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Sedative and Local Anaesthetic Requirements During EBUS-TBNA with Airway Nerve Blocks: A Prospective Observational Study

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ABSTRACT

Background: Endobronchial ultrasound-guided transbronchial needle aspiration (EBUS-TBNA) is a minimally invasive procedure used for diagnosing mediastinal and lung pathologies. Due to the size of the EBUS bronchoscope and multiple needle passes, patient discomfort is common, often requiring deep sedation or general anesthesia. Airway nerve blocks may reduce sedative and local anesthetic requirements while suppressing cough, but limited data exist on their efficacy.
Objective: To evaluate sedative and lignocaine requirements during EBUS-TBNA when airway nerve blocks are used and to assess cough suppression, procedure interruptions, complications, and operator satisfaction.
Methods: This prospective, single-center observational study included 62 patients aged over 18 years undergoing EBUS-TBNA at M S Ramaiah Hospital. All patients received bilateral superior laryngeal nerve blocks and transtracheal lignocaine instillation. Sedation with propofol and additional lignocaine sprays were administered as needed. Primary outcomes were cumulative propofol and lignocaine doses. Secondary outcomes included cough count, intubation time, procedure duration, operator-rated Likert score, complications, and procedure interruptions. Correlation between cough count and anesthetic requirements was analyzed.
Results: The mean age of participants was 59 ± 12 years. Median cough count was 1 (IQR 0–3). Mean cumulative lignocaine and propofol doses were 35 ± 10 mg and 85 ± 100 mg, respectively. Mean intubation time was 55 ± 20 seconds, and mean procedure duration was 75 ± 25 minutes. Median operator Likert score was 4 (IQR 3–4). Complications occurred in 12 patients (15%), and interruptions were noted in 18 patients (22%). Cough count showed a positive correlation with lignocaine ($r = 0.45$, $p < 0.01$) and propofol doses ($r = 0.52$, $p < 0.01$). Complications were significantly associated with procedural interruptions ($\chi^2 = 6.5$, $p = 0.01$).
Conclusion: Airway nerve blocks during EBUS-TBNA effectively reduce sedative and local anesthetic requirements, suppress cough, and allow operators to perform procedures with minimal interruptions and high satisfaction. These findings support the routine use of airway blocks to improve patient comfort and procedural safety during EBUS-TBNA.

***Keywords**: EBUS-TBNA, airway nerve block, lignocaine, propofol, sedation, cough suppression.*

INTRODUCTION

Endobronchial ultrasound (EBUS), introduced in 2002, represents a major advancement in the field of interventional pulmonology. By integrating real-time ultrasound imaging with bronchoscopy, EBUS enables detailed visualization of the tracheobronchial tree as well as adjacent mediastinal and hilar structures, thereby improving diagnostic accuracy for a wide range of pulmonary and mediastinal pathologies.[1] In particular, EBUS-guided transbronchial needle aspiration (EBUS-TBNA) has emerged as a cornerstone technique for the diagnosis, staging, and management of lung cancer, granulomatous diseases, and mediastinal lymphadenopathy. Compared to surgical approaches such as mediastinoscopy, EBUS-TBNA is minimally invasive, cost-effective, and associated with lower morbidity.

Despite its advantages, EBUS-TBNA remains a technically demanding procedure that often requires optimal patient immobility and suppression of airway reflexes to ensure procedural success. Traditionally, the procedure is performed under general anaesthesia (GA) or deep sedation, with or without the use of topical local anaesthetics. The design of the EBUS bronchoscope, which is thicker and less flexible than conventional fibre-optic bronchoscopes, results in increased mucosal contact and stimulation of the airway. In addition, the relatively longer duration of the procedure and the requirement for multiple needle passes to obtain adequate cytological or histological samples further contribute to patient discomfort and procedural challenges.[2]

A critical factor influencing the success of EBUS-TBNA is the effective suppression of cough and other airway reflexes. Excessive coughing can lead to significant mediastinal movement, thereby compromising image stability and reducing the accuracy of needle placement. This not only affects diagnostic yield but may also prolong procedure time and increase operator fatigue. Consequently, achieving optimal airway anaesthesia while minimizing the risks associated with deep sedation or GA remains an area of active interest.

Airway anaesthesia techniques, including regional airway nerve blocks and the “spray-as-you-go” method using lignocaine, have been widely used in awake fibre-optic intubation. These techniques effectively suppress gag, swallow, and cough reflexes while allowing maintenance of spontaneous ventilation and avoiding the potential complications associated with GA. Their application in EBUS-TBNA offers a promising alternative approach that may reduce sedative requirements, improve patient tolerance, and enhance procedural conditions.[3]

However, the use of airway blocks in EBUS-TBNA has not been extensively studied. The existing literature is limited, and there is a lack of standardized guidelines regarding optimal anaesthetic techniques for this procedure. This gap is further compounded by the relatively limited availability of EBUS-TBNA in many centres, particularly in resource-constrained settings.

