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Original Article

Is ASA Classification Useful in Risk Stratification for EBUS-TBNA?

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Abstract

OBJECTIVE: The efficiency and safety of American Society of Anesthesiologists (ASA) in predicting peri-bronchoscopic morbidity and mortality is an increasing concern as endobronchial ultrasound (EBUS) gains popularity. The purpose of this study is to investigate whether the ASA classification is useful in risk stratification for EBUS.

MATERIAL AND METHODS: The patients who underwent EBUS and had anesthesia assessment before the procedure, were enrolled. Data about the age, gender, comorbidity, ASA score, and complications were collected retrospectively from their medical files.

RESULTS: A total of 221 patients with ASA class documentation in anesthesia assessment before EBUS, were enrolled in the study. The study population comprised 125 (56.6%) male and 96 (43.4%) female patients with a mean age of 59.08 ± 11.15 years. Comorbidity was present in 161 patients (72.9%), of which hypertension (64%) was the most common. There was no significant difference between the pre-bronchoscopic and post-bronchoscopic values of oxygen saturation (SpO_2), systolic and diastolic blood pressure, and heart rate (respectively $P = .83$, $P = .12$, $P = .15$, $P = .89$). The most frequent complication during EBUS was desaturation that happened in 109 (49.3%) patients. There was no correlation between ASA score and complications ($P > .999$). There was no statistically significant difference in ASA scores with respect to complications ($P = .14$). The sensitivity and the specificity of pre-bronchoscopic evaluation in predicting the post-anesthesia care unit (PACU)/intensive care unit (ICU) requirement, were 83.3% and 61%, respectively. The significant deciding factors for post-bronchoscopic follow-up sites were found to be as ASA and age (respectively, $P = .025$, $P < .001$).

CONCLUSION: There was no correlation between ASA and complications. To organize PACU/ICU beds more efficiently, a better scoring system is required.

KEYWORDS: ASA, EBUS TBNA, bronchoscopy
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INTRODUCTION

Endobronchial ultrasound-guided transbronchial needle aspiration (EBUS-TBNA) is an established, safe, and minimally invasive technique for the diagnosis of mediastinal lymph nodes and lung masses. Since the duration of the procedure is longer than conventional bronchoscopy, it is very difficult to perform EBUS without sedation. Both deep and conscious sedation are acceptable for EBUS.[1] Mostly, moderate sedation is sufficient, but in some cases, general anesthesia is required. Each center or physician can apply conscious or deep sedation, intermittently or continuously, according to the preferences and facilities.

In most centers, sedation is performed by an anesthesiologist during EBUS. Since the patients for whom EBUS is performed are generally old and have serious comorbidities, sedation should be applied carefully. Anesthesiologists evaluate the patient before the procedure, in order to define the risks. The American Society of Anesthesiologists (ASA) classification, which has been reported to accurately predict morbidity and mortality for many surgical procedures, has been used in pre-bronchoscopic evaluation also.[2-4] ASA was associated with adverse endoscopic events in a previous study, but to the best of our knowledge, there is no research on whether ASA classification is useful in risk stratification for EBUS.[5]

In this study, we evaluated the relationship between ASA score and complications during EBUS, and the pre-bronchoscopic assessment efficiency in prevention of unnecessary post-anesthesia care unit (PACU)/intensive care unit (ICU) bed reservations or unexpected PACU/ICU bed requirement.

MATERIAL AND METHODS

Study Population

The patients for whom EBUS was performed between April 2016 and February 2019 in Akdeniz University Chest Disease Department and who had anesthesia assessment before EBUS, were enrolled in the study. Each participant signed an informed consent form.

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Data Collection

Data about the age, gender, comorbidity, ASA score, procedure lengths, drugs and doses, results of non-invasive arterial pressure, heart rate, ECG, and SpO_2 value before, during, and after EBUS, complications, recommended and actual follow-up sites after EBUS, were collected from the medical files of the patients.

Anesthesia Assessment

Before EBUS, all the patients were evaluated with respect to predicting the peri-bronchoscopic morbidity and mortality. Pre-bronchoscopic anesthesia assessments were performed by different anesthesiologists. The anesthesiologists used ASA, a measurement of comorbidity and a predictor of peri-operative morbidity and mortality. They scored the patients and decided post-bronchoscopic follow-up sites during this assessment. After EBUS, the anesthesiologist followed the patient in either the bronchoscopy unit or the PACU or ICU.

