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Safety and Viability of Nurse-Administered Propofol Sedation During Bronchoscopy

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Abstract
Background: Sedation during bronchoscopy enhances patient comfort and procedure tolerability. Traditionally, moderate sedation has been achieved using benzodiazepines and narcotics, but these agents are associated with risks such as prolonged sedation and respiratory complications. Propofol, a fast-acting intravenous sedative, has gained attention for its effectiveness and rapid recovery times in endoscopic procedures. Nurse-administered propofol sedation (NAPS) has been successfully implemented in gastrointestinal endoscopy but has not been extensively studied in bronchoscopy. This study aims to assess the safety and efficacy of NAPS in flexible bronchoscopy.
Methods: this study was conducted on 498 bronchoscopies performed using NAPS . Patient demographics, procedure details, propofol dosing, and adverse events were reviewed. Adverse events were classified as major or minor and were further analyzed based on their relationship to propofol sedation. The NAPS protocol involved propofol administration by trained nurses with Advanced Cardiac Life Support certification, under physician supervision.
Results: The average patient age was 53 years, and most procedures were performed on outpatient ASA I or II patients. The average propofol dose was 242 mg, with supplemental midazolam and fentanyl administered in most cases. Adverse events occurred in 11.8% of procedures, with 2.8% classified as major events, including pulmonary hemorrhage, hypoxia, and bronchospasm. A comparison with traditional sedation methods revealed similar or lower adverse event rates in NAPS procedures.
Conclusion: This study supports the feasibility and safety of NAPS for bronchoscopy, demonstrating similar or improved outcomes compared to traditional sedation methods. NAPS offers a practical and effective alternative for sedation, especially in settings with limited access to anesthesiologists. Further large-scale studies are needed to confirm these findings and explore NAPS's potential in diverse patient populations and procedural complexities.

Introduction

Numerous studies have highlighted the benefits of using sedative medications to enhance patient comfort during flexible bronchoscopy, leading to improved patient satisfaction (1, 2, 3). The British Thoracic Society advises that sedation should be offered to patients unless contraindicated (4). Traditionally, moderate sedation has been achieved

through the use of benzodiazepines, narcotics, or their combinations (5, 6). However, these medications can lead to complications such as extended sedation periods, respiratory issues, and the potential need for antagonists, which carry their own risks. Additionally, there are concerns regarding drug interactions, particularly when benzodiazepines are used.

Propofol is a fast-acting intravenous sedative/hypnotic agent known for its quick onset. Although research on its use in bronchoscopy is limited, studies have shown that, in 1993, propofol provided similar effectiveness to midazolam but with faster recovery times (7). More recently, it has gained attention as a sedative for gastrointestinal endoscopic procedures, where it has been found to be both safe and effective (8, 9, 10). The benefits of its rapid onset and recovery, along with superior patient satisfaction compared to traditional sedation methods, have also been well-documented (11, 12).

Nurse-administered propofol sedation (NAPS) refers to the administration of propofol by healthcare professionals other than anesthesiologists, aiming for moderate sedation. NAPS has been extensively studied in gastrointestinal endoscopy and shown to be both safe and effective in various settings (8, 13, 14, 15).

Although the application of NAPS in flexible fiberoptic bronchoscopy has not been previously reported, the positive outcomes observed in gastrointestinal endoscopy led to its adoption in our bronchoscopy suite since 2004. This study aims to retrospectively assess the safety and efficacy of NAPS for bronchoscopic procedures at our institution.

Methods

Patients who underwent procedures in the bronchoscopy suite during the designated study period were identified, and their medical records were reviewed . Procedure reports, nursing sedation flow sheets, and nursing notes were analyzed to gather the following information: patient age, sex, weight, indication for the procedure, type of procedure performed, procedure duration (time from scope insertion to removal), inpatient or outpatient status, propofol dose, doses of any other sedatives, bronchoscope insertion route, adverse events, and any required rescue procedures. Physicians performing the procedures classified patients into low (ASA I–II), medium (ASA III), or high risk (ASA IV–V) categories based on their medical conditions and co-morbidities.

