Techniques of surgical lung biopsy in Interstitial Lung Disease (ILD). Advantages and Disadvantages.

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Scientific Meeting & Hands on Training

“The role of transbronchial cryobiopsy in Interstitial Lung Disease”

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SLB in ILD – When?

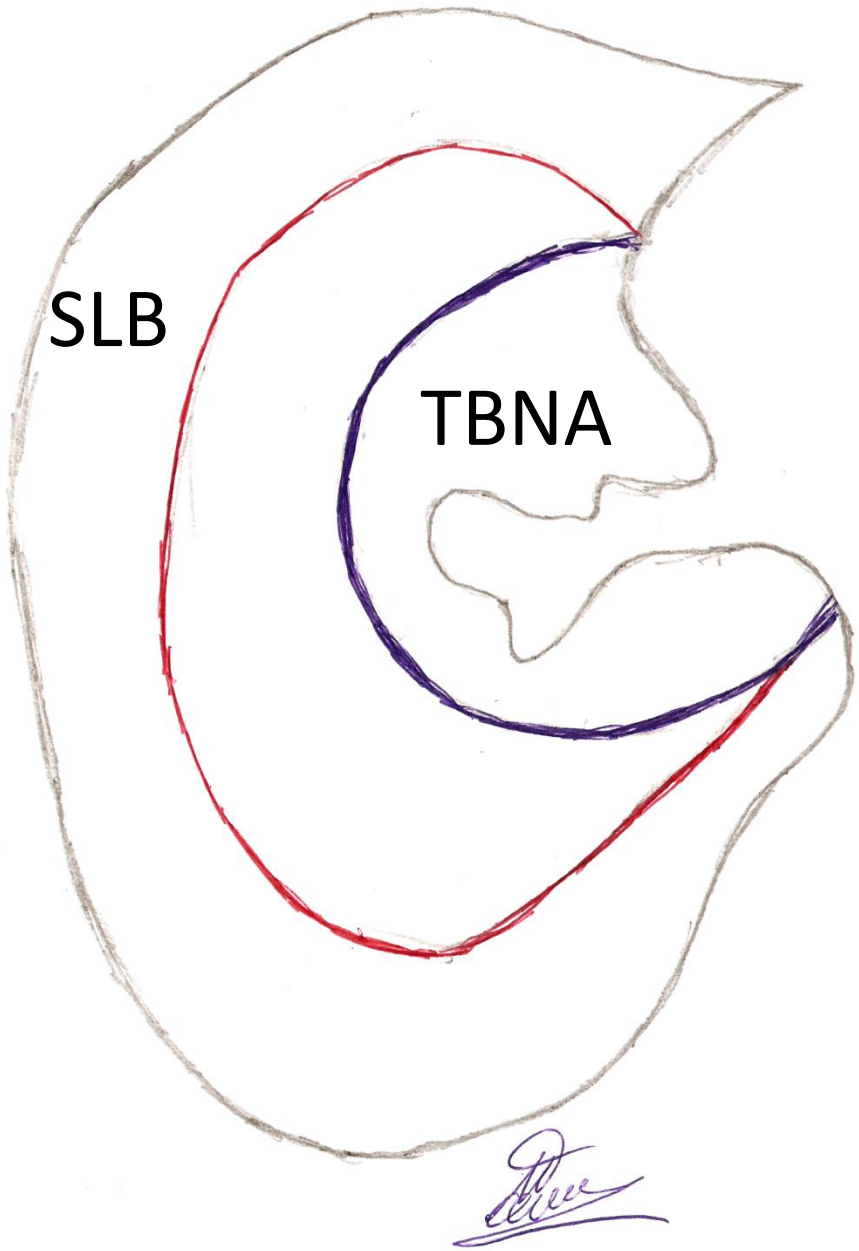
History, physical examination, laboratory investigations, radiologic imaging & invasive procedures (bronchial lavage, TBNA) fail to establish the diagnosis

Cottin V. Lung biopsy in interstitial lung disease: balancing the risk of surgery and diagnostic uncertainty. Eur Respir J 2016; 48: 1274-1277.

Surgical Lung Biopsy (SLB) in Interstitial Lung Disease (ILD) – Why?

- Final diagnostic step
- Large biopsy specimen/s
- Biopsy from lung periphery (outer 3rd) in contrast to TBLB (biopsy from lung tissue adjacent to bronchus)
- Confirmation of specific diagnosis, affects plan of treatment
- Predicts response to therapy
- Provides prognostic information

Yang S, Raghu G. Interstitial Lung Disease. In: Patterson AG, Cooper JD, Deslauriers J, Lerut A, Luketich JD, Rice TW. Pearson's Thoracic and Esophageal Surgery, 3rd edition, Elsevier, 2008.


