Exploratory Research and Hypothesis in Medicine **2025** vol. 000(000) | 000–000 Epub
DOI: 10.14218/ERHM.2024.00041

Original Article

Comparison of Pre-procedure Lignocaine Spray versus Spray-as-you-go for Topical Airway Anesthesia in Flexible Bronchoscopy: A Randomized Controlled Trial

Hira Ishtiaq[1], Talha Mahmud[2*], Faisal Iqbal[3] and Abdul Saeed Khan[4]

[1]*Department of Pulmonology, Punjab Rangers Teaching Hospital, Rahber Medical and Dental College, Lahore, Punjab, Pakistan;* [2]*Department of Pulmonology, Shaikh Zayed Hospital, Federal Postgraduate Medical Institute, Lahore, Punjab, Pakistan;* [3]*Department of Medicine, Islam Medical & Dental College, Sialkot, Punjab, Pakistan;* [4]*Department of Otolaryngology (ENT), Shaikh Zayed Hospital, Federal Postgraduate Medical Institute, Lahore, Punjab, Pakistan*

Received: January 19, 2025 | **Revised:** April 22, 2025 | **Accepted:** May 12, 2025 | **Published online:** July 31, 2025

Abstract

Background and objectives: Fiberoptic bronchoscopy involves various topical airway anesthesia protocols, which can impact patient comfort, procedural ease, and overall outcomes. This study aimed to compare pre-procedure lignocaine spray (PPL) and spray-as-you-go (SAYG) airway anesthesia in terms of patient discomfort and operator comfort during fiberoptic bronchoscopy.

Methods: A single-blind randomized controlled trial was conducted at the Pulmonology Department of Shaikh Zayed Hospital, Lahore, Pakistan, from March 2021 to March 2022. Fifty participants were randomly assigned to two groups (n = 25 each). Standard procedural sedation with midazolam and 2 mL of 4% lignocaine spray in the oropharynx was used to suppress the gag reflex. Additionally, 2% lignocaine spray was administered during the procedure according to body weight (3 mg/kg) via oral scope insertion. Cough severity, pain perception, and operator comfort were assessed using the Visual Analogue Scale, Faces Pain Rating Scale, and a 4-point Likert scale, respectively.

Results: Demographic characteristics were comparable between the groups, with a minor age difference (PPL: 53.25 years vs. SAYG: 50.88 years, $p = 0.017$). No significant differences were observed in pain perception, cough scores, or procedure duration between the PPL and SAYG groups. Operator comfort scores showed a trend favoring PPL (60% rated as "comfortable" or "very comfortable" vs. 28% in SAYG), though the difference was not statistically significant ($p = 0.108$).

Conclusions: Both PPL and SAYG topical airway anesthesia methods demonstrated similar effectiveness in pain control, cough suppression, operator comfort, and procedure duration. There was a slight, non-significant preference for PPL in operator comfort. These findings suggest that either technique may be effectively used, with potential implications for procedural efficiency and patient outcomes.

Introduction

Fiberoptic bronchoscopy (FOB) is a commonly used procedure for diagnosing and treating bronchopulmonary diseases, including airway inspection, bronchoalveolar lavage, bronchial brushing, endobronchial biopsy, and conventional transbronchial needle aspiration.[1] During FOB, an endoscope (bronchoscope) is typically inserted through the nose or mouth, which can cause anxiety, distress, discomfort, and pain for most patients.[2] Without the use of topical anesthesia, many patients report discomfort during the procedure, such as coughing, pain, nausea, a sensation of choking, and hypoxia. Sedation and analgesic premedication can be employed to reduce patient anxiety and enhance the effectiveness of the procedure. These interventions can improve patient satisfaction and reduce discomfort during the procedure.[3]

Keywords: Flexible; Fiberoptic; Bronchoscopy; Lignocaine; Spray-as-you-go; Topical airway anesthesia; Intratracheal; Pre-procedural.

