# AABIP JOURNAL CLUB

## CAN THE RIGHT PATHWAY COME AT THE CORRECT COST?

## THE CLINICAL QUESTION

What is the optimal diagnostic and staging strategy for patients with suspected lung cancer?

## STUDY CONCLUSION

The most cost-effective strategies depend on the nodal stage, lesion location, type of peripheral bronchoscopic biopsy, and use of ROSE.

## STUDY BACKGROUND

High-level recommendations exist on the use of bronchoscopy and computed-tomography-guided biopsy for peripheral and central nodules; however no consensus on best practices, order of procedures, complication rates, number of procedures to secure a diagnosis, and costs to the healthcare system.

Multiple studies and meta-analyses highlighting diagnostic yields, complication rates, and costs of the diagnostic procedures, including the AQuIRE registry and Medicare data. A previous cost-effectiveness study compared CTBx with rEBUS, but this did not include cEBUS, ROSE, or EMN.

## RESEARCH QUESTION

Identifying the optimal diagnostic and staging strategy for lung cancer?

# STUDY DESIGN

A decision analysis software (TreeAge Pro) was used to model 16 diagnostic and staging strategies for a selected base patient. This model was created to evaluate each modality's cost-effectiveness and quality trade-offs.

The decision context begins with selecting the first invasive test and ends once diagnosis and staging are complete, or the patient has a fatal complication.

All strategies start with either cEBUS or CTBx, and each subsequent procedure occurs based on the preceding securing a diagnosis or whether a complication arises.

All point estimates and complications are based on retrospective data in published literature. Meta-analysis preferred, then ACCP guidelines, the AQuIRE registry, and finally self-performed meta-analysis.

Pre-test probabilities of nodal metastasis were derived from HAL and HOMER models.

Cost-effectiveness with factoring in complication rate and performance of each permutation based on the incremental-cost-complication ratio (ICCR). i.e., the additional cost of a strategy to avoid one complication related to another. A base WTP was set at 10k.

One and two-way deterministic sensitivity analysis of multiple variables and probability sensitivity analysis using the Monte Carlo method.

Scenario analysis to explore how optimal strategies change for different clinical situations.

# CURRENT PRACTICE

Options for diagnosis of peripheral lesions include FFB alone or in combination with rEBUS, with our without EMN, CTBx, and surgery.
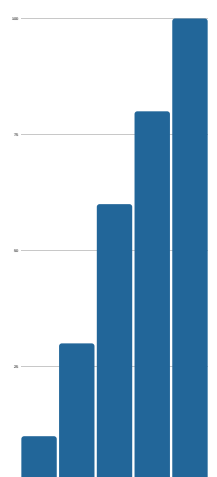
cEBUS may be used for nodal staging and central lesions with or without ROSE. cEBUS is often used in conjunction before or after bronchoscopy.
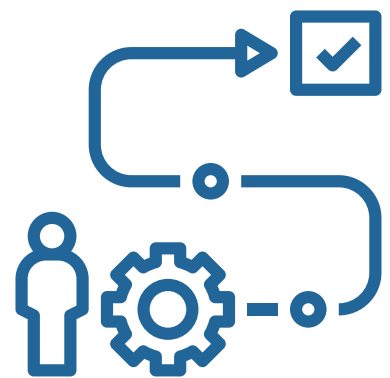
# OUTCOMES

Patient: complications, time, and the number of procedures to complete the diagnosis and staging for each permutation, incidence of undetected N2-3 disease, and cumulative mortality risk.

# RESULTS

Peripheral lesions with radiographic N0 disease:
- CTBx-alone is the least costly strategy overall but is not preferable to the most cost-effective bronchoscopy strategy (cEBUS-rEBUS) in terms of complication rate (risk-difference 14%) with a higher time to complete evaluation (8 days) with a higher rate of missed N2-N3 disease and increased mortality.

- Based on scenario analysis, when lesions are small (< 20 mm), bronchoscopy strategies' cost and cumulative complications double. This decreases with a bronchus sign compared with CTBx, but CTBx remains optimal with the WTP of $10,000.

- For central lesions, bronchoscopy was cheaper, safer, and faster, with a lower rate of undetected N2—3 disease

Radiographic N1 disease
- cEBUS-ROSE-rEBUS was the most cost-effective overall and dominant to CTBx.

# STUDY STRENGTHS

This study does an excellent job of incorporating the multidimensional and longitudinal costs associated with diagnostic modalities that are not captured in other studies.
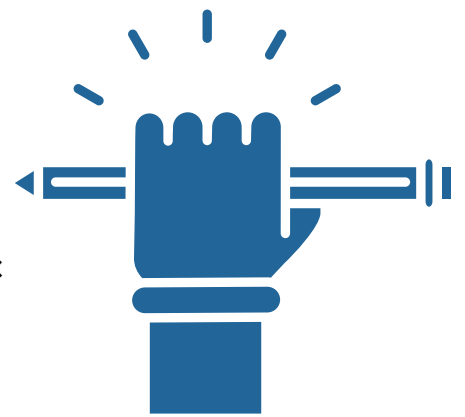
It considers the variability in diagnostic sensitivities between modalities reported in the literature and willingness to pay (WTP) thresholds to show the readers how each permutation changes the cost to benefit ratio.

Sheds light on potential ambulant guidelines on using different modalities to potentially narrow the focus for a clinician in terms of picking the most cost-effective modality with the lowest overall complication rate.

# STUDY LIMITATIONS

This study uses point estimates from retrospective studies of diagnostic yield that may not be accurate with changing technology. The assumption that EMN is less sensitive is based on the AQuIRE registry, which references studies with older technology that may not account for CT body divergence and image correction, in addition to acknowledging the results may have been from patient selection (more challenging cases), and all or nothing phenomena with lesion hit.
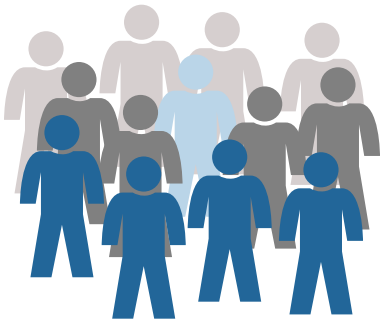
# TAKE HOME MESSAGE

The optimal decision strategy for diagnosis and staging lung nodules is complex. Clinicians must weigh the relative importance of cost, complications, time to complete the diagnosis, and risk of undetected N2-3 disease.

# POPULATION

The base case was used for simulation analysis with a 65-year-old male outpatient smoker with a 30 mm upper lobe pulmonary nodule who could tolerate lobectomy with N1 disease and 80% probability of cancer.

# FUNDING

# SUGGESTED READING

1. Diagnostic yield and complications of bronchoscopy for peripheral lung lesions. Results of the AQuIRE Registry. – Am J Respir Crit Care. 2016
2. . Sensitivity and Safety of EMN Bronchoscopy for Lung Cancer Diagnosis: a systematic review and meta-analysis – Chest 2020
3. Cost analysis of intra-procedural rapid on-site cytopathology evaluation with endobronchial ultrasound. In J technol 2015.
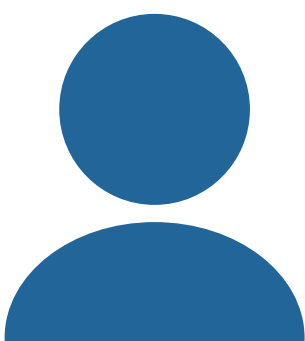
# ARTICLE CITATION

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