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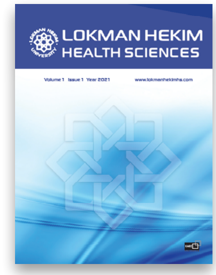

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ORIGINAL ARTICLE

Transbronchial Needle Aspiration under the Guidance of Endobronchial Ultrasound in Lung Cancer Diagnosis: Retrospective Evaluation of Anesthesia Methods

Akciğer Kanseri Tanısında Endobronşiyal Ultrason kılavuzluğunda Transbronşiyal İğne Aspirasyonu: Anestezi Yöntemlerinin Retrospektif Değerlendirilmesi

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Abstract

Introduction: Endobronchial ultrasound-guided transbronchial needle aspiration (EBUS-TBNA) has become a standard procedure in diagnosing and staging lung cancer. Anesthesia management is one of the critical steps in the EBUS-TBNA procedures. We planned to evaluate anesthesia methods for EBUS-TBNA, which was applied for the first time in our hospital, in terms of duration of the procedure and complications.

Methods: The records of patients who underwent EBUS-TBNA after ethics committee approval were reviewed retrospectively. We recorded demographic data of the patients, duration of the procedure, anesthesia methods, and complications.

Results: A total of 50 patients were given anesthesia for the EBUS-TBNA. General anesthesia was performed in 5 patients and sedation in 45 patients.The duration of anesthesia was 62±17.8 min ingeneral anesthesiaand 50.2±13.1 min in sedated patients (p=0.113). Ketamine/propofol (ketofol) was used in 22 patients, and propofol/fentanyl was used in 23 patients for sedation. The amount of propofol was significantly higher in those using propofol/fentanyl than ketofol (propofol/fentanyl: 342.2±140 mg, ketofol: 166.5±49.9 mg; p=0.002).There was no significant difference in the frequency of postoperative complications.

Discussion and Conclusion: The choice of anesthesia method for EBUS procedures should be adjusted according to factors associated with the operator, the patient, and the procedure itself. We think sedation can be used safely in EBUS procedures with good preliminary preparation, intraoperative management, and anesthesiologist–bronchoscopist compatibility.

Keywords: Diagnosis; Endobronchial ultrasound; General anesthesia; Sedation

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Endobronchial ultrasound-guided transbronchial needle aspiration (EBUS-TBNA) has become a standard procedure in diagnosing and staging lung cancer.[1,2] In recent years, increased practitioner experience and improvements in patient preparation have shortened exploration time, revealing a growing trend to replace general anesthesia with sedation.[3] Successful sedation allows the bronchoscopist to obtain adequate tissue while providing a comfortable environment for the patient. However, sedation during EBUS is complicated as it aims to achieve two opposite goals. In other words, sedation requires the patient to prevent coughing or movement during exploration and avoidsrespiratory depression as the airway is not controlled.[4.5]

In this study, we aimed to evaluate the anesthesia methods in our clinic for the EBUS-TBNA procedure and review the literature on anesthesia.

Materials and Methods

After the approval of the ethics committee (27/01/2021 and decision no: 2021-01/992), we retrospectively examined the data of all patients who underwent EBUS-TBNA between January 2019 and January 2020. All patients have signed an official informed consent, which includes the possible use of data for procedure and research. The Helsinki Declaration carried out data analysis. All data were obtained by examining the preoperative evaluation form, intraoperative anesthesia form, and postoperative form. Demographic data of patients, processing time,duration ofanesthesia, anestheticdrugs and their doses, and Modified Aldrete scores were recorded. Complications related to the EBUS-TBNA procedure (such as bleeding, pneumothorax, mediastinitis, or mediastinal abscess) and complications related to sedation/anesthesia [hypotension (systolic blood pressure <90 mmHg and requiring fluid or vasopressor therapy), hypertension (requiring fluid or vasopressor therapy), hypertension (mean arterial value according to base value) increased pressure >30%], hypoxemia (oxygen saturation <90% or hypoxemia requiring intervention such as mask, balloon ventilation, or mechanical ventilation), arrhythmia requiring antiarrhythmic drugs, and excessive cough preventing the completion of the process were recorded.

