



# Could a specific ventilatory protocol reduce atelectasis during peripheral bronchoscopy?

## BACKGROUND & OVERVIEW



### THE CLINICAL QUESTION

Can a ventilatory strategy reduce the incidence of atelectasis during bronchoscopy under general anesthesia (GA)?

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### STUDY CONCLUSION

A ventilatory strategy to prevent atelectasis (VESPA) using endotracheal intubation (ET) followed by a recruitment maneuver, FIO<sub>2</sub> titration (<100%), and PEEP of 8 to 10 cmH<sub>2</sub>O, significantly reduces the incidence of atelectasis without increased complications.



### STUDY BACKGROUND

Development of intraprocedural atelectasis can negatively affect the outcomes of peripheral bronchoscopy performed under general anesthesia. It can interfere with navigation, obscure targets, cause CT scan-to-body divergence, and create false-positive radial-probe endobronchial ultrasound (RP-EBUS) images, which all contribute to nondiagnostic sampling. The impact of atelectasis during peripheral bronchoscopy was realized with dynamic intraprocedural advanced imaging with real-time visualization.

The I-LOCATE trial demonstrated a high incidence of atelectasis during bronchoscopy with GA and identified a correlation between higher BMI and longer duration under GA with increased proportion of atelectatic lung segments.

The investigators in this trial sought to explore whether using VESPA can decrease the incidence of atelectasis.

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## CURRENT PRACTICE

Currently proposed ventilation protocols have only been supported by scarce retrospective data based mainly on single-center studies.

# METHODS & RESULTS



## STUDY DESIGN

**Type of trial:** Randomized (1:1) controlled study. Not blind to the bronchoscopist, but it was blinded to the chest radiologist reading the CBCT and 2 out of 3 bronchoscopists who reviewed the RP-EBUS images.

**N:** 118 patients screened; 76 patients enrolled.

**Study groups:** Adult patients referred for nodal staging with convex-probe endobronchial ultrasound (CP-EBUS) with or without peripheral bronchoscopy.

**Settings:** Large academic tertiary cancer centers. (University of Texas MD Anderson Cancer Center, Houston, TX and Banner Boswell Medical Center, Gilbert, AZ).

**Enrollment:** July 2020 to December 2021

**Follow up:** Beginning of bronchoscopy until 48 hours later through electronic medical records and a follow-up call from nurses.

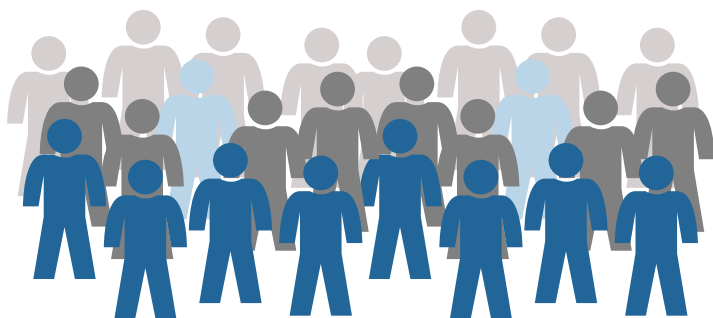
### Primary Outcomes:

- Comparing the effect of VESPA vs. conventional mechanical ventilation on the incidence of intraprocedural atelectasis found on chest CT scan assessment at 40-45 mins after induction (time 2)
- Proportion of patients with any atelectasis (either unilateral or bilateral) at time 2, according to chest CT scan findings

**Secondary outcome:**

- Assessment and comparison between groups of the proportion of patients with atelectasis by chest CT scan at time 1
- Proportion of patients with atelectasis and the number of atelectatic segments by RP-EBUS at times 1 and 2
- Progression of atelectasis between times 1 and 2 by chest CT scan

Comparison between groups in the proportion of complications during and after bronchoscopy



## POPULATION

**Inclusion Criteria:**

- Adult patients who required nodal staging with CP-EBUS with or without peripheral bronchoscopy, and
- Had undergone chest CT imaging within four weeks of bronchoscopy

**Exclusion criteria:**

- Patients with evidence on chest CT scan of lung consolidation or interstitial changes or with lung tumors in dependent areas
- Pregnant patients
- Patients with known pleural effusions or ascites
- Patients with diaphragmatic paralysis
- Patients with indication for endotracheal intubation (i.e., difficult airway, severe gastroesophageal reflux)

**Baseline Characteristics:** were similar in both groups.

**Intraoperative Characteristics:** There was no difference in the number of EBUS and peripheral bronchoscopy between the two groups.

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## INTERVENTIONS

Bronchoscopy was performed following the institution's standard of care with total IV anesthesia, including neuromuscular blocking agents in all patients. All patients received volume control ventilation with a target tidal volume of 6 to 8 mL/kg of ideal body weight.

	Control group	VESPA group
Device	LMA	8.5 ETT
Tidal volume, mL/kg of IBW	7 (7-7.6)	8 (7-8)
FIO <sub>2</sub> , %	100	50 (40-60)
PEEP, cm H <sub>2</sub> O	0	10 (8-10)
Recruitment maneuvers	No	Yes
Time from induction to CT scan survey, min		
- Time 1	9.11	11.71
- Time 2	40.95	43.58
Time from induction to RP-EBUS survey, min		
- Time 1	15.26	16.34
- Time 2	46.97	47.68

### VESPA group

- FIO<sub>2</sub> of < 100% titrated as low as possible to maintain an oxygen saturation of > 94%
- All patients in the VESPA group except one patient underwent a recruitment maneuver immediately after intubation or anytime the ventilatory circuit was disconnected

### **For both groups:**

- After the artificial airway was secured, before starting the indicated bronchoscopic procedure, all patients underwent the initial (time 1) CBCT scan of both lung bases, followed by the time 1 RP-EBUS survey for atelectasis.
- After or during indicated Bronchoscopic procedure, a second (time 2) assessment for atelectasis with CBCT imaging and RP-EBUS.

