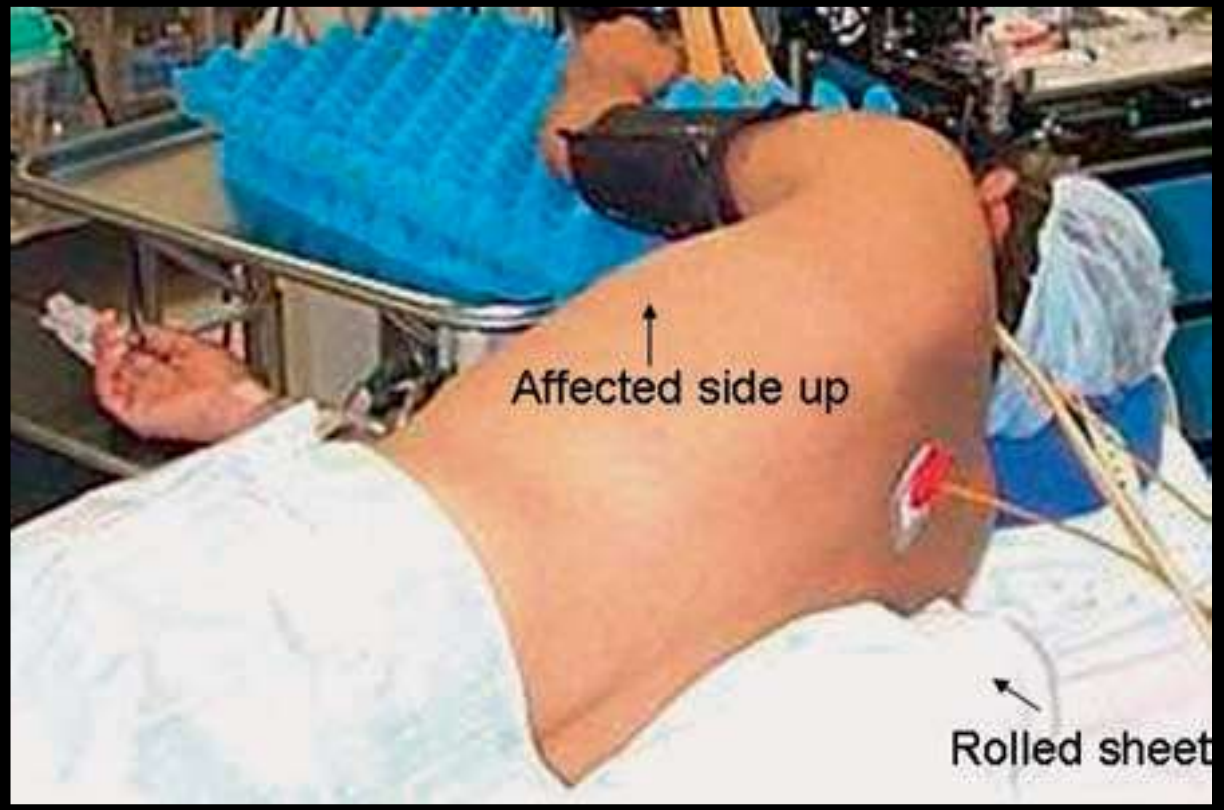
消毒範圍從胸骨一直延伸到鎖骨，穿過腋窩，經過肩胛骨到棘突，和下至胸腔底部。

病人覆蓋著無菌布單。

術前評估

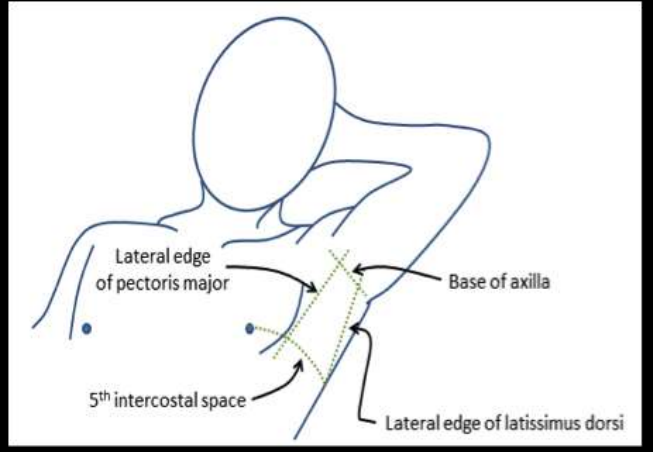
- 藥物評估，抗凝血劑需停足夠時間
- 基本抽血數據，凝血功能
- 影像學：胸部X光、胸部電腦斷層
- 胸部超音波檢查
- 檢查同意書
- 足夠禁食時間

病人姿勢



- 患者通常側臥於健側而患側朝上； 頭在枕頭
- 病人的活動動通過緩衝物支撐最小化；
- 吊帶的幫助下將手臂舉起
- 捲起的床單或將枕頭放在患者側腹下方，支撐脊柱，從而加寬肋間的空間。