***Correspondence to:** Talha Mahmud, Department of Pulmonology, Shaikh Zayed Hospital, Federal Postgraduate Medical Institute, Lahore, Punjab 54000, Pakistan. ORCID: https://orcid.org/0000-0003-4585-0765. Tel: +92-3014397549, E-mail: drmtalha@hotmail.com

How to cite this article: Ishtiaq H, Mahmud T, Iqbal F, Khan AS. Comparison of Pre-procedure Lignocaine Spray versus Spray-as-you-go for Topical Airway Anesthesia in Flexible Bronchoscopy: A Randomized Controlled Trial. *Explor Res Hypothesis Med* 2025;000(000):000–000. doi: 10.14218/ERHM.2024.00041.

Local anesthesia plays a crucial role in optimizing patient comfort and satisfaction during bronchoscopy, thereby minimizing potential complications. Among various local anesthetics, lignocaine (lidocaine) is the most commonly employed due to its favorable safety profile and pharmacokinetic properties. Its widespread use is attributed to its rapid onset of action, effective anesthetic effect, and minimal systemic absorption, which ensures optimal patient comfort while reducing adverse effects.[3,4] Lignocaine can be administered to the respiratory tract through several methods, including oropharyngeal spray, nebulization, transtracheal injection, local nerve block, and spray-as-you-go (SAYG) instillation into the airways (larynx, trachea, bronchi).[4]

Although FOB is a critical diagnostic procedure in pulmonology, patient discomfort and operator ease remain significant challenges. Topical airway anesthesia is routinely used to reduce discomfort, but methods of administration vary. Two commonly used techniques are pre-procedure lignocaine spray (PPL) and SAYG. While both methods are widely practiced, there is limited evidence comparing their effectiveness in terms of patient comfort, procedure duration, and operator satisfaction. This study addresses a key scientific gap by systematically comparing these two techniques in a controlled setting, evaluating both patient and operator outcomes. By assessing these parameters, the study aimed to inform clinical decision-making and enhance the procedural experience for both patients and bronchoscopists.

The SAYG technique involves delivering lignocaine solution through a syringe attached to the bronchoscope's working channel during scope insertion, targeting the larynx, trachea, and lobar bronchi. It has become one of the most popular methods for topical airway anesthesia. The current study was carried out to compare the effects of PPL versus SAYG in terms of patient discomfort and bronchoscopist comfort during flexible bronchoscopy.

Materials and methods

A single-blind randomized controlled trial (RCT) was conducted at Shaikh Zayed Hospital Lahore's Pulmonology Department from March 2021 to March 2022, following approval from the Institutional Review Board, Shaikh Zayed Medical Complex Lahore (approval number: SZMC/IRB/Internal/0063/2021). The study conformed to the ethical guidelines of the Helsinki Declaration (as revised in 2024). Informed consent was obtained from all participants. This RCT has been registered with the ClinicalTrials.gov with NCT number: NCT07084623, available at https://clinicaltrials.gov/study/NCT07084623.

Sample size calculation

The sample size for the present study was 50 patients (25 in each group), calculated with a 95% confidence interval and 90% study power. The calculation was based on an expected mean cough score of 51 ± 23.6 for the PPL group and 27 ± 27 for the SAYG group. A pilot trial was conducted in the department to estimate cough scores. The sample size was calculated using the fresh data from the pilot, which might result in imprecise measurements not fully comparable to the literature. The Sample Size version 2.0 calculator was used for this purpose.

Inclusion and exclusion criteria

Inclusion criteria comprised all consecutive patients indicated for diagnostic FOB, aged over 18 years, both genders (males and females), hemodynamically stable (defined as systolic blood pressure between 100 and 180 mm Hg), and sedated with an intravenous injection of midazolam at 0.01 mg/kg. Exclusion criteria included hypersensitivity to lignocaine, use of general anesthesia for the procedure or other emergency procedures, pregnancy, comorbidities such as heart failure, advanced chronic kidney disease stage 3–4, chronic liver disease, contraindications to sedation, and hypoxemia (oxygen saturation by pulse oximetry, SpO_2 < 92%). Patient characteristics, including presenting respiratory symptoms (e.g., chronic cough, dyspnea, hemoptysis) and indications for bronchoscopy (such as suspected lung malignancy, pulmonary infections, or interstitial lung disease), were recorded at consultation. Only patients undergoing diagnostic FOB for evaluation of undiagnosed pulmonary conditions were included. Patients with the above exclusion criteria were not enrolled (Fig. 1).