ASA Classification

The ASA classification is a 6-point-scale used to describe a wide range of comorbid illness. The ASA classification is as follows: (i) ASA I: A normal healthy patient. (ii) ASA II: A patient with mild systemic disease. (iii) ASA III: A patient with severe systemic disease. (iv) ASA IV: A patient with severe systemic disease that is a constant threat to life. (v) ASA V: A moribund patient who is not expected to survive without the operation. (vi) ASA VI: A declared brain-dead patient whose organs are being removed for donor purposes.

Statistical Analysis

The Statistical Package for Social Sciences version 23.0 software (IBM Corp.; Armonk, NY, USA) was used for the statistical analysis. A P value < .05 was accepted as statistically significant. Descriptive statistics were presented with frequency, percentage, mean, standard deviation, median (median), minimum (min.), and maximum (max.) values. Fisher's exact Test or Pearson's chi-square test was used to analyze the relationships between categorical variables, and the Kolmogorov–Smirnov, *t*-test, Mann–Whitney *U*-test, ANOVA, and Šidák tests were used for the distribution of numerical measurements. Statistical analysis of the study was performed by the Statistical Consultancy Application and Research Centre. The study was conducted in accordance with the rules of the Declaration of Helsinki after approval from the Ethics Committee of Akdeniz University School of Medicine (Approval No: KAEK-327. Date: May 13, 2020).

RESULTS

A total of 221 patients with ASA class documentation in the anesthesia assessment form before EBUS, were enrolled in the study. The study population comprised 125 (56.6%) male and 96 (43.4%) female patients with a mean age of 59.08 ± 11.15 years. Comorbidity was present in 161 (72.9%) patients, of which hypertension was the most common. The majority of patients (50.7%) were in the ASA II class. ASA scores and patients' characteristics are presented in Table 1.

Table 1. Baseline Characteristics of the Study Population

	N	%
Gender		
Male	125	56.6
Female	96	43.4
Comorbidity		
Hypertension	64	29
Diabetes Mellitus	47	21.3
Asthma	14	6.3
COPD	13	5.9
Interstitial lung disease	2	0.9
Cardiovascular disease	37	16.7
Cerebrovascular disease	10	4.5
ASA		
I	75	33.9
II	112	50.7
III	34	15.4

COPD, chronic obstructive pulmonary disease; ASA, American Society of Anesthesiologists.

Propofol was the most preferred sedative drug during EBUS. It was administered to all patients, with the mean dose 238.46 ± 90.26 (range, 60-500) milligram. Midazolam was used in combination with propofol in 134 (60.6%) patients. Ketamine was the least frequently used drug with propofol, in only 15 (6.7%) patients. The mean procedure length was 51.36 ± 16.17 (range, 20-100) minutes.

The most frequent complication during EBUS was desaturation that happened in 109 (49.3%) patients (Table 2). The second most common complication was laryngospasm/bronchospasm, that was observed in 21 (9.5%) patients. Arrhythmia, allergy, severe hemorrhage, and nausea were the other complications in decreasing order. No death occurred during or following EBUS. There was no correlation between

Table 2. The Most Common Complications During EBUS

	N
Desaturation	109 (49.3)
Laryngospasm/bronchospasm	21 (9.5)
Arrhythmia	7 (3.1)
Allergy	4 (1.8)
Hemorrhage	2 (0.9)
Nausea	1 (0.4)

MAIN POINTS

- Most of the complications during EBUS are temporary and resolve quickly during the procedure.
- Many of the PACU/ICU bed reservations for EBUS are unnecessary.
- ASA is not a good predictor for pre-procedure risk stratification in EBUS.

the ASA score and complications ($P > .999$). The ASA scores of patients with complications was similar to the ASA scores of patients without complications ($P = .14$).

During the pre-bronchoscopic anesthesia assessment, 79 (35.7%) patients were recommended to be followed in PACU after EBUS. Only 19 of 79 patients were followed in PACU. Unexpectedly, 2 of the 79 patients needed ICU. In the study, 58 of 79 patients were followed in the bronchoscopy unit. Of 39 (17%) patients for whom ICU follow-up had been recommended during pre-bronchoscopic anesthesia assessment, 11 (5%) were followed in the ICU, 14 (6.3%) in the PACU, and 14 (6.3%) in the bronchoscopy unit. The sensitivity and the specificity of pre-bronchoscopic evaluation in predicting the post-bronchoscopic need for PACU or ICU were 83.3%, and 61%, respectively. There was a statistically significant correlation between the prediction of pre-bronchoscopic PACU or ICU and the need for post-bronchoscopic PACU or ICU—poor correlation for PACU and moderate correlation for ICU ($\kappa = 0.243$; $\kappa = 0.544$ $P < .001$) (Table 3 and 4). The rate of PACU or ICU recommendation increased with increasing ASA score. PACU was recommended for 30% of patients with ASA I, and for 52% of patients with ASA III (Table 5). The significant deciding factors for post-bronchoscopic follow-up sites were found to be as ASA and age (respectively, $P = .025$, $P < .001$).

