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Shaping Scope Skills: Efficiency and Safety Outcomes of Advanced Diagnostic Bronchoscopy with Pulmonary and Critical Care Medicine Fellows

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The clinical question

How does training PCCM fellows affect the efficiency, length, diagnostic performance, and safety of advanced diagnostic bronchoscopic procedures?

Take Home Message

- Although IP fellowships are growing in number, the majority of PCCM fellows gain their basic bronchoscopy skills and exposure to ADB in PCCM fellowship. ADB procedure times can be longer when training PCCM fellows in ADB which should be accounted for when planning/scheduling procedures times and sedation exposure for patients.
- The involvement of PCCM fellows in ADB procedures can lengthen procedure duration (+10 minutes) with a reported 18% efficiency loss and a cumulative impact of 15-20% reduction in efficiency. This could sacrifice volume capabilities of at least 1 procedure per day.
- This could have a substantial impact on operations when resources are already constrained for dedicated procedure space or time.

Background

- Training in ADB occurs among more than 100 Accreditation Council for Graduate Medical Education-accredited pulmonary disease and PCCM fellowships. However, the ACGME does not specify minimum standard or distinguish ADB from routine flexible bronchoscopy.
- Simulation training can improve efficiency and technical proficiency, but these benefits may not translate to real-world outcomes in performance and procedure times.
- Individual learning curves for ADB vary. Training programs vary in ADB standards. There are no nationally established competency requirements for fellow readiness on ADB techniques. This leads to variance among individual programs to train and assess fellows.
- The ideal curriculum to maximize the acquisition of bronchoscopy skills in a PCCM fellowship program is unknown.
- There is limited data analyzing the impact of training PCCM fellows on ADB efficiency and safety.
- This study hypothesizes that procedures performed with fellows would take at least 10 minutes longer than when performed by IP faculty alone (10 minutes was considered a significant cumulative loss of efficiency when performing about 4-6 procedures daily).

Study Design

- **Type of study:** Retrospective observational cohort study of a prospectively collected registry for 628 ADB procedures, most performed by two IP faculty (with fellow participation at the discretion of the IP attending).
- **Randomization, blinding, controls: N/A**

Number: n=34 PCCM fellows (each with a dedicated four-week IP rotation). The database included 1467 consecutive bronchoscopies and of these, 628 were ADBs among which 379 (60.3%) included fellows. Outpatient procedures accounted for 68.5%. Moderate sedation was used in 66.1%. The most common procedure was convex endobronchial ultrasound (cEBUS) bronchoscopy (44.4%).

Definition: ADB is bronchoscopy with any of the following procedures performed in tissue sampling: cEBUS, radial endobronchial ultrasound (rEBUS), or electromagnetic navigation (EMN).

Study Design continued...

Study groups: Cohort groups, including GP and PCCM fellows stratified by training year (PGY4, PGY5, and PGY6, compared to faculty of interventional pulmonology).

Settings: Tertiary academic center with a PCCM fellowship and IP service. No IP fellows were included in this study.

Enrollment: This is a prospectively collected registry with data from consecutive ADB procedures supplemented by data review from the EMR.

Study period: February 2018 - December 2021

Follow up: N/A; there was no post-training follow-up for the PCCM fellows who completed their fellowship after the study period.

Primary outcome: Procedure duration.

Secondary outcomes:

- Major complications: pneumothorax requiring chest tube; bleeding (requiring balloon blocker, ablation, embolization, or blood transfusion); respiratory failure requiring endotracheal intubation; escalation of disposition for any reason; cardiac arrest; death
- Minor complications: all other complications
- Procedure breadth: number of lesions sampled, number of diagnostic techniques used
- Need for premature termination of the procedure for any reason
- Diagnostic performance
- Specific diagnostic yield: per-subject recovery of a specific actionable diagnosis like malignancy, granuloma, organizing pneumonia or infection
- Diagnostic sensitivity for malignancy (and two years radiographic follow up for non-specific results)

Subgroup analysis: All outcomes by procedure type and fellow training level.

The authors estimated a sample size of 200 ADBs to detect a 10-minute between-group difference for 90% power using a two-sided test. The t-tests and Wilcoxon rank sum tests were used to evaluate between-group differences for continuous variables. For categorical variables, chi-square tests were applied.

Population

Inclusion criteria:

- ADB cases performed by either Pulmonary/PCCM fellow or faculty.
- A fellow was considered to have participated if they were the primary operator for at least one key component of the procedure, such as intubation and airway inspection, cEBUS bronchoscope intubation, and mediastinal survey (with or without sampling).
- Fellows were provided with supplementary reading material and assignments on a high-fidelity simulator before their 4-week IP rotation.
- PGY-4 fellows attended a regional EBUS course.
- Fellows were given task-oriented instruction based on established bronchoscopy skills assessment tools during their rotation.,
- After the IP rotation, fellows were given a multiple-choice question exam and provided comprehensive feedback on their overall performance.

Exclusion criteria:

- Non-ADB advanced bronchoscopies (n=839)

Baseline Characteristics:

- Patient demographics included age, gender, underlying medical risk factors, chronic sedative or narcotic use, body mass index (BMI), and malignant diagnosis.