SLB
TBNA

Indications for SLB

- Patient < 65 years
- History of fevers, weight loss & sweets
- History of hemoptysis
- Family history of ILD
- Symptoms and signs of peripheral vasculitis
- History of pneumothorax (especially recurrent)
- Normal chest radiography despite clinical signs
- Atypical radiographic features of idiopathic pulmonary fibrosis
- Unexplained pulmonary hypertension
- Unexplained cardiomegaly
- Rapidly progressive disease (functional, objective)
- Rapid deterioration or new symptoms with new radiologic features
- Unexplained extrapulmonary manifestations (i.e. Erythema nodosum)

Hess DR, MacIntyre NR, Galvin WF, Mishoe SC. Respiratory Care. Principles and Practice, 3rd edition. Jones & Bartlett Learning, MA 2015.

Vaszar LT, Larsen BT, Swanson KL, Ryu JH, Tazelaar HD. Diagnostic utility of surgical lung biopsies in elderly patients with indeterminate interstitial lung disease. Respirology 2018; 23: 507-511.

(SLB) may still be required in patients who lack definite CT features of Usual Interstitial Pneumonia (UIP).

Mayo Clinic:

55 patients aged>75years old (76-80)

30-day mortality: **10%**

90-day mortality: **90%**

The high mortality rate of SLB complicates the **risk-benefit analysis** in elderly patients with Idiopathic Interstitial Pneumonia.

The decision to proceed with SLB in ILD must be individualized.

↓

<50% of patients with ILD (USA)

Ponn RB, Knight H. Diffuse Lung Disease. In: Shields TW, LoCicero J, Ponn RB (eds): General Thoracic Surgery, 5th edition. Lippincot Williams & Wilkins, PA, 2001.

SLB – Where to target for biopsy

- Avoid regions with honeycombing cysts (end-stage fibrosis)
- Ground glass opacities denote active disease (??)
- Normal lung parenchyma adjacent to and remote to obviously abnormal sites
- 2-3 specimens form different lobes (critical)
- Avoid tip of lingula or of middle lobe (scarring and inflammatory changes unrelated to ILD) → axiomatic in the past

HRCT guides selection of appropriate areas to biopsy

SLB – handling of specimens

- Submitted for bacteriologic-virologic studies under sterile conditions
- Be fixed in 10% formalin
- Be fixed in methacarnoys solution for potential immunofluorescence studies
- Be fixed in gluteraldehyde for electron microscope studies
- Be cryopreserved for potential immunologic & molecular studies

Techniques for SLB

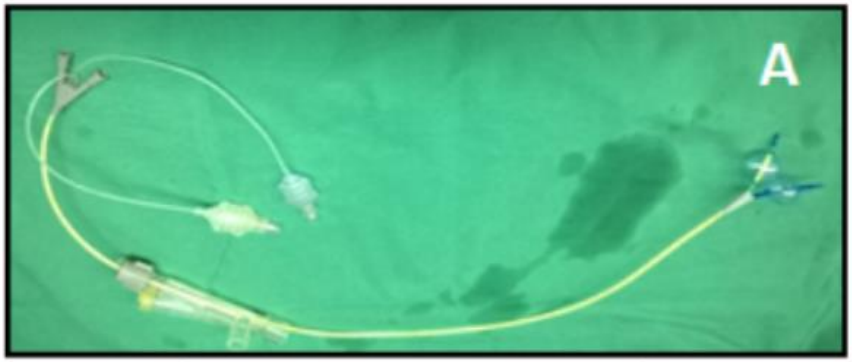
1) Thoracoscopic (VATS) approach
2) Open (mini-thoracotomy) approach

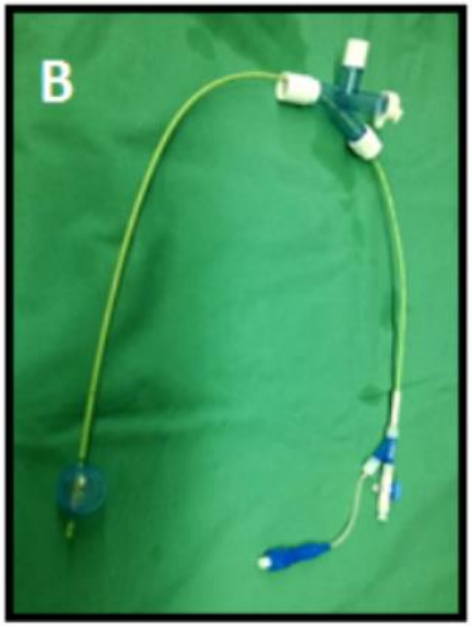
Thoracoscopic lung biopsy (VATS)