Statistical Analyses

The data were analyzed using SPSS Statistics for Windows, Version 22.0 (IBM SPSS Statistics for Windows, Version 22.0. Armonk, NY: IBM Corp). Categorical variables are defined as absolute frequencies and percentages, and quantitative variables are expressed as mean and standard deviation according to whether they show normal distribution. A Chi-squared test or Fisher's exact test was used to determine whether there was a relationship between the two categorical variables. Student's t-test or the Mann–Whitney U test measured the relationship between quantitative variables. P<0.05 was considered meaningful for all analyses.

Table 1. Demographic characteristics of patients

	General anesthesia	Sedation	p
Age (years)	67.2±9.3	54.6±15.4	0.118
Gender (F/M)	2/3	21/24	0.0612
ASA (I/II/III)	0/4/1	0/27/18	0.838
Processing time (min)	52.7±14.6	48±11.2	0.226
Duration of anesthesia (min)	62±17.8	50.2±13.1	0.113
Diagnosis of malignancy before the procedure (n)	1	32	
Pre-procedure chemotherapy /radiationtherapy	1/1	28/4	

Data are given in the form of the number of patients (n) and mean±standard deviation.

Results

The same two bronchoscopists performed all EBUS-TBNA procedures. A total of 50 patients were given anesthesia for the EBUS-TBNA procedure. General anesthesia was performed in 5 patients and sedation in 45 patients. The mean age of the 50 cases was 57.2±15.1 years (Table 1). The mean processing time was 52.7±14.6 min in general anesthesia and 48±11.2 min in patients undergoing sedation (Table 1). Premedication with 2 mg intravenous midazolam was administered in 73.3% of the patients.

A laryngeal mask (LMA) was preferred in 2 patients who underwent general anesthesia, and endotracheal intubation was preferred in 3 patients. The duration of anesthesia was 62±17.8 min in patients given general anesthesia. Total intravenous anesthesia with propofol/remifentanil was applied for general anesthesia, and hypotension developed in 2 patients.

Anesthesia duration was 50.2±13.1 min in sedated patients. Although the procedure was shorter than the patients who underwent general anesthesia, this difference was not statistically significant (p=0.113). Ketamine/propofol (ketofol) was preferred in 22 patients and propofol/fentanyl in 23 patients for sedation. The dose of propofol was 342.2±140 mg in patients given propofol/fentanyl. It was significantly higher than ketofol (Table 2, ketofol: 166.5±49.9 mg, p=0.002). The dose of propofol was 176±25 mg in those

Table 2. Complications and anesthetic drug doses

	Propofol/fentanyl (n=23)	Propofol/ketamine (n=22)	General anesthesia (n=5)	p
Complications related to EBUS				
Hemorrhage	–	–	–	
Pneumothorax	–	–	–	
Mediastinitis	–	–	–	
Mediastinalabscess	–	–	–	
Sedation/anesthesia-related complication				>0.05
Hypotension	4	–	2	
Hypertension	2	7	–	
Arrythmia	–	–	–	
Hypoxemia	10	2	–	
Aspiration	–	–	–	
Excessive cough	2	4	–	
Laryngospasm/bronchospasm	–	–	–	
Total Propofol dose (mg)	342.2±140	166.5±49.9	176±25	0.002* 0.035**
Total ketamine dose (mg)	–	133.1±58.2	–	
Totalfentanyl dose (µg)	120.3±61.6	–	–	
Modified Aldrete Score	9.03±0.3	8.9±0.8	9±0.3	>0.05

Data aregiven in the form of the number of patients (n) and mean±standard deviation. *: Propofol/fentanyl vs ketofol; **: General anesthesia vs sedation.

given general anesthesia, and a lower dose of propofol was used when compared withsedated patients (249±134.5 mg, p=0.035). It was determined that a total of 11 patients developed an excessive cough, and the procedure was completed with general anesthesia in 5 of them and sedation in 6patients. The hemodynamic data and SpO_2 values were compared according to the anesthesia methods.No significant difference was found (Table 3, p>0.05). Oxygen desaturation (SpO_2 ≤90) was detected in 12 (24%) patients. Hypoxemia was observed in 10 patients given propofol/fentanyl (Table 2). Antihypertensive medication was required in 7 patients who received ketofol, and hypotension developed in 4 patients who were given propofol/fentanyl. According to the anesthesia method, there was no difference in the frequency of postoperative complications (Table 4).