Patient enrollment

The study enrolled 50 patients using purposive sampling. Randomization was performed by the lottery method, dividing participants equally into two groups: the PPL spray group and the SAYG group, each containing 25 participants. For randomization using a lottery method, folded slips with 'SAYG' and 'PPL' were placed in a jar, shuffled, and then drawn for each participant. The study participants were blinded to the allocation, while the researcher remained blinded until the slip was opened, thereby ensuring allocation concealment. Although randomization tables were not utilized, the lottery method employed in this study provided a simple and effective means of randomizing participants into two groups. After providing a comprehensive verbal briefing on the study's purpose, potential benefits, and risks, written informed consent was obtained from participants who agreed to partake. Baseline demographic data were then collected, including age, gender, procedure duration, and weight, to establish a comprehensive participant profile. While this study provides useful insights, the sample size (n = 50) may have been insufficient to detect statistically significant differences between groups. A larger sample size may be needed to achieve adequate statistical power and draw more definitive conclusions.

Data collection

This study compared the efficacy of two topical anesthesia regimens for diagnostic bronchoscopy. All patients received standard procedural sedation with intravenous midazolam (1–2 mg, 0.01 mg/kg) and 4% lignocaine topical spray (2 mL) applied to the posterior oropharynx to suppress the gag reflex. The bronchoscope was inserted orally following the department's standardized protocol. Participants were randomly assigned to one of two groups (n = 25 each), both receiving 2% lignocaine administered according to body weight (3 mg/kg). The PPL group received 2–4 mL of lignocaine sprayed over the vocal cords via a syringe attached to the bronchoscope's working channel, followed by a single bolus injection of the remaining calculated dose into the larynx/trachea. The bronchoscope was then withdrawn for 3 m to allow cough settling. In contrast, the SAYG group received 2–4 mL of lignocaine sprayed over the vocal cords through the bronchoscope's working channel, followed by intratracheal injection during bronchoscope advancement. Additional lignocaine doses were administered in the mainstem bronchi as the bronchoscope descended. After anesthesia administration, diagnostic procedures including bronchial washings and biopsies were performed in both groups.

The primary outcomes were patient discomfort and operator comfort; the secondary outcome was procedure duration. Post-bronchoscopy subjective assessments were conducted by an in-

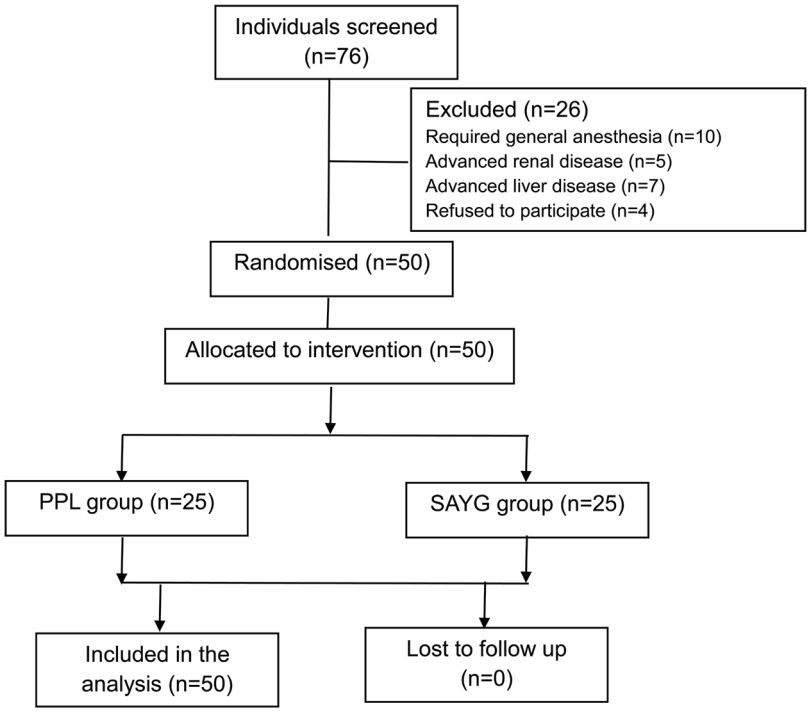

Fig. 1. Study flow diagram. PPL, pre-procedure lidocaine spray; SAYG, spray-as-you-go.

dependent observer, evaluating cough severity using a 100 mm Visual Analog Scale (VAS) and pain perception via the Faces Pain Rating Scale. The VAS ranged from 0 (no cough) to 100 (worst cough), while the Faces Pain Rating Scale consisted of six faces with numerical values from 0 to 10. Procedure duration was recorded from bronchoscope insertion to withdrawal. All bronchoscopies were performed by departmental operators under the supervision of a single experienced pulmonologist with extensive training in bronchoscopy.