進入點選擇

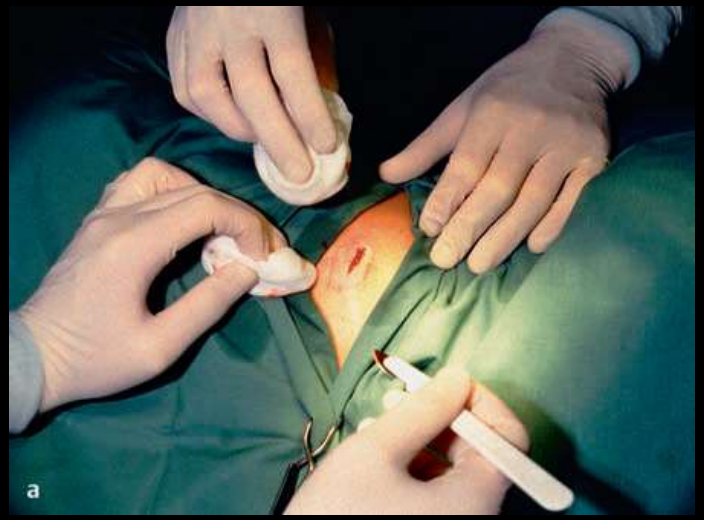


- 大多數情況下選擇腋窩進入點
  - 腋三角無大塊肌肉阻塞：前面邊界為胸大肌下緣，向後由背闊肌前緣，下方位於膈肌頂點。其頂點達第二肋間。
- 進入點取決於預期病理病變的位置。 提供良好的視野病變
  - **腋中線第四或第五肋間**，允許最好做完整的胸腔檢查。
  - 轉移性腫瘤常見於下肋椎角和橫膜表面。 第五或第六或第七肋間進入允許直接可視化這些病變。
- 太靠近入口是看不到的。從對面最容易接近病灶邊。 因此，
  - **對於後部病變：腋前線**。
  - **對於前部病變：腋後線**。
  - **對於外側病變：鎖骨中線**。
- 確定超音波、X光/CT 圖像上的病變，以便進行適當的進入點。

鎮靜、止痛

- 在局部麻醉及中度鎮靜下操作，患者對此有很好的耐受性。
  - 提高患者舒適度。
  - 抑制疼痛。
  - 誘發對檢查過程失憶。
  - 減弱運動反應和咳嗽反射。
- “自覺鎮靜”在文獻中被廣泛使用，指的是對於在治療期間保持清醒或可喚醒的患者在給予輕度抗焦慮藥和止痛藥的同時進行檢查。

Drug	Actions	Route/dose	Onset	Duration	Adverse effects
Sedatives					
Benzodiazepines	Sedation Anterograde Amnesia Antiepileptic				Respiratory depression Hypotension
Midazolam		IV, IM 5–10 mg (0.075 mg/kg)	IV: 5 min IM: 15 min	IV, IM: 2 h 2 h	IV, IM: Paradoxical aggression
Diazepam		IV: 5–10 mg IM: not advised PO: 5–10 mg	IV: < 3 min IM: 15 min to hours	IV: min to hours	Coma at high doses Thrombophlebitis
Narcotics	Analgesia Sedation Anxiolysis Antitussive				Respiratory depression Drowsiness Seizures Bronchospasm Bradycardia Hypotension Nausea, vomiting Constipation Biliary spasm
Morphine		IV, IM, SC 1–10 mg	IV: 5 min IM: 15 min SC: 30 min	1–4 h	
Fentanyl		IV, IM 50–100 µg	IV: 2 min IM: 10–15 min	30–45 min	Adverse effects less common than with morphine
Alfentanil		IV, IM 250–1000 µg	< Fentanyl	< Fentanyl	Similar to fentanyl
Sufentanil		IV, IM 5–70 µg	< Fentanyl	< Fentanyl	Similar to fentanyl
Propofol	Sedation	IV 50 µg/kg/min	< 1 min	10 min	Respiratory depression Hypotension Bradycardia



檢查步驟

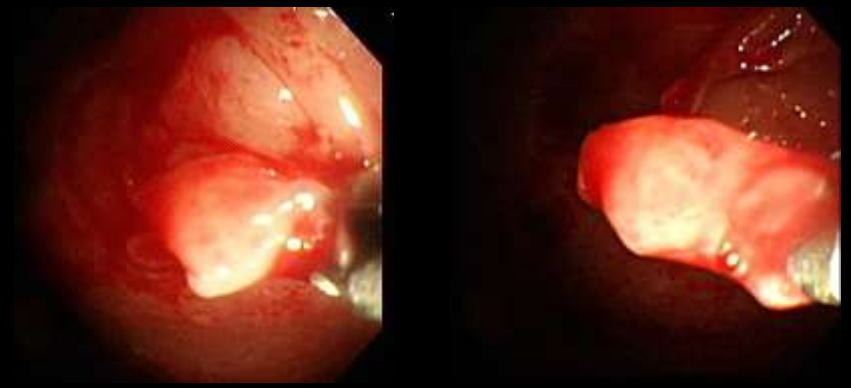
- 患者準備（病歷、禁食狀態、皮膚準備）
- 每位患者都必須有X光檢查
- 患者擺位
- IV、氧氣、EKG、血壓、血氧
- 將病人影像資料調出
- 仔細局部麻醉並根據需要進行鎮靜
- 小皮膚切口後引入Trocar
- 使用胸腔鏡/胸膜鏡檢查胸腔
- 影像記錄
- 獲取多個活檢樣本
- 控制出血
- 引流管置入
- 恢復期間的監測