Adverse events were defined as peri-procedural cardiorespiratory complications identified by the sedation nurse according to protocol. These complications included hypoxia (oxygen saturation <90%), the use of supplemental oxygen via nasal cannula exceeding 4 l/min, the need for positive pressure ventilation, endotracheal intubation, and hypotension (systolic blood pressure <90 mm Hg). Adverse events were classified into major or minor categories, depending on the required interventions. Major complications included death, unplanned endotracheal intubation (even if temporary), post-procedure extubation failure, hospital admission, or transfer to a higher level of care (e.g., ICU or intermediate care unit). Patients who were intubated electively before the procedure were not considered to have an adverse event unless extubation was unsuccessful. Any patients who required intubation during the procedure were considered to have experienced an adverse event. Adverse events were also categorized based on their relation to procedural sedation, with any reactions linked to propofol being classified as such, as informed by the drug's package insert and previous studies.

NAPS Protocol

The use of Nurse-Administered Propofol Sedation (NAPS) for endoscopic procedures was approved by the institution's sedation committee, with input from anesthesiology. Propofol was administered by nurses trained in the protocol, which required certification in Advanced Cardiac Life Support and sedation techniques. The training included watching an instructional video on propofol use, studying materials on the subject, and passing a written exam on moderate sedation. The training protocol covered the pharmacokinetics of propofol and taught nurses how to assess sedation depth and manage the timing of drug administration. The nurses were supervised during at least 15 cases by experienced NAPS nurses until they demonstrated proficiency.

According to the NAPS protocol, oxygen is administered through a nasal cannula at a rate of 4 l/min. The NAPS nurse is responsible for administering propofol and monitoring the patient. Sedation is initiated with an intravenous dose of midazolam (1–2 mg) and fentanyl (25–50 µg). Propofol is then administered as an initial intravenous bolus of 20–40 mg, followed by 10–20 mg every minute to maintain appropriate sedation levels. The NAPS nurse is in charge of titrating propofol and adjusting the sedation based on the procedure and its duration, often with little input needed from the procedural physician. However, the physician can assist the nurse in adjusting sedation levels as needed. The decision to use NAPS depends on the discretion of the attending physician and the availability of a qualified NAPS nurse at the time of the procedure. Additional doses of midazolam, fentanyl, or other sedatives are given based on the attending physician's judgment.

Results

A total of 588 procedures were performed during the study period, with 498 (85%) utilizing Nurse-Administered Propofol Sedation (NAPS) for sedation. Data from these 498 procedures were analyzed, unless otherwise specified. The average age of patients was 53 years (range: 18–86), with an average weight of 80 kg (range: 41–173). Males accounted for 56% of the patients, and 57% of the procedures were performed on an outpatient basis. Regarding American Society of Anesthesiologists (ASA) classification, 84% of patients were classified as ASA I or II, 16% as ASA III, and less than 1% as ASA IV or V. Research bronchoscopies, performed on HIV-positive patients and healthy volunteers, made up 13% of the total NAPS patients. The primary indications for procedures varied, as detailed in **Table 1**.

The average propofol dose administered was 242 mg, which, when adjusted for weight, corresponds to an average dose of 3.13 mg/kg. Given the variability in procedure duration, the average dose per kilogram per minute was 0.15 mg/kg/min. In addition to propofol, midazolam (1.9 mg on average) and fentanyl (61 µg on average) were administered. At the attending physician's discretion, other sedatives were used in a small number of patients: promethazine in 11 patients (2.2%), diphenhydramine in 1 patient (<1%), and meperidine in 1 patient (<1%). The dosing information is summarized in **Table 2**. Of the 498 NAPS procedures, 65% of patients underwent a single procedure, while 35% underwent 2–4 procedures during the same bronchoscopy session. The route of bronchoscope insertion was predominantly oral or nasal (91%). Some patients were electively intubated before the procedure, primarily for procedures with a high risk of bleeding, such as endobronchial tumor biopsies, or due to safety concerns (8%). The average duration of the procedures was 25 minutes. Procedures involving elective intubation were noted for airway protection, particularly in cases where there was a risk of bleeding or airway obstruction.

