AABIP JOURNAL CLUB

# When A Needle Is All We Need:

## Ultrasound-guided Transthoracic Needle Biopsy by Interventional Pulmonologists is Fast and Accurate

## THE CLINICAL QUESTION

Is a physician-led ultrasound-guided transthoracic lung biopsy an expedited, safe and efficient alternative to radiology-led lung biopsy?

## TAKE HOME MESSAGE

An interventional pulmonologist with focused training and experience in ultrasound-guided thoracic procedures can perform transthoracic needle biopsy safely and with a high diagnostic yield. These results are comparable to an imaging-guided biopsy performed by the radiologists. This expedited pathway shortens the time from initial clinic review to diagnosis, and provides adequate samples for molecular profiling. Further research is needed to better characterize which patients may qualify to receive this intervention, as well as to understand the holistic impact of and patient satisfaction with this expedited pathway.

## STUDY BACKGROUND

The diagnosis of suspected pleural or lung cancer by image-guided procedures has been customarily under radiology service. This reliance on radiology services can limit a pulmonologists ability to deliver a responsive service, cause diagnostic delays, lead to excessive workload for radiology, and affect patients' mental health.

A retrospective study by Khorana et al. published in 2019 using National Cancer Database found that every week of delayed time to treatment initiation of newly diagnosed stage I and II NSCLC patients was associated with a 3.2% and 1.6% increased risk of mortality, respectively. Factors such as treatment at an academic center, black race and transfer of facility were associated with delayed time to treatment initiation. Initiatives such as the United Kingdom's National Optimal Lung Cancer Pathway (NOLCP) encourage a "direct to biopsy" and same-day approach to clinical evaluation and diagnostic intervention to reduce the time take to achieve a diagnosis.

While the clinical application of thoracic ultrasound for basic pleural procedures such as thoracentesis and tube thoracostomy is well established, this study aims to examine if an interventional pulmonologist-led ultrasound-guided transthoracic lung biopsy is an expedited, safe, and efficient alternative to the imaging-guided needle biopsy by a radiologist. Of note, this study refers to the interventional pulmonologists as "physicians" in the title as well as the text, but with a clarification to that effect in the methods section.

## CURRENT PRACTICE

A retrospective study in 2013 already demonstrated no significant difference in success rate and a reduced incidence of postprocedural pneumothorax with the use of ultrasound compared to CT-guided biopsy of pleural or peripheral lung lesions. A subsequent retrospective study done in Denmark in 2013 reported that a respiratory physician-led ultrasound-guided transthoracic needle aspiration biopsies were safe with a low risk of complications and an acceptable diagnostic yield. However, no information on the adequacy of molecular profiling was made available in that study. A radiology-led imaging-guided sampling of suspected pleural or peripheral lung cancer remains the convention.

## STUDY DESIGN

**Type of trial:** A single-center prospective case series analysis of a new interventional pulmonology-led service line developed to introduce an expedited diagnostic pathway for suspected lung cancers. No randomization, blinding or control group was reported. **Total subjects (N):** 151

**Study groups:** Patients suspected to have lung cancer with the chest wall, pleural or peripheral lung involvement that was deemed technically feasible for needle biopsy under ultrasound guidance by an interventional pulmonologist.
**Setting:** Single-center, Chest Clinic at University Hospitals Plymouth NHS Trust, Plymouth, UK
**Enrollment:** October 2017 to December 2019
**Follow up:**

- Focused point-of-care transthoracic ultrasound on all patients post-procedure for sonographic signs of pneumothorax and intrapleural bleeding.
- Observation for 1 hour (chest wall and pleural biopsy) or 4 hours post -procedure (peripheral lung biopsy)
- Plain Chest radiographs 1 hour (all procedures) and 4 hours post-procedure (peripheral lung biopsies only)
- Heart rate, blood pressure, respiratory rate and peripheral oxygen saturation monitoring every 15 minutes for the first hours and regularly thereafter as guided by the patient's early warning score during this period.
- Patients with a nonmalignant diagnosis of nonspecific (fibrinous) pleuritis were kept under clinical and radiologic follow-up for a minimum of 18 months or until death to ensure the validity of this diagnosis.

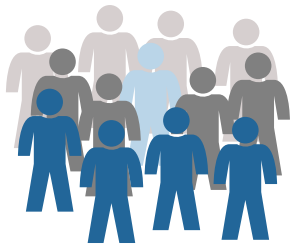
## FUNDING

None reported

# POPULATION

**Inclusion criteria:**

- Cases suspicious of lung cancer with chest wall, pleural or peripheral lung lesions that were deemed technically feasible (lesions within or immediately abutting the chest wall) for needle to biopsy under ultrasound guidance.
- The biopsy was necessary for diagnosis and staging while exposing the patient to the least risk.



**Exclusion criteria:**

- Patients not meeting the above criteria.