切片

- 胸膜活檢前，應使用鈍探針確定肋骨和肋間隙。
- 如果可能，應始終對肋骨進行活檢
- 抓住壁層胸膜並輕輕拉向操作者
- 懷疑惡性腫瘤，但內視鏡檢查結果是非特異性的，活檢應增加到 10-12 個來自不同區域

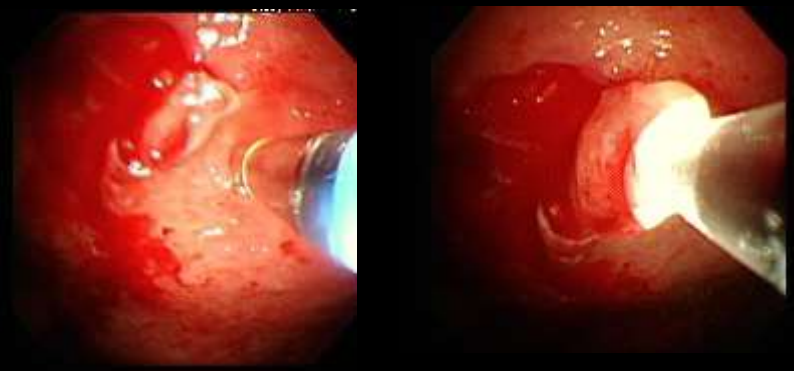
Flexible Forceps Biopsy

- **FB-55K-1 ; FB-35C-1** (Olympus, Japan)