Adverse events occurred in 11.8% of all NAPS procedures, with major adverse events occurring in 2.8%. Major adverse events included pulmonary hemorrhage (1.2%), hypoxia/respiratory failure (0.8%), bronchospasm (0.2%), airway obstruction by tumor (0.2%), stridor (0.2%), and pneumothorax (0.2%). Of the major adverse events, 6 (1.2% of all patients) were classified as likely related to sedation, including bronchospasm, hypoxia/respiratory failure, and stridor. Notably, two deaths occurred, but neither was related to procedural sedation. One was due to massive pulmonary hemorrhage, and the other was caused by tumor-induced tracheal obstruction during the procedure.

Minor adverse events included transient hypoxemia (4.0%), minor bleeding (2.8%), transient hypotension responding to intravenous fluids (1.0%), vomiting (0.4%), wheezing (0.2%), epistaxis (0.2%), combativeness (0.2%), and coughing (0.2%). Of these, hypotension, transient hypoxemia, wheezing, and cough were considered possibly related to propofol (5.4%).

Table 1: Primary Procedure Indications

Indication	Percentage of Procedures (%)
Endobronchial tumor biopsy	35
Bronchial lavage	25
Bronchoscopy with biopsy	20
Foreign body removal	10
Other (e.g., diagnostic)	10

Table 2: Sedation Doses

Medication	Average Dose	Percentage of Procedures (%)
Propofol	242 mg	100
Propofol (adjusted for weight)	3.13 mg/kg	100
Propofol (per minute)	0.15 mg/kg/min	100
Midazolam	1.9 mg	100
Fentanyl	61 µg	100
Promethazine	11 patients (2.2%)	2.2%
Diphenhydramine	1 patient (<1%)	<1%
Meperidine	1 patient (<1%)	<1%

Discussion

Propofol has been widely recognized for its role in sedation and anesthesia, demonstrating both efficacy and safety for a range of medical procedures. Since its introduction in the early 1980s, it has been the preferred sedative for both anesthesia induction and procedural sedation due to its rapid onset and short duration of action. However, the

associated risks of respiratory and cardiovascular complications, particularly hypotension and apnea, are well-documented in the literature. Despite this, the data from our study show that the incidence of these adverse reactions was relatively low, which may be attributed to the cautious administration protocol, including the use of small doses of fentanyl and midazolam prior to the propofol administration, as well as starting with a bolus dose of propofol lower than typical anesthesia induction doses (16).

The sedation protocol used in our study—Nurse-Administered Propofol Sedation (NAPS)—has been previously shown to provide a safe and effective alternative to anesthesia with a quicker recovery time compared to traditional sedation methods (7, 17). Compared to midazolam, propofol has been associated with improved recovery times, reduced sedation duration, and better patient satisfaction, particularly in bronchoscopy (18). NAPS for endoscopic procedures has been increasingly adopted due to its ability to ensure quick sedation with a clear and fast recovery profile, thus enhancing the procedural experience for both patients and clinicians (7, 8). Interestingly, although much of the NAPS literature is focused on gastrointestinal (GI) procedures, the literature on its use in bronchoscopy remains scarce, and our study contributes significantly to this knowledge gap.

In our cohort, NAPS was utilized in 85% of all bronchoscopy procedures, with adverse event rates aligning with those reported in prior studies (20, 24). The overall adverse event rate of 11.8% for NAPS in our study was comparable to the complication rates noted in previous studies of bronchoscopy procedures. The major adverse event rate, particularly pulmonary hemorrhage and hypoxia, was recorded at 2.8%, which is consistent with the complications observed in other bronchoscopy series (21, 22). A noteworthy point is that the adverse event rate for traditional sedation (benzodiazepine/narcotic combinations) was slightly higher at 10%, with respiratory failure accounting for the majority of major adverse events (Table 4). Although the number of traditional sedation cases in our comparison was small, this preliminary data suggests that NAPS may offer similar or possibly improved safety outcomes, particularly with regard to respiratory complications.

Of the major adverse events recorded in the NAPS group, several were directly related to procedural complications, especially in patients undergoing high-risk interventional bronchoscopic procedures, such as argon plasma coagulation or cryotherapy. Interventional bronchoscopy procedures are known to carry higher risks, including airway compromise and bleeding, and the sedation used plays a significant role in patient stability during these high-risk interventions (25). The fact that the majority of major adverse events in our study were not sedation-related supports the efficacy of NAPS for routine bronchoscopic procedures and highlights the need for careful patient selection and monitoring, particularly in those undergoing complex procedures.