Outcomes

Primary outcomes:

- Fellow participation during ADB increased overall bronchoscopy duration by 7.2 minutes, approximate 13% compromise in efficiency compared with average faculty-performed bronchoscopy. Median 58 minutes vs 52 minutes (95% CI 3-11 min, p<0.001).
- Differences were largest comparing cEBUS between PGY-4 (2.5 mins) and PGY-5 (14.5 mins) from 37.5-minute when faculty performed cEBUS.
- The procedure duration differentials were largest for cEBUS bronchoscopy (+11.5 mins, 95% CI 6-14 mins, p<0.001) and rEBUS or EMN guided peripheral bronchoscopy (+10.5 mins, 95% CI 2-18 mins p=0.016).
- PGY-5 fellows were consistently the least efficient across procedure types compared to faculty only cases with duration of +8.8 minutes, 95% CI 4.6-13 mins, p<0.001).

Secondary outcomes:

- Other factors associated with long ADB duration included general anesthesia, combined modalities, ROSE, more sampling techniques and occurrence of complications.
- Minor events such as inefficiently controlled airway bleeding, occurred more frequently during fellow - involved cases.
- ADB complications with fellow involved procedures compared to IP faculty were 38.7% vs 25.8% ($p<0.001$).
- Major complications were similar in both groups, 3.4% vs 2.5% $p=0.50$.
- Neither group had complications like major bleeding, cardiac arrest or death.
- The odds ratio for any complications for fellow involved procedures was 2.0 (95% CI 1.3-3.0, $p<0.001$).
- Occurrence of complications also independently increased procedure time.
- Procedure efficiency and complication outcomes both improved slightly in PGY-6.
- Per patient specific diagnostic yield and sensitivity for malignancy were 74.5% and 89.7%.
- Procedures with fellows were more likely to be prematurely terminated (6.3% vs 1.8%, $p=0.009$) and 63% of these were because of recurrent and/or persistent minor complications (like inefficiently controlled airway bleeding) or patient agitation and excessive coughing that detracts from procedural objectives.

Subgroup analysis:

- Procedure duration differences between fellow level were:
- PGY-4 (5.1 min), $p=0.07$
- PGY-5 (8.8 min), $p<0.001$
- PGY-6 (7.1 min), $p<0.001$

Adverse events: not applicable

Commentary

Study Strengths:

- This study adds to the literature of medical education in ADB training for PCCM fellows with supervision.
- The study evaluated different levels of trainees from PGY-4 to PGY-6 assuming a graduated level of expectations and exposures from basic airway inspection and sampling to ADB with multimodal sampling.
- This is a real-world study with generalizable findings as currently the PCCM fellowships outnumber IP fellowships and the majority of PCCM trainees will receive some degree of exposure to ADB in PCCM fellowship though not nationally standardized.

Limitations:

Single center and retrospective data.

Biases:

Supervising bronchoscopy faculty for this study were experienced interventional pulmonologists, which can mitigate procedural risks when providing supervision and may underestimate the patient safety risks or overestimate diagnostic yield outside of this environment.

Conclusions:

- The participation of PCCM fellows in advanced diagnostic bronchoscopy (ADB) can increase peripheral bronchoscopy duration by 10 minutes and convex-probe EBUS by 11.5 minutes. There may be a higher risk of minor complications and more frequent premature termination of procedures, especially among 2nd-year fellows (PGY-5).
- However, major complications and diagnostic performance are similar between IP Faculty and supervised PCCM fellows.
- The most inefficient procedures were cases under moderate sedation and those without rapid on-site evaluation (ROSE).
- The study can help support collaboration between PCCM fellowship directors and supervising bronchoscopy faculty to optimize training while still maximizing procedural efficiency and patient safety.

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Suggested Reading

(References in Vancouver style)

- Chandrika S, Yarmus L. Recent developments in advanced diagnostic bronchoscopy. European Respiratory Review [Internet]. 2020 Sep 2;29(157):190184. Available from: https://doi.org/10.1183/16000617.0184-2019
- Gupta S, Ghiathi C, DiBardino D, Josan ES, Salguero BD, Chaddha U, et al. Effect of interventional pulmonology fellowships on pulmonary Critical care fellows' core bronchoscopy competencies. ATS Scholar [Internet]. 2025 Feb 18; Available from: https://doi.org/10.34197/ats-scholar.2024-0079oc
- Voduc N, Adamson R, Kashgari A, Fenton M, Porhownick N, Wojnar M, et al. Development of learning curves for bronchoscopy. CHEST Journal [Internet]. 2020 Jul 3;158(6):2485–92. Available from: https://doi.org/10.1016/j.chest.2020.06.046
- Knox DB, Wong WW. Graduating fellows' procedural comfort level with pulmonary critical care procedures. Journal of Bronchology & Interventional Pulmonology [Internet]. 2018 Dec 20;26(4):231–6. Available from: https://doi.org/10.1097/lbr.0000000000000563
- Green ML, Aagaard EM, Caverzagie KJ, Chick DA, Holmboe E, Kane G, et al. Charting the road to competence: developmental milestones for internal medicine residency training. J Grad Med Educ 2009;1:5–20

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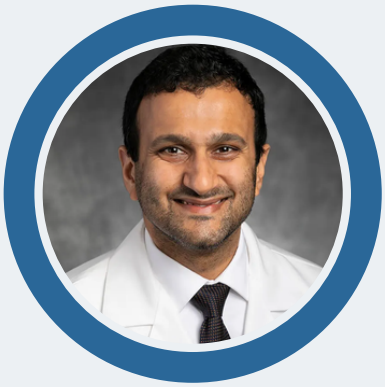

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