Statistical analysis

Data were processed and analyzed using SPSS v.25. Normality was assessed with the Shapiro-Wilk's Test, which showed the data were normally distributed. Age, weight, cough score, pain score, and duration were reported as mean ± standard deviation. Comparisons between the two groups were made using an independent samples Student's t-test. Gender and operator comfort were reported as frequencies and percentages and compared using the chi-square test. A p-value of <0.05 was considered statistically significant.

Results

Demographical characteristics

The study enrolled 50 participants, divided into two groups: PPL (n = 25) and SAYG (n = 25). Demographically, the groups were comparable. The PPL group was slightly older (mean ± standard deviation: 53.25 ± 18.38 years) compared to the SAYG group (50.88 ± 17.46 years), with a statistically significant difference (p = 0.017). However, the clinical relevance of this small difference (2.37 years) is likely negligible. No significant difference was observed in the weights of subjects between the two groups (PPL: 68.19 ± 8.05 kg vs. SAYG: 66.71 ± 7.58 kg, p = 0.08), indicating comparable baseline weight distributions. Gender distribution was also similar, with 14 males and 11 females in the PPL group and 16 males and nine females in the SAYG group (Fig. 2).

Comparative analysis

Comparative analysis revealed no statistically significant differences between groups regarding pain perception (PPL: 2.62 ± 1.217, SAYG: 3.11 ± 1.302; t (48) = −1.376, p = 0.175), cough scores (PPL: 38.33 ± 18.491, SAYG: 41.76 ± 17.405; t (48) = −0.677, p = 0.502), or procedure duration (PPL: 11.41 ± 4.85 m, SAYG: 12.68 ± 6.78 m; t (48) = −0.764, p = 0.448).

Pain score

The PPL group reported marginally lower pain scores compared to SAYG (PPL: 2.62 ± 1.217, SAYG: 3.11 ± 1.302; t (48) = −1.376), but this difference was not statistically significant (p = 0.175).

Cough score

Cough severity (measured via VAS) was slightly lower in the PPL group (38.33 ± 18.49) than in the SAYG group (41.76 ± 17.40), but the difference was not significant (p = 0.502).

Duration of procedure

The PPL group had a shorter mean procedure time compared to SAYG (PPL: 2.62 ± 1.217, SAYG: 3.11 ± 1.302; t (48) = −1.376), but this difference was not statistically significant (p = 0.448).

Clinical relevance

Although the differences between groups were not statistically significant, clinical relevance should be considered. The mean pain score difference of 0.49 points between the PPL and SAYG groups