- **Cup opening size 7.4mm**

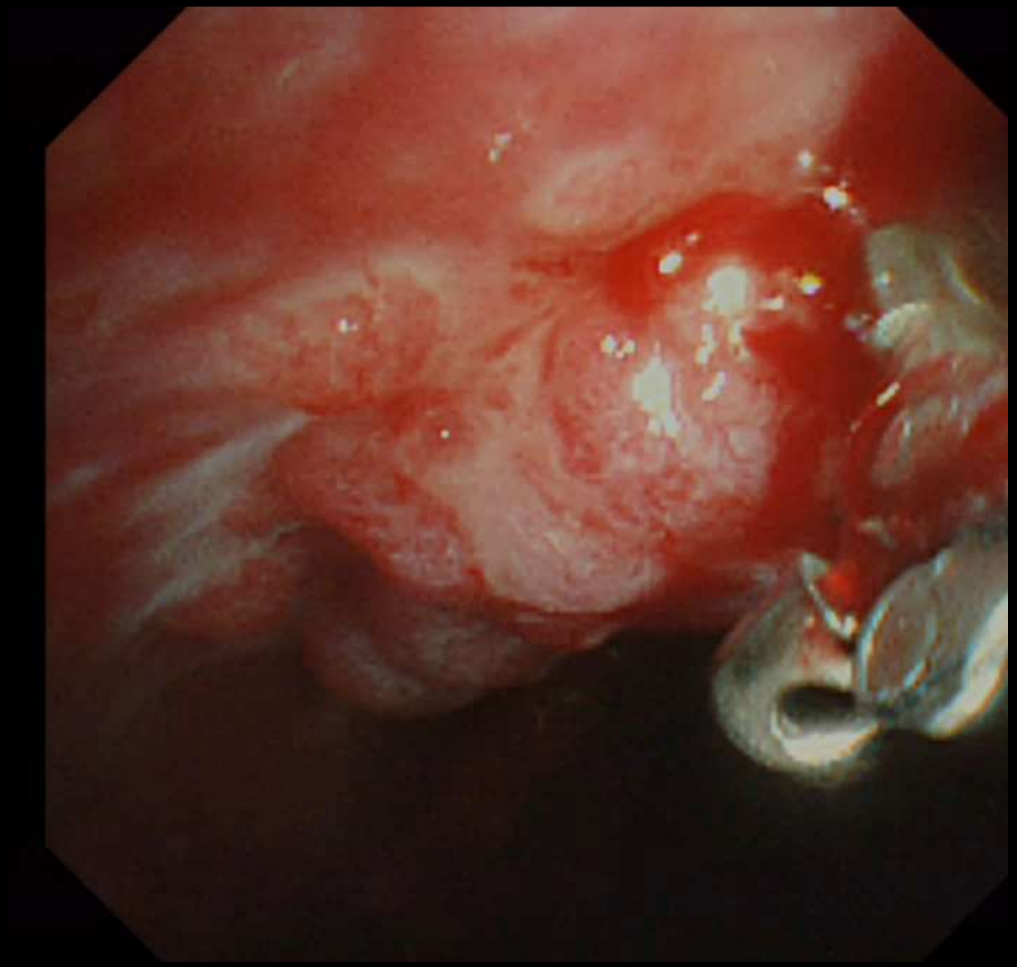


Cryobiopsy

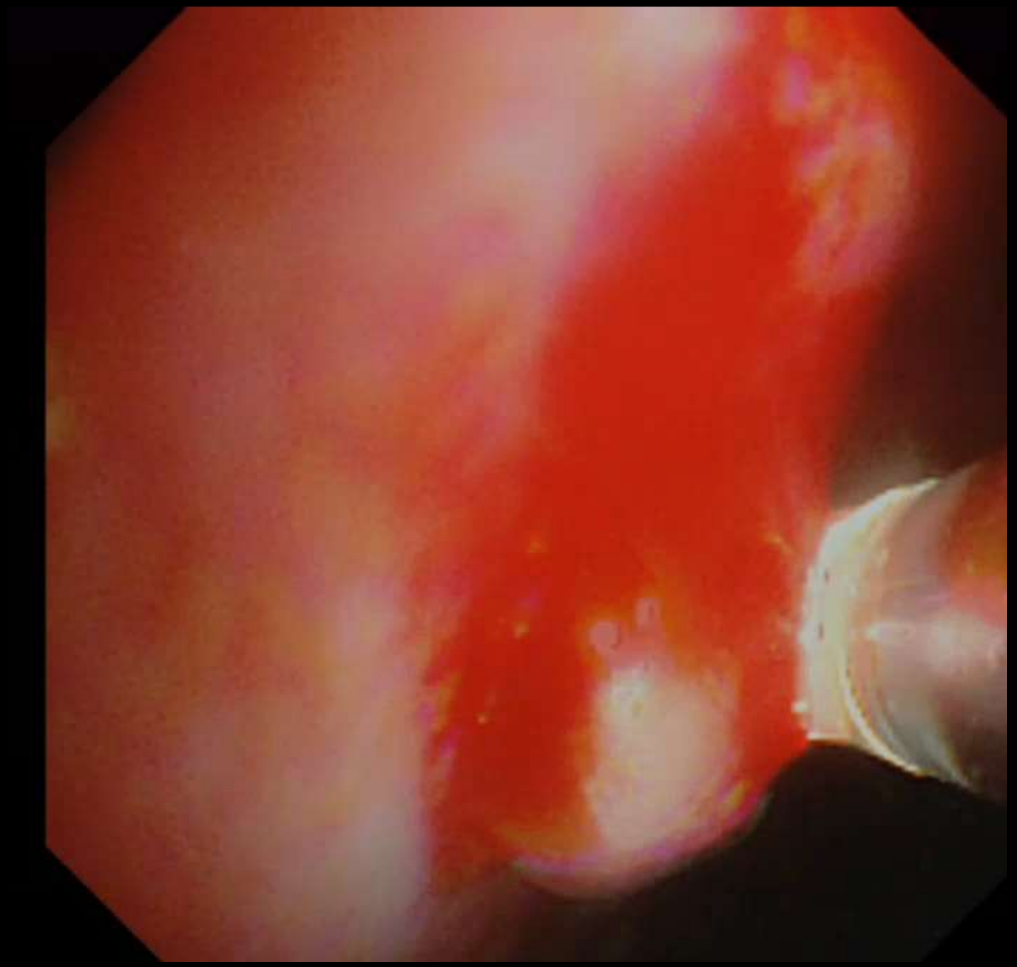
- **Flexible cryoprobe: .19-2.4 mm diameter (Erbe, Germany)**
- **Freezing time: 3-5 secs**