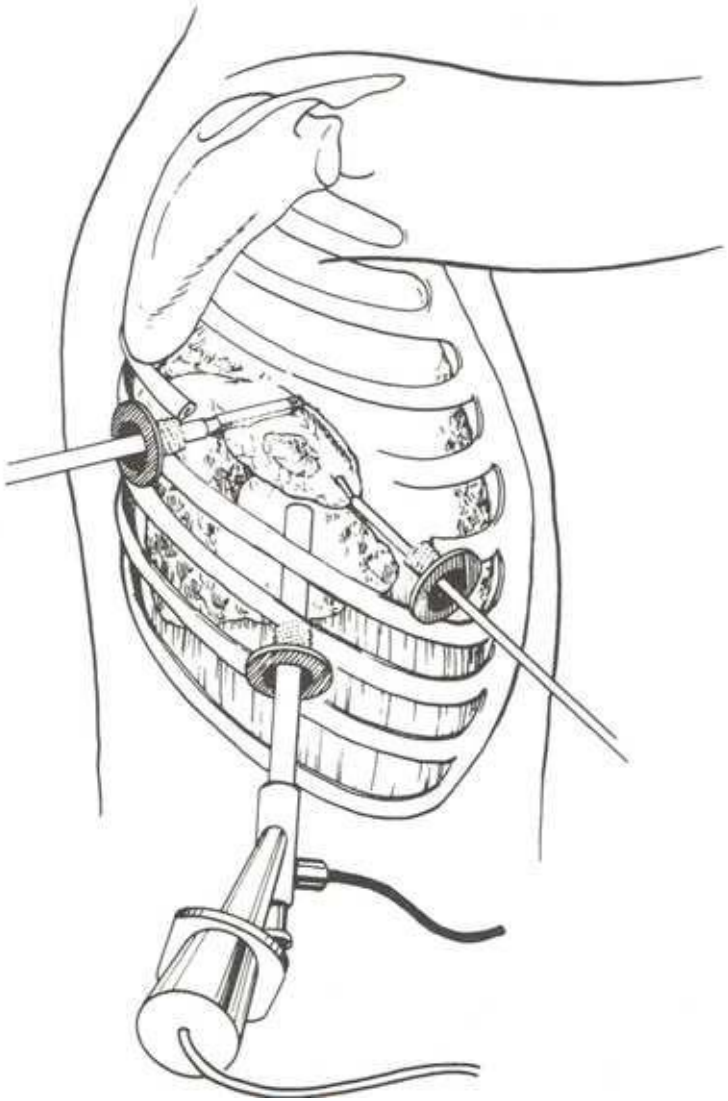
- General anesthesia/endotracheal intubation
- Lateral decubitus position
- **Panoramic view of the whole lung surface**
- **Biopsy from different lobes**
- Non-ventilator dependent patient
- Non-urgent lung biopsy
- Lung isolation required – can tolerate lung isolation?
- Specific instrumentation is required – adequate set up
- Endo-staplers (endo-GIA) required/reloads (cost?)
- Conversion to OLB? Failure to establish one lung ventilation or dense adhesions