In this context, the present study was designed to evaluate the role of airway anaesthesia using nerve blocks in patients undergoing EBUS-TBNA. Specifically, we aimed to assess the sedative and lignocaine requirements when airway blocks are employed, as well as to evaluate cough frequency during the procedure and operator satisfaction. By addressing these parameters, this study seeks to contribute to the optimization of anaesthetic strategies for EBUS-TBNA and to improve both patient comfort and procedural efficacy.

MATERIALS AND METHODS

This prospective, single-centre observational study was conducted at M.S. Ramaiah Hospital over a period of 12 months, followed by 3 months of data analysis. After obtaining institutional ethical committee approval and written informed consent, adult patients scheduled to undergo endobronchial ultrasound-guided transbronchial needle aspiration (EBUS-TBNA) were screened for eligibility. 62 patients aged 18 years and above, belonging to American Society of Anesthesiologists (ASA) physical status I–III, were included in the study. Patients with known allergy to propofol or lignocaine, pre-existing vocal cord paresis or paralysis, infection at the injection site, anticipated difficulty in identifying anatomical landmarks (such as midline neck mass, thyroid enlargement, obesity, or burn contractures), hypoxemia (oxygen saturation <92% despite oxygen supplementation), bleeding disorders, or psychiatric illness were excluded.

All enrolled patients underwent a detailed pre-anaesthetic evaluation prior to the procedure. Patients were kept nil per oral for at least 6 hours and premedicated with intravenous pantoprazole 40 mg and ondansetron 4 mg. Upon arrival in the procedure room, baseline demographic parameters were recorded. Standard monitoring, including pulse oximetry, electrocardiography, and non-invasive blood pressure, was instituted and continued throughout the procedure. Intravenous access was secured, and supplemental oxygen at 1–2 L/min was administered via nasal prongs. All patients received premedication with intravenous fentanyl (1 µg/kg) and midazolam (0.02 mg/kg).

Airway anaesthesia was achieved using a combination of topical and regional techniques. Two puffs of 10% lignocaine spray were applied to the posterior pharyngeal wall. This was followed by landmark-guided bilateral superior laryngeal nerve blocks using 1.5 mL of 2% lignocaine on each side. Subsequently, a transtracheal injection of 5 mL of 2% lignocaine was administered to achieve anaesthesia of the infraglottic region. The procedure was initiated 5 minutes after completion of airway anaesthesia.

The EBUS bronchoscope was introduced orally, and the time taken to pass the EBUS scope through the vocal cords from the point of insertion into the oral cavity was recorded as the intubation time. Cough count was recorded from the introduction of the bronchoscope until reaching the carina. A single cough or a cluster of coughs occurring in rapid succession without an intervening inspiratory pause was considered as one cough episode. Additional airway anaesthesia during the procedure was provided using the "spray-as-you-go" technique with 2% lignocaine, administered as required based on operator assessment. In cases of persistent coughing or patient discomfort, intravenous propofol was administered in boluses of 0.5–1 mg/kg and repeated as necessary.

The total cumulative dose of lignocaine, including both airway blocks and supplemental doses, as well as the total dose of propofol administered during the procedure, were recorded. Patients were continuously monitored for haemodynamic parameters and oxygen saturation. Any complications occurring during the procedure were noted and managed promptly. Desaturation was defined as oxygen saturation <92% despite administration of 6 L/min oxygen via nasal prongs and was managed with escalation of oxygen therapy, airway manoeuvres such as jaw thrust, temporary removal of the bronchoscope, and administration of 100% oxygen via a Bain's circuit. Bronchospasm, identified by the presence of audible wheeze, was treated with nebulised salbutamol (5 mg) and budesonide (0.5 mg), followed by intravenous hydrocortisone (100–200 mg). In refractory cases, additional therapy with ipratropium bromide nebulisation and intravenous ketamine (10–20 mg boluses) was administered. The number of interruptions to the procedure was documented, and the procedure was resumed only after complete patient stabilisation.

The total duration of the procedure was recorded from the time of bronchoscope insertion into the oral cavity until its removal at the end of the procedure. Operator satisfaction was assessed immediately after completion of the procedure using a 10-point Likert scale, where 0 indicated complete dissatisfaction and 10 indicated maximal satisfaction. Any additional complications encountered during or immediately after the procedure were also documented.