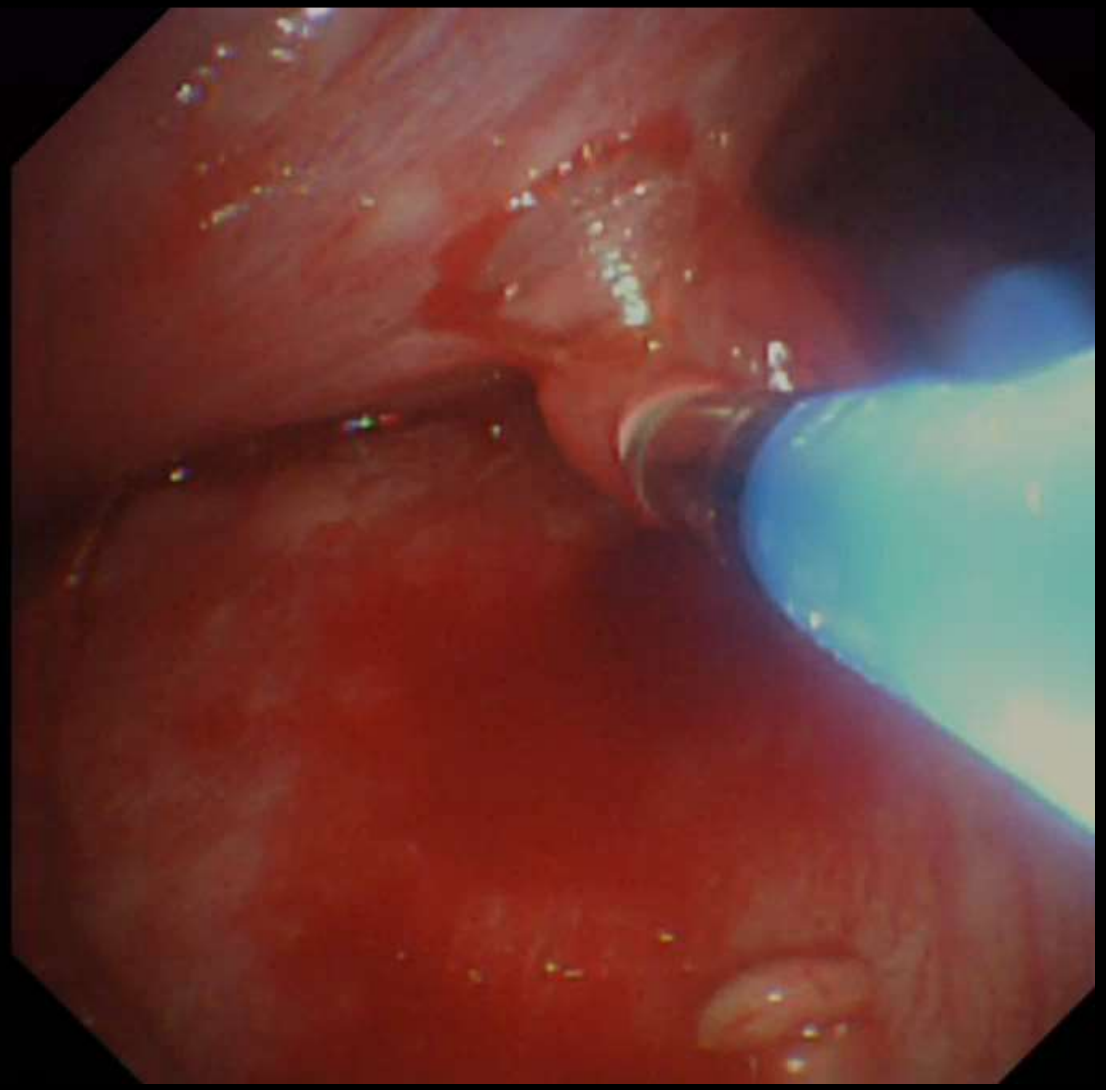


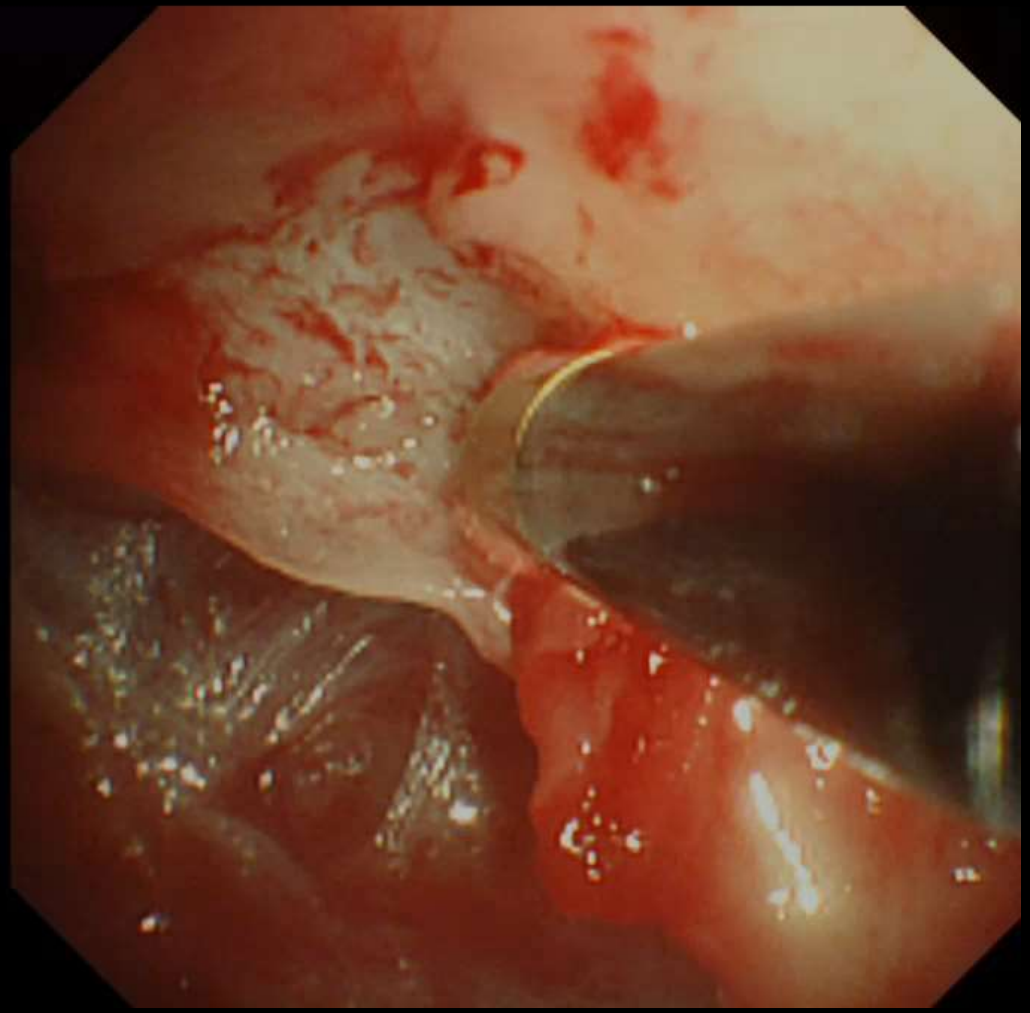
- Flexible Forceps Biopsy



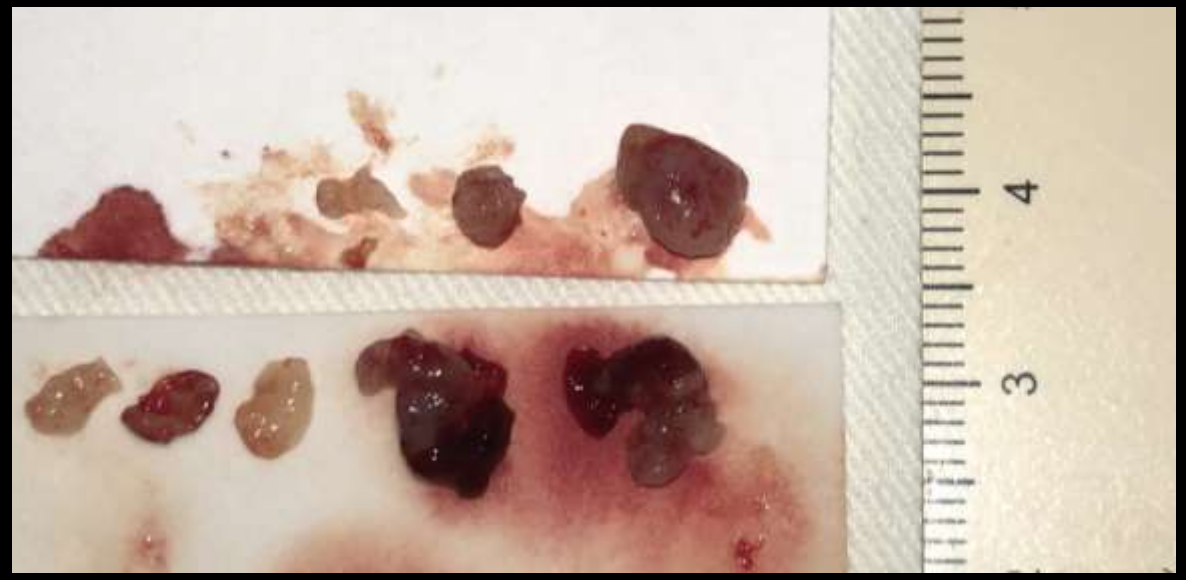
- Cryobiopsy







Forceps biopsy



Cryobiopsy

Pleural Cryobiopsy A Systematic Review and Meta-Analysis

Study or Subgroup	Cryoprobe biopsy Events	Total	Flexible Forcep biopsy Events	Total	Weight	Odds Ratio IV, Fixed, 95% CI
Chen et al, 2018	91	92	84	92	15.2%	8.67 (1.06-70.77)
Maturu et al, 2015	6	6	3	4	5.6%	5.57 (0.18-176.26)
Pathak et al, 2017	10	10	10	10		Not estimable
Rozman et al, 2014	14	14	15	15		Not estimable