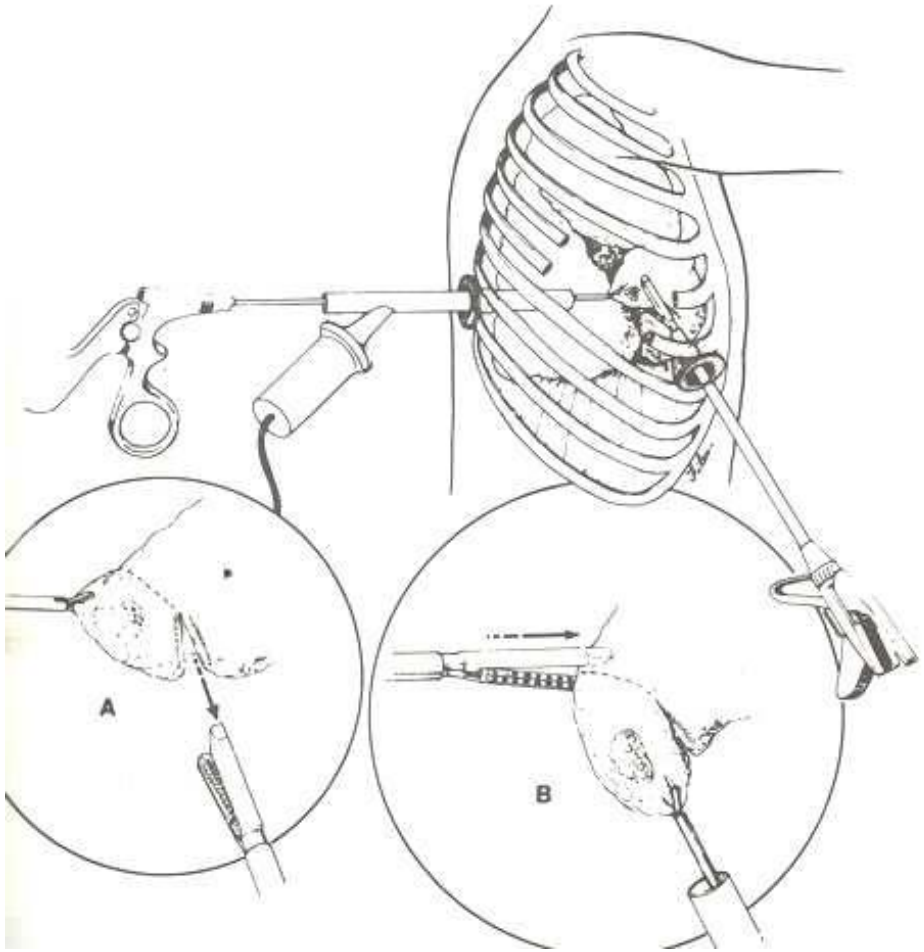
One lung ventilation (OLV)

1. Double lumen endotracheal tube
2. Various type bronchial blockers
3. Apneic oxygenation (can tolerate?)









Three-port and two-port VATS

Open Lung Biopsy (OLB)

- General anesthesia/endotracheal intubation
- Lateral decubitus position
- Limited anterolateral thoracotomy → intact latissimus dorsi
- Lung isolation: preferable, not always required
- Suitable for ventilator dependent patients/urgent biopsy
- **Biopsy sites: limited view through mini-thoracotomy incision**

OLB vs. VATS
Is VATS the gold standard for lung biopsy in ILD?

	OLB	VATS
General endotracheal anesthesia	+	+
Lateral decubitus position	+	+
Lung isolation (OLV)	+/-	+
Biopsy from different lobes	-	+
Cannot tolerate OLV/failure to establish OLV	+	-
Ventilator dependent patient	+	-
Urgent biopsy (non-elective)	+	-
Special instrumentation	-	+

How safe is SLD in patients with ILD?

Mortality? Morbidity? → negligible in stable patient

How negligible are mortality and morbidity of SLB for the diagnosis of ILD?

Hutchinson JP, McKeever TM, Fogarty AW, Navaratnam V, Hubbard RB. Surgical lung biopsy for the diagnosis of interstitial lung disease in England: 1997–2008. Eur Respir J 2016; 18: 1453-1461.

2,820 patients / 12-year period (66% VATS)

In hospital mortality: 1.7%

30-day mortality: **2.4%**

90-day mortality: 3.9%

Complications rate: **13.9%**

Risk factors for death: age, comorbidity, open approach

30-day mortality similar to that of lobectomy for cancer!

How safe is SLD for ILD?

Hutchinson JP, Fogarty AW, McKeever TM, Hubbard RB. In-hospital mortality after surgical lung biopsy for interstitial lung disease in the United States. 2000 to 2011. Am J Respir Crit Care Med 2016 15; 193:1161-7.

≈ 12,000 SLDs per year for ILD

Mortality

Elective procedures: **1.7%**

Non-elective procedures: **16.1%**

Risk factors: Male sex, age, comorbidity, open surgery, and a provisional diagnosis of IPF or connective tissue disease-related ILD

Is really OLB a risky procedure for the patient with ILD?

Open approach → higher mortality → high risk patients

- ventilator dependent patients
- non-elective (urgent) procedures
- Patients who cannot tolerate OLV

Iliadis K, Foroulis C, Kontaxis A. The role of thoracoscopic lung biopsy in the diagnosis of diffuse lung disease. 10th Panhellenic Congress of Chest Diseases, Athens, December 1-5, 1999.

31 good risk patients (18 men)
17-68 years old (median: 51)
Mortality rate: 0%
Conversion to OLB: 1/31 (3.22%) → dense adhesions
Air leak > 24 hours: 3/31 (9.7%)

Is Surgical Lung Biopsy superior to any other lung biopsy technique in the diagnosis of ILD?

Romagnoli M, et al. Poor concordance between sequential transbronchial lung cryobiopsy and surgical lung biopsy in the diagnosis of diffuse interstitial lung diseases. Am J Respir Crit Care Med 2019; 199: 1249-1256.