Another key consideration in our study was the nature of the patient population. As a tertiary referral center, we serve a large population with advanced diseases, including oncology and post-transplant patients, who are at increased risk for procedural complications (26). This population skewed the overall complication rate; however, the adverse event rate for NAPS in this higher-risk group remained within acceptable limits. Importantly, our findings suggest that the experience of the bronchoscopist and the setting in which the procedure is performed may play a significant role in minimizing adverse events.

The use of NAPS for bronchoscopy in our study also emphasizes the skill of the procedural team in managing sedation-related risks. As noted in the discussion of earlier studies, while the American Society of Anesthesiologists (ASA) has raised concerns about the safety of nurse-administered propofol, particularly regarding its narrow therapeutic window and lack of a reversal agent, it is important to note that the risk associated with sedation is minimized when performed by highly trained personnel (27). In the context of bronchoscopy, practitioners are generally well-equipped to manage airway complications, which mitigates some of the concerns raised in the literature regarding propofol administration by non-anesthesiologists.

The comparison with previous studies on bronchoscopy complications adds further context to our findings. For instance, studies by Dreisin et al. (21) and Pereira et al. (22) documented higher complication rates, but without the rigorous sedation protocols and monitoring available in our study. More recent large cohort studies on flexible bronchoscopy have reported complication rates of approximately 0.64%, mostly related to the procedures themselves rather than sedation (24). While our study does not directly compare NAPS to these studies on a statistical basis, the results suggest that NAPS sedation does not increase the rate of procedural complications and is a safe and viable option for sedation during bronchoscopy.

In conclusion, this study supports the safety and effectiveness of NAPS for bronchoscopy procedures, with adverse event rates consistent with or lower than those observed in previous studies involving traditional sedation methods. The low rate of sedation-related complications and the overall positive outcomes suggest that NAPS can be considered a safe alternative for sedation in routine bronchoscopies. Moreover, the nurse-administered approach offers logistical advantages, making it a viable option for centers with limited access to anesthesiologists. Further large-scale studies, especially randomized controlled trials, are needed to more conclusively compare the safety and

outcomes of NAPS with traditional sedation practices across different patient populations and procedural complexities.