Thomas et al, 2015	20	22	20	22	15.9%	1.00 (0.13-7.81)
Tousheed et al, 2018	86	87	50	52	11.4%	3.44 (0.30-38.90)
Wurps et al, 2016	73	80	74	80	51.9%	0.85 (0.27-2.64)
Total (95% CI)		**311**		**275**	**100.0%**	**1.61 (0.71-3.66)**
Total events	300		256			

Heterogeneity: $\chi^2 = 4.78$, df = 4 ($P = .31$); $I^2 = 16\%$
Test for overall effect: $z = 1.15$ ($P = .25$)

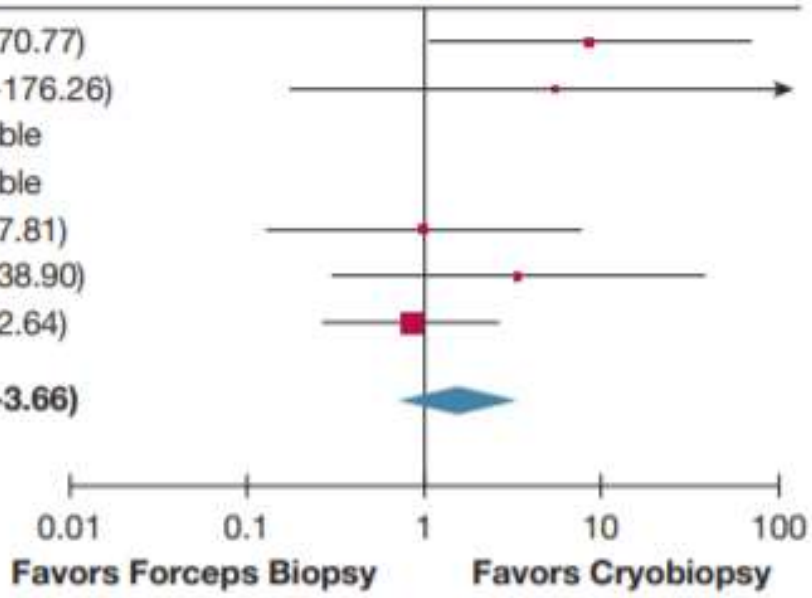


Figure 2 – *Meta-analysis of diagnostic yield based on biopsy technique. IV = inverse variance.*

Pleural cryobiopsy is safe but does not increase diagnostic yield over flexible forceps biopsy