DISCUSSION

In our study, we observed that the major factors that are considered during anesthesia assessment before EBUS, are the ASA score and the age. The tendency to recommend PACU and ICU increased with increasing ASA score and age. Unexpected PACU or ICU bed requirement was very low and pre-bronchoscopic assessment sensitivity was high, but the specificity was not so high. There was a poor agreement for PACU and moderate agreement for ICU between the pre-bronchoscopic predicted sites and post-bronchoscopic follow-up sites. Complications during EBUS, such as rapid desaturation and laryngospasm, developed regardless of the patient's ASA score, and they were not determinative of the post-bronchoscopic follow-up sites. Collectively, our findings showed that ASA could not determine whether complications would occur, and pre-bronchoscopic assessment specificity was not high enough to prevent unnecessary PACU/ICU bed reservation.

Table 3. Agreement Between PACU Recommendation and PACU Follow-up Site

	PACU follow-up site (*n*)		
	YES	**NO**	**Total (*n*)**
PACU recommended			
Yes	19	60 (2 of them required ICU)	79
No	5	137 (1 of them required ICU)	142
Total	24	197	221

$P < .001$, $\kappa = 0.243$.
PACU, post-anesthesia care unit.

Table 4. Agreement Between ICU Recommendation and ICU Follow-up Site

	ICU follow-up site (*n*)		
	YES	**NO**	**Total**
ICU recommended			
Yes	11	14	25
No	2	194	196
Total	13	208	221

$P < .001$, $\kappa = 0.544$.
ICU, intensive care unit.

The ASA classification, which is adopted for surgical procedures in order to predict postoperative morbidity and mortality, is used by the anesthesiologists during pre-bronchoscopic evaluation in clinical practice without prior validation. However, no one actually knows the sensitivity and specificity of the ASA classification in EBUS with non-fatal complications such as rapid desaturation, arrhythmia, and laryngospasm. Complications occur during the procedure and usually end by the termination of the procedure. To the best of our knowledge, this is the first study that investigates the sensitivity and specificity of ASA for predicting the morbidity, mortality, and the success in prevention of unnecessary PACU/ICU reservations or unexpected PACU/ICU requirements.

Previously, some investigations about the predictive ability of the ASA for endoscopic ultrasonography (EUS) have been performed.[5,6] EUS is a procedure similar to EBUS with respect to the total procedure time and sedation depth. Therefore, they may be almost identical with respect to risks related with the procedure. Eisen and colleagues reported that the tendency for adverse events increased with increasing ASA score, but there was no significant association between ASA and adverse events in the multivariate analysis. There was an increase in the risk of serious adverse events related to high ASA scores, in another study.[5,6] In another study, ASA IV was significantly associated with major complications, but there was no association between ASA III and the complications.[7] In our study,

Table 5. The Distribution of the Number and Percent of Patients Within ASA Groups and PACU Recommendation

	PACU Recommendation		
ASA	**Yes**	**No**	**Total**
I			
N	23	52	75
% within ASA	**30.7**	69.3	100
II			
N	38	74	112
% within ASA	**33.9**	66.1	100
III			
N	18	16	34
% within ASA	**52.9**	47.1	100

ASA, American Society of Anesthesiologists; PACU, post-anesthesia care unit.

we found that there was no correlation between ASA score and complications ($P > .999$). Complications were common in ASA I and II as in ASA III. About half of the patients had rapid desaturation during the procedure and it was not associated with ASA score; it developed in ASA I and ASA II as frequently as in ASA III. As expected, EBUS is a procedure with a greater risk for rapid desaturation than EUS. Therefore, we should always be ready for rapid desaturation and be able to manage it well during the process, regardless of the ASA score in the pre-procedural assessment.