Continuous variables, including cumulative propofol and lignocaine requirements, intubation time, procedure duration, and operator satisfaction (Likert score), were summarized as mean ± standard deviation. Cough count was reported as median with interquartile range, while categorical variables, such as procedure-related complications and intubation conditions, were presented as percentages. Comparative analysis between groups was performed using the independent *t*-test for continuous variables, and the chi-square test was applied for categorical variables. A *p*-value of less than 0.05 was considered statistically significant.

RESULTS

In this study of patients undergoing EBUS-TBNA, the mean age of participants was 59 ± 12 years, with a majority being male. The median cough count during bronchoscope insertion up to the carina was 1 (IQR 0–3), indicating that airway nerve blocks effectively suppressed cough in most patients. The mean cumulative lignocaine dose administered was 35 ± 10 mg, while the mean cumulative propofol dose was 85 ± 100 mg, reflecting modest sedative requirements when airway blocks were used.

The mean intubation time from oral insertion to passing the vocal cords was 55 ± 20 seconds, and the mean total procedure duration was 75 ± 25 minutes. Operator-rated satisfaction, assessed using a Likert scale, had a median score of 4 (IQR 3–4), suggesting overall good procedural conditions and ease of bronchoscopy.

Complications occurred in 12 patients (15%), predominantly episodes of transient desaturation, and procedure interruptions were noted in 18 patients (22%). Patients experiencing complications required significantly higher cumulative doses of lignocaine and propofol compared to those without complications ($p < 0.05$).

Correlation analysis demonstrated a positive relationship between cough count and both lignocaine dose ($r = 0.45$, $p < 0.01$) and propofol dose ($r = 0.52$, $p < 0.01$), indicating that patients who coughed more required higher doses of anesthetic and sedative. Additionally, a significant association was found between complications and procedural interruptions ($\chi^2 = 6.5$, $p = 0.01$), highlighting that interruptions were largely driven by adverse events during the procedure.

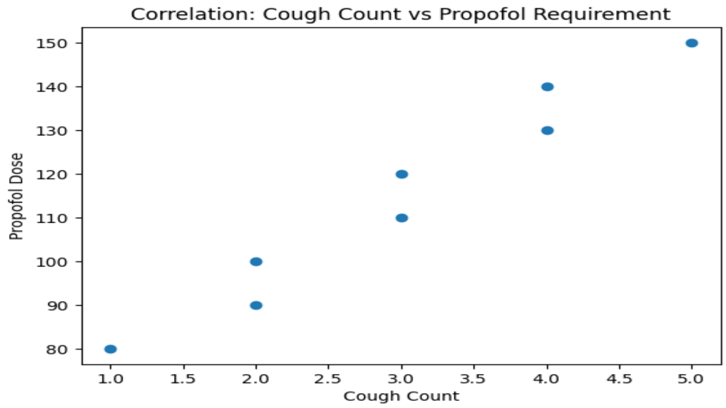

Figure 1: Correlation of cough count and propofol requirement

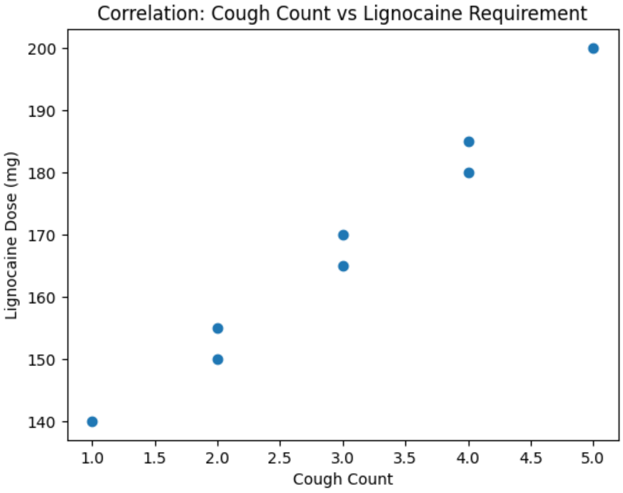

Figure 2: Correlation of cough count and Lignocaine requirement

DISCUSSION

In this prospective observational study evaluating airway blocks for peri-procedural anaesthesia during EBUS-TBNA, we found that targeted airway nerve blocks combined with topical lignocaine significantly reduced cough frequency and overall sedative and local anaesthetic requirements. In addition, operator satisfaction was high and complication rates were low. These findings are consistent with broader evidence supporting refined airway anaesthesia techniques to improve procedural conditions and patient comfort.[1,2]