CHEST 2020; 157(1):223-230

TABLE 3] Specimen Characteristics and Bleeding Rates

Study/Year	Cryobiopsy: Average Specimen Size (Metric)	Flexible Forceps Biopsy: Average Specimen Size (Metric)	Cryobiopsy: Rate of Major Bleeding (Total Occurrences/Total Cases)	Flexible Forceps Biopsy: Rate of Major Bleeding (Total Occurrences/Total Cases)
Rozman et al[9]/2016	NR	NR	0/14	0/15
Maturu et al[10]/2015	9.17 ± 1.84 mm[a] (depth; mean ± SD)	3.75 ± 0.96 mm (depth; mean ± SD)	0/6	NR
Thomas et al[11]/2015	10 (7-15.8) mm^2[,a] (cross-sectional area; median, range)	4 (3-8) mm^2 (cross-sectional area; median, range)	0/22	0/22
Wurps et al[12]/2016	14.4 ± 12.8 mm^2[,a] (surface area; mean ± SD)	7.1 ± 9.3 mm^2 (surface area; mean ± SD)	0/80	0/80
Pathak et al[13]/2017	320 mm^3[,a] (mean cumulative tissue volume)	80 mm^3 (mean cumulative tissue volume)	NR[b]	NR[b]
Tousheed et al[14]/ 2018	13.2 ± 6.7 mm[a] (size; mean ± SD)	6.8 ± 3.3 mm (size; mean ± SD)	0/87	0/52
Chen et al[15]/2018	9.1 ± 4.5 mm[a] (size; mean ± SD)	4.0 ± 2.1 mm (size; mean ± SD)	0/92	0/92

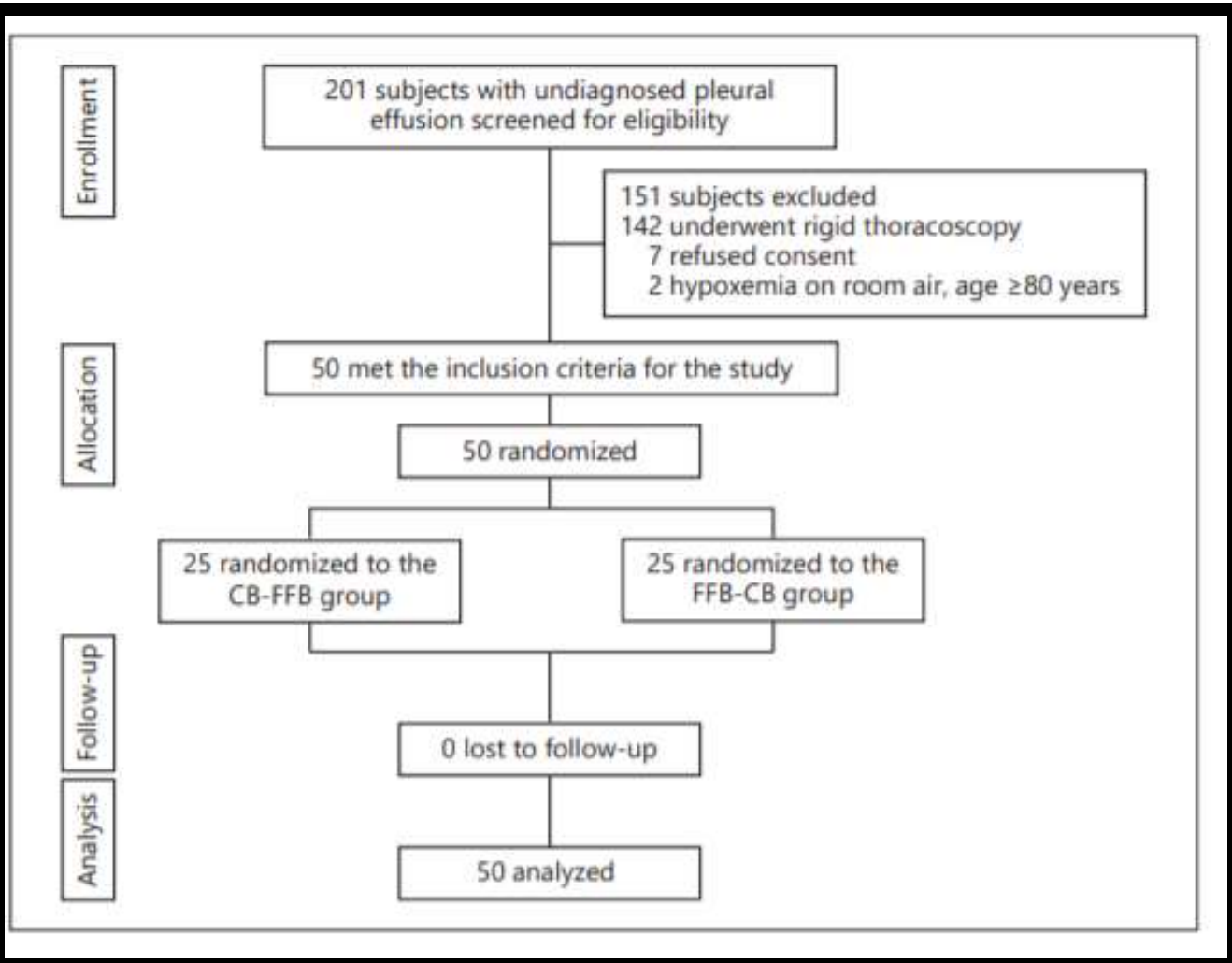
NR not reported.

a P value for comparison with flexible forceps biopsy < .05.