The peri-procedural complications in EBUS are temporary and manageable. Monitoring the non-invasive arterial pressure, heart rate, ECG, and SpO_2 is sufficient and obligatory during EBUS.[8] Rapid decreases in oxygen levels are frequently observed due to the effect of sedation and the narrowed airway during bronchoscopy.[8,9] In our study, we found that during the procedure, oxygen desaturation occurred in 109 (49.3%) patients, and 102 of 109 even had rapid desaturation ($SpO_2 \leq 90$). The lowest SpO_2 was 65%. However, there was no significant difference between the pre-bronchoscopic and post-bronchoscopic SpO_2 levels. Therefore, this suggests that hypoxemia that occurs during bronchoscopy is reversible and recovers rapidly. Similar to our study, it has been reported that desaturations developing during bronchoscopy are temporary and do not require specific treatment other than oxygen supplementation.[10] Major arrhythmias, suggested to be related with myocardial ischemia, are rare during bronchoscopy. In a previous study, it was observed that bronchoscopy was associated with sinus tachycardia in 55-58%.[11] Both atrial and ventricular arrhythmias are possible during bronchoscopy. Ventricular arrhythmias occur mainly during passage through the vocal cords and are suggested to be correlated with decreasing oxygen saturation. The relation between hypoxemia and arrhythmia is not certain yet. Lundgren et al.[12] found that there was no increase in cardiac arrhythmia, despite hypoxemia and increased cardiac work. Moreover, the frequency of bradycardia/tachycardia or premature atrial/ventricular activity did not change according to oxygen supplementation.[13] In our study, the most common arrhythmia was ventricular extra systole, that resolved by the end of the procedure. The other common complication was laryngospasm/bronchospasm. This complication is suggested to be related to both the drugs used during bronchoscopy and the reaction to the passage of bronchoscope through the larynx. To reduce the risk of laryngeal edema, prophylactic prednisolone may be administered.[14] We managed laryngospasm/bronchospasm by administration of steroid, bronchodilator drugs, and positive pressure, by applying just after the development of these complications. We did not have any fatal complication during the procedure, all intra-procedural complications were temporary and resolved by appropriate interventions, just by the end of the procedure.

As EBUS is performed more often, problems regarding the organization of PACU/ICU beds are encountered more frequently. Since the PACU/ICU beds are limited, delays are possible for EBUS. The more accurately the predictive factors are determined, the more effectively the PACU/ICU beds can be used, without unnecessary bed reservation or unexpected bed requirements. In our study, about half of the PACU/ICU reservations were unnecessary. The sensitivity and specificity of pre-bronchoscopic evaluation in predicting the post-bronchoscopic need for PACU/ICU, were 83.3% and 61%, respectively. There was a poor agreement for PACU and a moderate agreement for ICU between the predicted and follow-up sites. Complications during the procedure were not determinative for the follow-up sites. Some patients needed PACU or ICU, even if ASA score was low. On the contrary, some patients with high ASA scores did not need PACU or ICU. Therefore, we think that a more accurate pre-bronchoscopic evaluation system with higher sensitivity and specificity than ASA, is required.

There are some limitations of our study. First of all, the study is retrospective and possible involuntary bias may be present due to its retrospective nature. Secondly, it is not a multicenter study, and this might be the most important factor that restricts its generalization. Thirdly, we had no patients with ASA IV and the majority of the patients in our study were in ASA I and ASA II. In a study with more ASA III and IV, the results could be different. Finally, ASA classification was performed by different anesthesiologists in the study. Previously, it was observed that ASA classification may show high variability among scorers.[15] These limitations should be considered when evaluating the findings of this study.

CONCLUSION

We found that ASA is not a good predictor of complications during the EBUS procedure. Complications occurred regardless of the ASA score. However, all complications during the procedure were temporary and resolved with appropriate interventions by the end of the procedure. Complications during the procedure were not determinative for the post-procedural follow-up site either. The significant deciding factors for post-bronchoscopic follow-up sites before the procedure were ASA and age. However, details were not good enough for accurate determination of the PACU/ICU bed requirement. Therefore, in order to use the PACU/ICU beds more effectively and to stop unnecessary bed reservation and unexpected requirements, a more accurate pre-bronchoscopic assessment system with a higher sensitivity and specificity should be developed.

Ethics Committee Approval: This study was approved by Ethics committee of Akdeniz University School of Medicine (Approval No: KAEK-327).

Informed Consent: Written informed consent was obtained from each participant who participated in this study.

Peer Review: Externally peer-reviewed.

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