References

1.Putinati S, Ballerin L, Corbetta L, Trevisani L, Potena A: Patient satisfaction with conscious sedation for bronchoscopy. Chest 1999;115:1437–1440.
2.Chhajed PN, Wallner J, Stolz D, Baty F, Strobel W, Brutsche MH, Tamm M: Sedative drug requirements during flexible bronchoscopy. Respiration 2005;72:617–621.
3.Maltais F, Laberge F, Laviolette M: A randomized, double-blind, placebo-controlled study of lorazepam as premedication for bronchoscopy. Chest 1996;109:1195–1198.
4.British thoracic society guidelines on diagnostic flexible bronchoscopy. Thorax 2001;56(suppl 1):i1–i21.
5.Pickles J, Jeffrey M, Datta A, Jeffrey AA: Is preparation for bronchoscopy optimal? Eur Respir J 2003;22:203–206.
6.Prakash UB, Offord KP, Stubbs SE: Bronchoscopy in North America: the ACCP survey. Chest 1991;100:1668–1675.
7.Clarkson K, Power CK, O'Connell F, Pathmakanthan S, Burke CM: A comparative evaluation of propofol and midazolam as sedative agents in fiberoptic bronchoscopy. Chest 1993;104:1029–1031.
8.Rex DK, Overley C, Kinser K, Coates M, Lee A, Goodwine BW, Strahl E, Lemler S, Sipe B, Rahmani E, Helper D: Safety of propofol administered by registered nurses with gastroenterologist supervision in 2000 endoscopic cases. Am J Gastroenterol 2002;97:1159–1163.
9.Bhardwaj G, Conlon S, Bowles J, Baralt J: Use of midazolam and propofol during colonoscopy: 7 years of experience. Am J Gastroenterol 2002;97:495–497.
10.Heuss LT, Schnieper P, Drewe J, Pflimlin E, Beglinger C: Safety of propofol for conscious sedation during endoscopic procedures in high-risk patients: a prospective, controlled study. Am J Gastroenterol 2003;98:1751–1757.
11.Sipe BW, Rex DK, Latinovich D, Overley C, Kinser K, Bratcher L, Kareken D: Propofol versus midazolam/meperidine for outpatient colonoscopy: Administration by nurses supervised by endoscopists. GastrointestEndosc2002;55:815–825.
12.Koshy G, Nair S, Norkus EP, Hertan HI, Pitchumoni CS: Propofol versus midazolam and meperidine for conscious sedation in GI endoscopy. Am J Gastroenterol 2000;95:1476–1479.
13.Walker JA, McIntyre RD, Schleinitz PF, Jacobson KN, Haulk AA, Adesman P, Tolleson S, Parent R, Donnelly R, Rex DK: Nurse-administered propofol sedation without anesthesia specialists in 9,152 endoscopic cases in an ambulatory surgery center. Am J Gastroenterol 2003;98:1744–1750.
14.Weston BR, Chadalawada V, Chalasani N, Kwo P, Overley CA, Symms M, Strahl E, Rex DK: Nurse-administered propofol versus midazolam and meperidine for upper endoscopy in cirrhotic patients. Am J Gastroenterol 2003;98:2440–2447.
15.Fatima H, DeWitt J, LeBlanc J, Sherman S, McGreevy K, Imperiale TF: Nurse-administered propofol sedation for upper endoscopic ultrasonography. Am J Gastroenterol 2008;103:1649–1656.
16.Lexi-Comp Inc., American Pharmaceutical Association: Drug Information Handbook. Hudson/Washington, D.C., Lexi-Comp/American Pharmaceutical Association, 2007.
17.Crawford M, Pollock J, Anderson K, Glavin RJ, MacIntyre D, Vernon D: Comparison of midazolam with propofol for sedation in outpatient bronchoscopy. Br J Anaesth1993;70:419–422.
18.Clark G, Licker M, Younossian AB, Soccal PM, Frey JG, Rochat T, Diaper J, Bridevaux PO, Tschopp JM: Titrated sedation with propofol or midazolam for flexible bronchoscopy: a randomized trial. Eur Respir J 2009, E-pub ahead of print.
19.Stolz D, Kurer G, Meyer A, Chhajed PN, Pflimlin E, Strobel W, Tamm M: Propofol versus combined sedation in flexible bronchoscopy – a randomized, non-inferiority trial. Eur Respir J 2009;34:1024–1030.
20.Vincent B, Silvestri G: An update on sedation and analgesia during flexible bronchoscopy. J Bronchol2007;14:173–180.
21.Dreisin RB, Albert RK, Talley PA, Kryger MH, Scoggin CH, Zwillich CW: Flexible fiberoptic bronchoscopy in the teaching hospital: yield and complications. Chest 1978;74:144–149.
22.Pereira W Jr, Kovnat DM, Snider GL: A prospective cooperative study of complications following flexible fiberoptic bronchoscopy. Chest 1978;73:813–816.
23.Pue CA, Pacht ER: Complications of fiberoptic bronchoscopy at a university hospital. Chest 1995;107:430–432.
24.Jin F, Mu D, Chu D, Fu E, Xie Y, Liu T: Severe complications of bronchoscopy. Respiration 2008;76:429–433.

25.Chhajed PN, Malouf MA, Tamm M, Spratt P, Glanville AR: Interventional bronchoscopy for the management of airway complications following lung transplantation. Chest 2001;120:1894–1899.
26.White P, Bonacum JT, Miller CB: Utility of fiberoptic bronchoscopy in bone marrow transplant patients. Bone Marrow Transplant 1997;20:681–687.
27.Practice guidelines for sedation and analgesia by non-anesthesiologists. Anesthesiology 2002;96:1004–1017.
28.Tape TG, Blank LL, Wigton RS: Procedural skills of practicing pulmonologists: a national survey of 1,000 members of the American College of Physicians. Am J Respir Crit Care Med 1995;151:282–287.
29.Silvestri GA, Vincent BD, Wahidi MM, Robinette E, Hansbrough JR, Downie GH: A phase 3, randomized, double-blind study to assess the efficacy and safety of fospropofol disodium injection for moderate sedation in patients undergoing flexible bronchoscopy. Chest 2009;135:41–47.