Discussion

Ultrasound-guided transbronchial needle aspiration is a minimally invasive procedure that is helpful in the diagnosis of mediastinal lymphadenopathy and tumors. The morbidity and cost are lower than mediastinoscopy, and the leading indication for the procedure is the staging of patients with lung cancer. Our study found that the EBUS-TBNA process can be performed with sedation and that ketofol for sedation may be a good option in selected patients.

Table 3. Intraoperative hemodynamic data and SpO_2 values

	Propofol/ fentanyl (n=23)	Propofol/ ketamine (n=22)	General anesthesia (n=5)
SBP baseline	134.4±14	129.4±13.7	139±13.4
SBP 5 min	133.8±23.6	133.3±13.2	132±13.5
SBP 15 min	119.4±21.8	137.2±23.4	110.6±32.3
SBP 30 min	121.1±17.2	128.8±27.7	133.6±26.1
SBP60 min	113.3±15.2	115±13.2	135±35.3
DBP baseline	79.4±11.3	72.7±5.6	76±8.9
DBP 5 min	77.7±16.6	78.8±9.6	70±6.1
DBP 15 min	74±13.3	75.1±11.4	63±20.4
DBP 30 min	69.2±6.8	71.6±10	72.4±9
DBP 60 min	65±5	65±13.2	80±14
HR baseline	85.5±16.6	79.5±9.5	86±15.1
HR 5 min	86.6±17.8	80.2±9.7	80.2±15
HR 15 min	86±19.9	79.4±9.2	82.6±12.9
HR 30 min	83.1±18.8	76±12.8	91±13.8
HR 60 min	98.3±18.7	73.6±6.3	120±14.1
SpO_2 baseline	94.6±1.5	93.3±1.8	94±1.7
SpO_2 5 min	98.2±1.3	97±2.7	97.6±2.4
SpO_2 15 min	92±12.6	96.8±2.6	94.9±6.5
SpO_2 30 min	97.6±1.5	96.6±3	97±2
SpO_2 60 min	97±2	97±0	97.4±1.5

SBP: Systolic blood pressure; DBP: Diastolic blood pressure; HR: Heart rate. Data are given as mean±standard deviation, and no statistically significant difference between groups was found; p>0.05.

Table 4. Postoperative complications

	Propofol/ fentanyl (n=23)	Propofol/ ketamine (n=22)	General anesthesia (n=5)	p
Postoperative complications				>0.05
Nausea	5	8	2	
Vomiting	1	2	–	
Hallucination	–	–	–	

Data aregiven in the form of the number of patients (n).

The anesthesia technique used for the EBUS-TBNA procedure has not been standardized, and the sedation method has been chiefly institutional and dependent on the practitioner. General anesthesia with an endotracheal tube or LMA offers excellent working conditions for the endoscopist.[5] Sarkiss et al.[6] consider that general anesthesia is mandatory due to the larger size of the EBUS device compared withthe traditional fiber optic bronchoscope. General anesthesia prevents coughing and reduces bronchospasm and laryngospasm, the most described complications. For the patient, coughing is the main problem during bronchoscopy. Coughing causes the disappearance of ultrasound bookmarks and slows down the process. If coughing episodes occur during a needle biopsy, it may cause injury to mediastinal structures and decrease the procedure's efficiency. In addition, it is complicated to adjust the sedation level in patients with coughing. More superficial sedation promotes coughing, while more profound sedation reduces coughing but may lead to further desaturation. In our patient group, it was observed that a total of 11 patients developed an excessive cough, and 5 of these patients were switched to general anesthesia. Few studies determine which patients will have higher cough intensity during the procedure.[7–9] Identifying predictive factors for cough or identifying patients with higher cough intensity seems to be open topics for research. While general anesthesia is a good choice for less experienced operators or training clinics, avoiding general anesthesia eliminates the risks of anesthesia itself, shortens postoperative recovery time, and reduces costs by eliminating the need for additional anesthesia personnel, medicines, and equipment.