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## OUTCOMES

### **Primary outcome:**

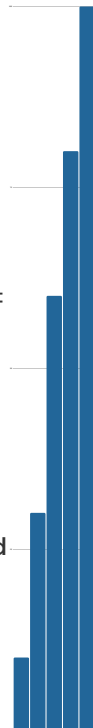
- The proportion of patients with any atelectasis according to chest CT scan at time 2 was 84.2% (95% CI, 72.6%-95.8%) in the control group and 28.9% (95% CI, 15.4%-45.9%) in the VESPA group (P < .0001)
- The proportion of patients with bilateral atelectasis at time 2 was 71.1% (95% CI, 56.6%-85.5%) in the control group and 7.9% (95%CI, 1.7%-21.4%) in the VESPA group (P<.0001).

### Secondary outcomes:

- At time 2, of the six evaluated bronchial segments,  $3.84 \pm 1.67$  segments (mean  $\pm$  SD) in the control group vs.  $1.21 \pm 1.63$  segments (mean  $\pm$  SD) in the VESPA group were deemed atelectatic ( $P < .0001$ ).
- At time 1, of the six evaluated bronchial segments,  $2.00 \pm 2.04$  segments (mean  $\pm$  SD) in the control group vs.  $0.76 \pm 1.42$  segments (mean  $\pm$  SD) in the VESPA group were deemed atelectatic ( $P = .0031$ ).

### Adverse events:

- No differences were found in the rate of complications between the two groups
- No Pneumothorax or pneumomediastinum was reported in either group
- Transient systemic hypotension was reported in 10 patients (26.3%) in the control group vs. 12 patients (31.6%) in the VESPA group ( $P = .6130$ )



## FUNDING



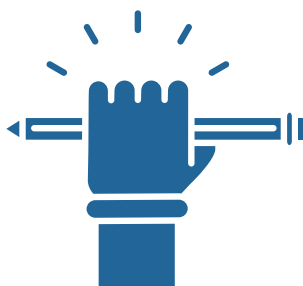
### FUNDING

This study was partly supported by the National Institutes of Health through MD Anderson's Cancer Center Support Grant [Grant CA016672].

## ARTICLE CRITIQUE

### STUDY STRENGTHS

- First randomized controlled trial of a ventilatory strategy to reduce the incidence of atelectasis during bronchoscopy with GA.
- Baseline and intraprocedural characteristics between the two groups are well matched.
- Assessment of atelectasis performed both at the beginning (time 1) and toward the end (time 2) of the procedure to investigate whether the effect of VESPA would persist over time.
- Use of dual imaging modalities (CBCT and RP-EBUS) to detect atelectasis.



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## STUDY LIMITATIONS & POTENTIAL FOR BIAS

- The number of patients who underwent peripheral bronchoscopy with lung biopsies was low (4 patients in each group), which hinders characterizing the complications related to lung biopsy using the VESPA protocol.



- The ventilation strategy for the control group in this study (LMA with 100 FiO<sub>2</sub> and PEEP of 0) may not represent the standard of care at other institutions.
- This study excluded patients with interstitial lung diseases and patients with lung masses in dependent areas. Further evaluation of the VESPA strategy is needed in these challenging cases.
- The assessment of this trial for atelectasis is limited to only up to 45-50 mins which could be longer in real life, especially with the presence of trainees.

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## RESEARCH QUESTION

Can a ventilatory strategy reduce the incidence of atelectasis during bronchoscopy under general anesthesia (GA)?

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## TAKE HOME MESSAGE

Atelectasis is a common consequence of peripheral bronchoscopy under GA, which may lead to inaccurate localization and reduced diagnostic yield. The VESPA trial confirmed that

a ventilation protocol optimized for advanced guided bronchoscopy leads to a significant reduction in the incidence of atelectasis.

Future randomized studies are needed to evaluate if VESPA can also improve the diagnostic yield of peripheral bronchoscopy without increasing the risk of complications.



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## REFERENCES

### ARTICLE CITATION

Salahuddin M, Sarkiss M, Sagar AS, et al. Ventilatory Strategy to Prevent Atelectasis During Bronchoscopy Under General Anesthesia: A Multicenter Randomized Controlled Trial (Ventilatory Strategy to Prevent Atelectasis -VESPA- Trial) [published online ahead of print, 2022 Jul 6]. Chest. 2022;S0012-3692(22)01227-2.

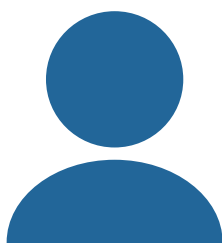
## SUGGESTED READING



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3. Bhadra K, Setser RM, Condra W, Pritchett MA. Lung Navigation Ventilation Protocol to Optimize Biopsy of Peripheral Lung Lesions. *J Bronchology Interv Pulmonol*. 2022;29(1):7-17



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