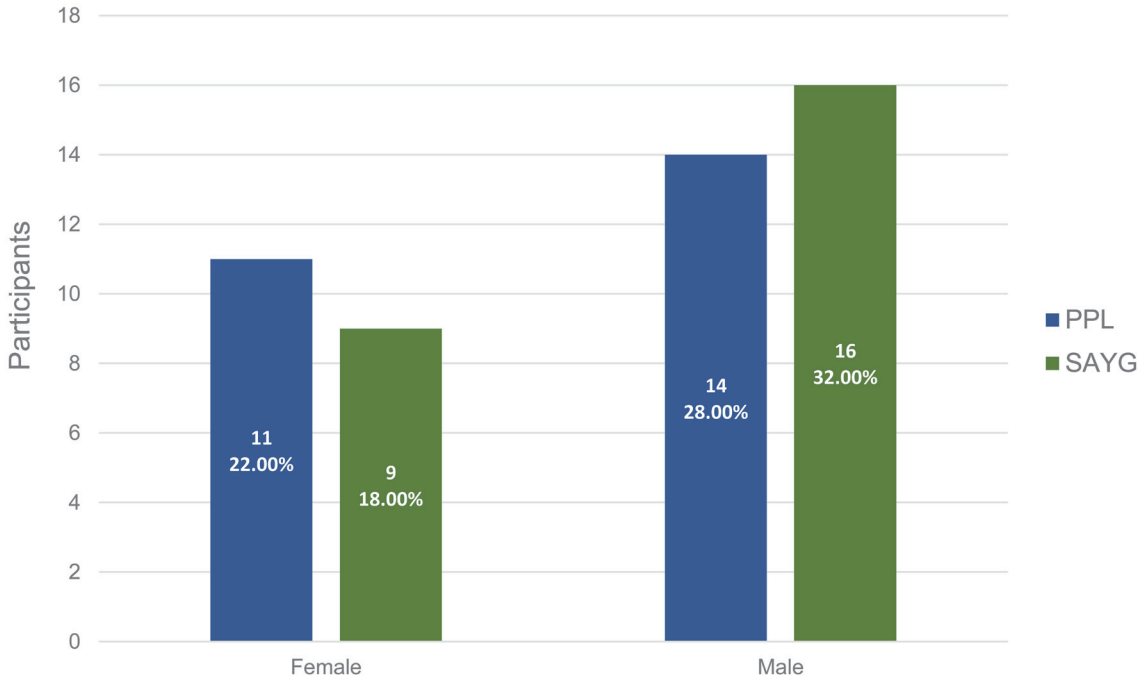

Fig. 2. Comparison of gender distribution in study groups. PPL, pre-procedure lidocaine spray; SAYG, spray-as-you-go.

on a standard numeric pain scale is relatively small and unlikely to produce a perceptible improvement in patient comfort. Similarly, the slight reduction in procedure duration and higher operator comfort in the PPL group, while favorable, may not confer a meaningful clinical advantage in routine practice.

Operator comfort

A higher proportion of operators reported being "Comfortable" (40.0% vs. 24.0%) or "Very Comfortable" (20.0% vs. 4.0%) in the PPL group compared to the SAYG group. Conversely, SAYG had more operators reporting "Slightly Uncomfortable" (48.0% vs. 24.0%) or "Not Comfortable" (24.0% vs. 16.0%). The overall distribution trended toward better operator comfort with PPL, but the difference did not reach statistical significance (p = 0.108) (Table 1).

Adverse events

No serious systemic toxicity symptoms associated with lignocaine use were reported in our patients, such as arrhythmias, visual/auditory disturbances or seizures. One (4%) patient in PPL group and 2 (8%) in SAYG reported self-settling mild generalized numbness and metallic taste, indicating safe lignocaine administration.

Discussion

This study compared two topical anesthetic regimens for bron-

Table 1. Comparison of age, weight, pain and cough scores, procedure duration, and operator comfort scores between the two study groups

Variable	PPL	SAYG	*p*-value
Age (years), mean ± SD	53.25 ± 18.38	50.88 ± 17.46	0.017
Weight (kg), mean ± SD	68.19 + 8.05	66.71 ± 7.58	0.08
Pain score, mean ± SD	2.62 ± 1.21	3.11 ± 1.30	0.175
Cough score, mean ± SD	38.33 ± 18.49	41.76 ± 17.40	0.502
Duration of procedure (minutes), mean ± SD	11.41 ± 4.85	12.68 ± 6.78	0.448
Operator Comfort			
Not comfortable	4 (16.0%)	6 (24.0%)	0.108
Slightly uncomfortable	6 (24.0%)	12 (48.0%)	
Comfortable	10 (40.0%)	6 (24.0%)	
Very comfortable	5 (20.0%)	1 (4.0%)	
Total	25 (100.0%)	25 (100.0%)	

PPL, pre-procedural lignocaine spray; SAYG, spray-as-you-go; SD, standard deviation.