Another reason for choosing general anesthesia in EBUS-TBNA procedures is that it is tough to pass the EBUS bronchoscope through the vocal cords during sedation. We also experienced that most of the sedation time was used in our patient group at this stage. This leads to less time being used for essential parts of the procedure, such as imaging and learning anatomical signs and tissue removal. Esther et al. reported that the sedation time was reported as 52 (38–65) min, and the EBUS-TBNA time was 40 (25–51) min, and Agostini et al. procedure time was reported as 30 min.[4,7] Jeyabalan and Medford[9] stated that the average duration of the procedure was 34 min. Although it is a newly applied procedure, the mean processing time in our cases was 53 min for general anesthesia and 48 min for sedation.

Retrospective reports have suggested no difference in the diagnostic yield of EBUS-TBNA performed under sedation or general anesthesia.[9–12] Despite the many advantages of general anesthesia, there has been an increasing trend toward sedation in the anesthesia preference for EBUS-TBNA. There are few publications about the drugs to be preferred for sedation and ideal doses for EBUS. Deep sedation with propofol has an acceptable safety profile in endoscopic procedures.[3,4] Propofol is a fast-acting anesthetic that provides rapid recovery. This drug has both amnestic and antiemetic effects but no analgesic activity.[5]

In recent years, the combination of propofol and ketamine has been a preferred agent for various endoscopic procedures. Ketofol, which has many benefits in terms of less drug consumption, hemodynamic stability, absence of respiratory depression, postoperative analgesia, and recovery, is frequently used for sedation in patients without severe cardiovascular disease. Ketamine adds analgesia to propofol sedation without hypoventilation caused by the propofol/opioid combination. The antiemetic effect of propofol reduces the risk of ketamine-related vomiting. In addition, since both drugs are powerful bronchodilators, the combination is a good choice for patients with airway sensitivity.[13] The use of ketamine alone increases secretions, and side effects such as hallucinations and anxiety may occur.[14,15] It has been reported that ketofol is effective and safe for sedation in bronchoscopy in a limited number of studies.[16,17] Our study showed that both combinations are sufficient and effective in providing sedation for EBUS-TBNA. Nevertheless, high-quality studies are needed to draw firm conclusions regarding the use of ketamine, other sedative drugs, or their combinations for sedation during EBUS-TBNA.

We did not experience any fatal complications during the procedure. Oxygen desaturation (SpO_2 ≤90) was detected in 12 (24%) patients. We thought that hypoxemia occurring during a bronchoscopy was reversible and rapidly resolved. It has been reported that desaturations during bronchoscopy are temporary and do not require any special treatment other than oxygen support.[18]

This study has several limitations. We had to rely on patient records for intraoperative hemodynamic data, sedation scores, and side effects. Data on patient comfort weremissing during the procedure.

It has been reported in previous studies that anesthesia techniques do not affect the frequency of complications related to EBUS-TBNA.[19,20] Therefore, there is no sufficient evidence to recommend one anesthetic method over another for diagnostic efficiency and procedural safety.

Conclusions

For advanced bronchoscopy procedures, including EBUS, general anesthesia seems to be the appropriate choice, especially in teaching and gaining experience. General anesthesia cannot be given in our bronchoscopy unit as in many centers. Therefore, this requires operating theaters for EBUS, which can lead to higher costs. For this reason, we think that sedation can be used safely in EBUS procedures with good preliminary preparation, intraoperative management, and anesthesiologist–bronchoscopist compatibility.

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Conflict of Interest: None declared.

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