b Authors reported that there was no morbidity or mortality among these groups of patients

CHEST 2020; 157(1):223-230

Pleural Cryobiopsy versus Flexible Forceps Biopsy in Subjects with Undiagnosed Exudative Pleural Effusions Undergoing Semirigid Thoracoscopy: A Crossover Randomized Trial (COFFEE Trial)



Respiration 2019;98:133–141

Outcome	CB	FFB	Estimate difference (95% CI)	*p* value
Primary outcome				
Diagnostic yield	39/50 (78.0)	38/50 (76.0)	−0.02 (−0.18 to 0.14)	1.00
Secondary outcomes	(*n* = 46)	(*n* = 49)		
Biopsy size, mm	7 (6–10)	4 (3–5)	–	<0.001
Depth of tissue				0.02
Up to mesothelial connective tissue	16 (34.8)	29 (59.2)	0.24 (0.04 to 0.42)	
Up to extrapleural fat or deeper	30 (65.2)	20 (40.8)		
Interpretability of specimens				0.69
Easy	36 (78.3)	33 (67.3)	0.11 (−0.07 to 0.28)	
With some difficulty	2 (4.3)	3 (6.1)		
With great difficulty	1 (2.2)	2 (4.1)		
Not interpretable	7 (15.2)	11 (22.4)		
Artefacts				0.62
None	45 (97.8)	46 (93.9)	−0.04 (−0.06 to 0.15)	
Crush	1 (2.2)	3 (6.1)		
Freeze	0	0		
Duration of biopsy procedure, min	10 (6–12)	15 (6–18)	–	<0.001
Difficulty in obtaining a biopsy (rated on VAS)	16 (9–55)	28 (14–46)	–	0.18
Bleeding on taking biopsy				1.00
Minimal bleeding (self-limited ooze)	46 (100)	49 (100)	0 (−0.07 to 0.08)	
Mild bleeding (requiring prolonged suctioning)	0	0		
Major hemorrhage (requiring blood transfusion, causing hemodynamic instability or ICU admission)	0	0		

Data are expressed as the median (IQR) or *n* (%). CB, cryobiopsy; FFB, flexible forceps biopsy; VAS, visual analog scale.

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檢查前併發症

- 空氣栓塞、
- 皮下氣腫
- 氣胸誘導期間的疼痛
- 氣胸後呼吸困難
- 對局麻藥的過敏反應

檢查中併發症

- 疼痛
- 低氧血症
- 通氣不足
- 心律異常
- 低血壓
- 出血
  - 需要開胸手術的無法控制的大出血沒有在任一大型報告中被報導，極為罕見。
- 肺部或其他器官損傷

檢查後併發症

- 復張性肺水腫 (Reexpansion pulmonary edema)
- **疼痛**
- 術後發熱
- 傷口感染
- 低血壓
- 膿胸
  - 是一種罕見的並發症，但可能發生在長時間引流後或由於支氣管胸膜瘻管。 三個研究中已報告 12 例在 652 名患者 **(2%)**
- **皮下氣腫**
- 持續性氣胸/長時間漏氣
- 持續產生胸水

Reexpansion Pulmonary Edema

- **罕見的**、仍可能會出現，

1. 大量胸腔積液導致肺不張，
2. 肋膜僵硬或肺受限時(Trapped lung)，
3. 在完全支氣管內阻塞，
4. 長期氣胸。

- 在這些情況下，通過引流管施加負壓須非常謹慎，應密切觀察患者

檢查相關死亡

- 有報導8000 例病例中只有 1 例死亡，死亡率為 0.01（Viskum 和 Enk 1981）；
- 另一個系列評論中4300 例，死亡率為 0.09% (Boutin et al.1981b).
- 其他大型統計，肋膜腔鏡的死亡率為 0.24%，與經支氣管切片活檢相當（0.22–0.66%) (Boutin et al. 1985a)。

預防併發症

- 如果患者嚴重咳嗽，可以考慮推遲幾天。
- 測量血氣； 監測心臟狀況。
- 在檢查過程中給患者氧氣。
- 出血超過20 毫升應考慮止血。
- 插入胸管至無漏氣為止，防止皮下氣腫。
- 檢查當天開始肺擴張活動以預防肺塌陷。
- 開始時溫和抽吸以避免肺復張肺水腫

總結

- 肋膜腔鏡是診斷肋膜積水重要工具，不明原因肋膜積水、惡性積水、結核性肋膜炎都有很好的診斷率。
- 肋膜腔鏡也可達成部分治療功能。
- 肋膜嚴重沾黏，**沒有肋膜空間**為肋膜鏡絕對禁忌症。
- 檢查前應檢視病人用藥、影像、抽血等數據。
- 檢查需在無菌下操作，內視鏡也須依指示無菌消毒。
- 檢查時病人通常側躺，患側在上；進入點依術前影像決定，大多從腋窩進入。
- 檢查中適當鎮靜及止痛合併局部麻醉。
- 切片從可視病灶執行，如果沒有特定病灶，可多點隨機切片。
- 使用冷凍探頭切片可以獲得較大檢體，可能幫助診斷。
- 切片處出血、傷口疼痛、皮下氣腫等併發症會發生；嚴重出血、膿胸、復張性肺水腫為少見但是可能發生併發症。檢查相關死亡非常低。


ANY
QUESTIONS?