choscopy: PPL and the SAYG techniques. The findings suggest that both PPL and SAYG techniques were equally effective, with similar patient and bronchoscopist experiences. Sedation and local anesthesia are crucial factors in bronchoscopy efficiency, but lack standardization, leading to variability in practice based on physician preferences. Many standard FOB guidelines target patient comfort, physician ease of execution, and minimal risk. Topical anesthesia before and during bronchoscopy decreases coughing and reduces the dose of sedation needed during the procedure.[4,5] Our results align with previous studies, showing no significant differences in pain, cough, and operator comfort between the two regimens.[4,6]

Lignocaine is the most commonly used medication for topical anesthesia during bronchoscopy due to its excellent cough-suppressing properties, brief duration of action, broad therapeutic safety margin, and negligible tissue toxicity.[4] The use of nebulized lignocaine during sedation, as well as during non-sedated bronchoscopy, is not supported by the bulk of existing research.[4–6] One trial randomized 1,050 patients to receive nebulized lidocaine (2.5 mL of a 4% solution), oropharyngeal spray (10 actuations of 10% lidocaine), or nebulized lidocaine (2.5 mL of a 4% solution) combined with two actuations of 10% lidocaine.[6] Patient- and bronchoscopist-rated cough severity was lowest in those who received 10 actuations of oropharyngeal lidocaine, which also happened to be the group that received the lowest cumulative dose of lidocaine. In our study, to avoid adverse reactions to lignocaine, the amount administered was kept as low as possible, following available guidelines for a lower cumulative dose. We used 2% lignocaine as recommended. While 1% lignocaine has been shown to be as effective as the commonly used 2% concentration,[7] only a 2% solution was used in our study, so we could not compare the impact of different lignocaine concentrations.

In another RCT, patients referred for FOB were randomly assigned to receive topical lidocaine anesthesia via the bronchoscope's working channel or through a washing pipe equipped with a spray nozzle. The primary outcome was cough rate, defined as the total number of coughs per minute. Secondary outcomes included subjective perceptions of both the patient and the operator regarding the bronchoscopy process. Similar to our study, these perceptions were rated on a VAS, with numerical ratings ranging from 0 to 10. The study favored the spray nozzle for delivering lidocaine, which provided superior topical airway anesthesia during FOB compared with the traditional method.[8] However, in another study, the authors did not find significant differences between the catheter spray and conventional syringe injection methods of lidocaine administration in terms of cough frequency, hemodynamic changes, or patient discomfort during non-sedated FOB.[9] On the other hand, transcricoid or transtracheal injection of lidocaine can provide effective topical anesthesia with high patient comfort and acceptance as a pre-procedural measure.[4] Administration through the working channel of the bronchoscope (SAYG method) and direct intratracheal injection of lignocaine (the cricothyroid method) are both recommended as acceptable modalities. In addition to greater comfort and less coughing, the cricothyroid method is associated with significantly lower cumulative lignocaine exposure during the procedure.[10]

Similar to our study, pre-procedural nebulized lidocaine initially gained popularity. However, two placebo-controlled trials found that administering nebulized lidocaine before bronchoscopy offered no additional benefit over nebulized saline in reducing cough and discomfort scores, despite being used in conjunction with topical lidocaine administration and sedation.[11,12] In terms of cough severity and bronchoscopist comfort during FOB, another recent study showed that endotracheal topical anesthesia via a multi-orifice epidural catheter (three holes/openings) using the SAYG technique during flexible bronchoscopy appeared to be superior to the conventional spray method via the bronchoscope's working channel.[13,14] Similarly, findings from another RCT demonstrated that lignocaine administration through an alternative SAYG delivery method using a spray catheter, compared to the conventional spray-as-you-go technique, reduced cough, decreased the need for sedation, and increased operator satisfaction.[15]