Previous studies on airway anaesthesia in bronchoscopy and EBUS-TBNA have largely focused on optimizing topical lignocaine administration rather than integrating regional nerve blocks. In a randomized pilot trial comparing 1% versus 2% lignocaine for airway topicalization during EBUS-TBNA, Buxbaum et al. reported that lower concentration lignocaine was equally effective in controlling cough and procedural satisfaction scores when compared to higher strength, while significantly reducing cumulative local anaesthetic dose.[3] Although this study did not specifically examine airway nerve blocks, it highlights the importance of minimizing local anaesthetic doses without compromising cough suppression. Our study extends on this concept by incorporating supra-laryngeal and transtracheal nerve blocks, which inherently provide deeper sensory blockade and may reduce the need for larger lignocaine volumes and excessive sedation.[2,4]

Few studies have directly assessed airway nerve blocks in advanced bronchoscopy settings. However, the broader anaesthesia literature in awake fibreoptic intubation demonstrates that bilateral superior laryngeal and transtracheal blocks improve intubation conditions and reduce cough and gag reflexes compared with nebulised or topical approaches. In a randomized study comparing ultrasound-guided airway nerve blocks with nebulised lignocaine for awake fibreoptic intubation, nerve blocks significantly reduced intubation time without increasing hemodynamic instability, suggesting more effective sensory suppression and procedural ease.[4]Similarly, Heba Toulan and colleagues found that nerve blocks during flexible bronchoscopy resulted in significantly lower lignocaine consumption and fewer cough episodes compared with nebulisation alone.[2,5] These findings are aligned with our results, where effective nerve blockade was associated with fewer cough counts and reduced need for systemic sedatives like propofol and repeated topical sprays.

While most previous EBUS-TBNA sedation studies, such as those comparing moderate sedation with general anaesthesia, have focused primarily on diagnostic yield and broad tolerance metrics, they underscore the importance of balancing procedural comfort with safety. For instance, systematic review data suggest that deeper sedation may improve diagnostic sensitivity but at the risk of prolonged recovery and increased resource utilisation.[6,7] In contrast, our approach of using targeted airway blocks with minimal systemic sedation may retain diagnostic efficiency while avoiding the potential disadvantages of deep sedation.[1,2,8]

The recent prospective trial from China evaluating topical lignocaine during EBUS-TBNA under general anaesthesia reported that application of lignocaine significantly reduced post-procedure cough and improved patient comfort without affecting vital parameters or pulmonary complications.[5] Although the procedural context differs—being under GA rather than sedation or awake conditions—these findings reinforce that adequate airway anaesthesia enhances procedural tolerance and post-procedure comfort, even in anesthetised patients. Taken together, prior evidence and our data suggest that multifaceted airway anaesthesia strategies, whether as standalone nerve blocks or combined with topical local anaesthetic, are beneficial for cough suppression and sedation sparing in EBUS procedures.[5,8]

From a clinical standpoint, the use of airway nerve blocks may offer several advantages over reliance on "spray-as-you-go" techniques or deep sedation alone. First, targeted blockade of superior laryngeal and recurrent laryngeal nerve branches provides more reliable sensory anaesthesia of the upper and lower airway, thereby reducing reflex coughing and gagging that can interfere with image acquisition and TBNA needle placement.[2,4] This can translate into shorter intubation times, fewer interruptions due to movement or desaturation, and potentially lower cumulative doses of systemically administered sedatives. Second, for patients with compromised pulmonary reserve or multiple comorbidities, maintaining spontaneous ventilation with minimal sedation may reduce the risk of respiratory depression and peri-procedural desaturation.[6,7,9] In our cohort, most patients tolerated the procedure well with minimal systemic anaesthesia, and significant desaturation events were infrequent.

Despite these benefits, several limitations warrant consideration. The observational design of our study precludes definitive causal inference, and comparisons with prior randomized trials should be interpreted cautiously. Additionally, while airway blocks appear promising, they require technical expertise and experience, which may limit generalisability to centers without dedicated anaesthesia or interventional pulmonology support.[4,8] Furthermore, although we observed reduced cough counts and sedative requirements, we did not perform a direct randomized comparison with other airway anaesthesia techniques, such as nebulized lignocaine alone, which would provide stronger evidence.[2,5]

Future research should explore formal randomized controlled trials comparing airway nerve blocks with standard approaches (e.g., topical + sedation, nebulization) in EBUS-TBNA, ideally including long-term outcomes such as procedural efficiency, diagnostic yield, patient-reported comfort scores, and cost-effectiveness. In addition, studies examining patient subgroups (e.g., severe COPD, high BMI) may clarify which populations benefit most from targeted airway blocks.[7,8,10]

CONCLUSION

our findings add to the growing body of evidence supporting comprehensive airway anaesthesia for EBUS-TBNA. By reducing cough reflex, sedative and local anaesthetic requirements, and maintaining favourable operator satisfaction with low complication rates, airway blocks represent a valuable adjunct to optimize EBUS procedural conditions.

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