**Baseline Characteristics:**

- Sample size: 151
- Male sex: 104 (68.9%)
- Female sex: 47 (31.1%)
- Mean age (SD): 71.8 (12.3) years
- Patient location: Outpatient - 119 (78.8%), Inpatient - 32 (22.2%)
- Primary operator: Registrar - 106 (70.2%), Consultant - 45 (29.8%)
- Median (IQR) number of biopsies taken: 6 (5-8)

**Pleural biopsies (n = 90)**

- Pleural fluid present: 62 (68.9%)
- Lung sliding present (if no pleural fluid): 12 (42.9%)

**Peripheral lung biopsies (n = 33)**

- Mean visceral-parietal pleural interface in mm (SD): 42.3 (20.1)
- Lung sliding: Present - 8 (24.2%), absent - 25 (75.8%)

# INTERVENTIONS

Continuous, direct real-time linear (5 to 12 MHz) or curved abdominal (2 to 5 MHz) transducer ultrasound-guided transthoracic biopsies under sterile conditions in a dedicated procedural area using either an 18- or 16-G semiautomatic core-cutting needle done by two consultant chest physicians trained in transthoracic ultrasound and supported by up to two specialist registrars undertaking a fellowship in interventional pulmonology.

# OUTCOMES

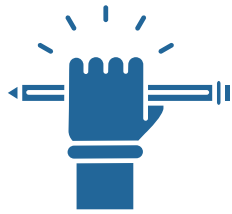
**Primary outcome:**

- Time from outpatient clinic review to biopsy
  - Median time: 4 days (IQR: 1 to 6 days)
    - 65 (54.6%) procedures done < 3 working days of clinic review.
    - 24 (20.2%) procedures were doe the same day as part of the "direct to biopsy" pathway.
  - Procedural delays
    - 16 (13.4%) cases needed to withhold either antiplatelet or anticoagulant therapy before biopsy.
    - 13 (10.9%) cases by patient's choice
- Adequacy of sample for molecular profiling: 81/82 (98.8%) cases
- Diagnostic Yield
  - Representative samples obtained: 144/151 (95.4%) cases
  - True histologic yield: 138/151 (91.4%) cases

**Adverse events (3): 2 with pleural (1-2) and 1 with peripheral lung biopsy (3)**

1. Pneumothorax (1) - requiring chest tube insertion and a 3-day hospital admission.
2. Bleeding (1) - minor parietal pleural bleeding that resolved with external pressure
3. Hemoptysis (1) - small volume fresh hemoptysis requiring overnight admission and resolution following treatment with tranexamic acid

## STUDY STRENGTHS



- Prospective observational study on the largest study population reported to date
- Lung cancer multidisciplinary team review of all cases, including a formal evaluation of radiology and pathology data.
- Establishes adequacy of sample for molecular profiling, which is increasingly being used for targeted treatment of cancers.
- Proposes and expedited diagnostic pathway, potentially a same-day "direct to biopsy" plan within the same clinic visit.
- Maintains a close patient-pulmonologist working relationship through the diagnostic journey and minimizes the need for patients to see one more specialist.

## STUDY LIMITATIONS

- Single-center study by a few interventional pulmonologists trained in the UK Royal College of Radiologists level 2 thoracic ultrasonography, which may be hard to replicate.
- No randomization was done, which may introduce a selection bias even in a prospective case series where subjects were selected after a feasibility review.
- Only lesions within or immediately abutting the chest wall were biopsied due to the technical limitation of poor ultrasound visualization through the air (normal parenchyma)
- The size and precise location of the lesions were not reported, which in our experience, can significantly influence the feasibility, diagnostic yield, and complications
- The total number of patients screened for biopsy using this modality was not reported, so we do not know what percent of the patients may qualify for this intervention

## RESEARCH QUESTION

Is a physician-led ultrasound-guided transthoracic lung biopsy an expedited, safe and efficient alternative to radiology-led lung biopsy?

## SUGGESTED READING


- Khorana AA, Tullio K, Elson P, et al. Time to initial cancer treatment of the United States and association with survival over time: an observational study. PLoS One. 2019;14:e0213209
- Malalasekera A, Nahm S, Blinman PL, et al. How long is too long? A scoping review of health system delays in lung cancer. Eur Respir Rev. 2018;27:180045
- Laursen CB, Naur TM, Bodtger U, et al. Ultrasound-guided lung biopsy in the hands of respiratory physicians: diagnostic yield and complications in 215 consecutive patients in 3 centers. J Bronchology Intery Pulmonol. 2016;23:220-228
- Sconifienza LM, Mauri G, Grossi F, et al. Pleural and peripheral lung lesions: comparison of US - and CT-guided biopsy. Radiology. 2013;266:930-935
- Meena N, Bartter T. Ultrasound-guided Percutaneous Needle Aspiration by Pulmonologists, Journal of bronchology and interventional pulmonology. 2015 Jul 1;22(3):204-8.


## ARTICLE CITATION


Corcoran JP, Taylor LM, Nicholson TW, McDill H, Hassan M, Daneshvar CJ. Outcomes from a physician-led Ultrasound-guided Transthoracic Biopsy Service: Supporting a Rapid Diagnostic Pathway in Suspected Lung Cancer. J Bronchology Intery Pulmonol[Internet]. 2022 Jan 1;29(1):86-90, Available from: http://dx.doi.org/10.1097/LBR.0000000000000825


## AUTHOR


**Siddharthan Vaithilingam, MBBS**
Institution: University of Arkansas
Twitter: @siddhuv


## REVIEWERS


**Christian Ghattas MD**
Institution: The Ohio State University
Twitter: @chghattas

**Abhishek Kumar, MBBS**
Institution: University of Nevada
Twitter: @medshek


If you would like to become a reviewer for the "**AABIP Journal Club,**"
Please contact **Christian Ghattas** at
**christian.ghattas@osumc.edu**