Despite the lack of a standardized protocol for administering topical airway anesthesia during bronchoscopy, researchers and clinicians continue to seek the optimal approach.[4,5] Our study investigated the effectiveness of PPL spray versus the SAYG technique. Notably, operators reported greater comfort with the PPL spray, which was associated with a perceived reduction in patient coughing during the procedure, although this difference did not reach statistical significance. In another study by Venkatnarayan *et al*.,[16] patients undergoing bronchoscopy were randomized to receive airway anesthesia with 2% lignocaine spray through a spray catheter (SC group) or via the SAYG technique through the working channel of the bronchoscope (WC group). The mean VAS for operator-rated satisfaction was 66.5 ± 16.8 in the WC group and 80.6 ± 14.2 in the SC group ($p < 0.001$). The median VAS score for operator-rated cough was 35 (23–44) in the WC group and 18 (11–28) in the SC group ($p < 0.001$). However, there was no significant difference in patient-rated comfort VAS scores (66.4 ± 14.5 in WC group vs. 69.9 ± 13.0 in SC group); $p = 0.07$.[16] A recent study by Rafiee *et al*.[17] compared patient and physician satisfaction during bronchoscopy in two groups: those receiving SAYG alone and those receiving a combination of SAYG and airway nerve block (ANB). The combination resulted in significantly higher satisfaction scores for both physicians (3.4 ± 1.6 vs. 4.6 ± 0.8) and patients (3.5 ± 1.3 vs. 4.9 ± 0.4) ($p < 0.001$). Thirteen individuals (38.2%) in the SAYG group and four individuals (11.8%) in the SAYG + ANB group experienced a drop in oxygen levels ($p = 0.023$). Additionally, sedation levels (Ramsay sedation scale score) were significantly higher in the SAYG-only group (score of 4) compared to the ANB group (score of 3) ($p = 0.001$). Combining ANB with SAYG resulted in higher patient and physician comfort during bronchoscopy compared to SAYG alone, with no increase in complications.[17] Although we used 2% lignocaine in our study, as mentioned above,[7] another interesting finding from a recent RCT suggested that 1% lignocaine was as effective as 2% lignocaine for topical anesthesia (similar cough and pain ratings) during routine flexible bronchoscopy procedures.[18]

Limitations

The study's single-center design and reliance on procedures conducted under the supervision of a single expert may introduce bias, despite ensuring procedural consistency. Furthermore, the relatively small sample size may not accurately represent the broader population, highlighting the need for larger, multicenter studies. The study did not include multivariable regression analysis to adjust for potential confounders. Technical constraints necessitated the use of subjective VAS assessments for cough episodes, rather than objective measurement with a cough recorder device. Additionally, intermittent vital sign monitoring may have overlooked transient arrhythmias, although close observation for hemodynamic compromise was maintained.

Future directions

Future research should prioritize larger cohorts to validate the study's findings and explore the clinical implications of PPL and SAYG airway anesthesia techniques. Comprehensive patient characteristics, such as underlying pulmonary conditions and demographic factors, should be included to improve generalizability. Systematic monitoring of adverse events, such as laryngospasm and systemic toxicity, would help determine the safety profile. Studies on pharmacokinetics in specific patient populations, such as those with renal or hepatic impairment, would inform optimal dosing strategies and side effect management.

Conclusions

This study concludes that PPL spray and SAYG protocols are comparable in efficacy for FOB, with no significant differences in patient-reported pain, discomfort, coughing, or procedure duration. Operator comfort was slightly higher with the pre-procedural protocol, although this difference did not reach statistical significance. Nonetheless, even a minor improvement in operator comfort could potentially lead to reduced fatigue, improved focus, and enhanced performance. Further studies with larger cohorts are warranted to validate these observations.

Acknowledgments

All staff of interventional bronchoscopy and medical thoracoscopy unit of Department of Pulmonology, Shaikh Zayed Hospital, Lahore Pakistan.

Funding

All authors declare that there are no financial or other relationships or activities that could appear to have influenced the submitted work.

Conflict of interest

None.

Author contributions

Concept, design (TM), data collection, initial write-up (HI), critical review of the manuscript for important intellectual content (HI, TM), supervision (TM), detailed critical review especially discussion part, thorough proof reading and corrections during the publication proves (FI, ASK). All authors have reviewed the final version to be published and agreed to be accountable for all aspects of the work.

Ethical statement

The study conformed to the ethical guidelines of the Helsinki Declaration (as revised in 2024). Approval was granted by the Institutional Review Board, Shaikh Zayed Medical Complex Lahore (approval number: SZMC/IRB/Internal/0063/2021). Informed consent was obtained from all participants. This RCT has been registered with the ClinicalTrials.gov with NCT number: NCT07084623, available at https://clinicaltrials.gov/study/NCT07084623.

Data sharing statement

The dataset used to support the findings of this study is included within the article.

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