

# Factors affecting patients' comfort during fiberoptic bronchoscopy and endobronchial ultrasound

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**Objective:** This study investigated the factors that can affect the comfort of patients who underwent diagnostic fiberoptic bronchoscopy (FOB) and diagnostic endobronchial ultrasonography (EBUS) for the first time and the effect of the patients' anxiety level on their comfort during the procedure.

**Materials and methods:** We recorded the demographics of the patients, the medications they used previously, the anesthesia applied during the procedure, the experience of the operator, the insertion technique of the bronchoscope, the types of the bronchoscopic interventions during the procedure, the duration of the procedure, and the anxiety levels of the patients before the session. Patients' discomfort level before and after the procedure and anxiety levels before the procedure were evaluated using a visual analog scale (VAS), and willingness for repeating FOB and EBUS was assessed using a questionnaire.

**Results:** We found that longer examination time, higher anxiety level before the procedure, the nasal insertion of bronchoscope, and higher number of interventions are related to the increased discomfort during FOB and EBUS. Patients' willingness for repeating FOB and EBUS increased as the level of discomfort decreased during the procedure.

**Conclusion:** The patient's anxiety level should be determined using a questionnaire before the FOB and EBUS procedures, and the operator should adjust their procedure according to the patients' anxiety level.

**Keywords:** patient comfort, fiberoptic bronchoscopy, endobronchial ultrasound, patient anxiety, preprocedure questionnaire, patient willingness

## Introduction

Fiberoptic bronchoscopy (FOB) and endobronchial ultrasonography (EBUS) are among the widely used procedures for diagnosis and treatment of various lung diseases. The majority of patients who underwent FOB and EBUS complain of discomforts during the process due to asphyxia, cough, nausea, and feeling of choking.<sup>1,2</sup> Patients often remember the process as a negative experience due to their unpleasant feelings during procedure and they even refuse to repeat the procedure.<sup>3</sup> To minimize patient discomfort during the process and increase the effectiveness of the process, some preparations are made before the FOB and EBUS. Although there are general guidelines and recommendations for premedication, there is no exact protocol for this. The sedative and analgesic premedications can increase patient satisfaction, and they seem to provide the benefit of reducing the patients' discomfort during the procedure.<sup>4,5</sup> Previous studies have shown that the anxiety levels of the patients before the procedure and the experience of the operator carrying out the process affect the patients' comfort

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during FOB.<sup>6,7</sup> In this study, we sought to clarify the factors that affect the comfort of patients who underwent diagnostic FOB and EBUS for the first time, and also examine the effect of the patients' anxiety level before the procedure on their discomfort level during the procedure.

## Materials and methods

We included a total of 250 patients (174 males and 76 females) who underwent diagnostic FOB and EBUS for the first time at the Faculty of Medicine, Department of Pulmonary Medicine, Gazi University, between April 2011 and April 2012. Our study was approved by the ethics committee of Gazi University Medical Faculty. The application methods of procedures, the reasons of the procedures, and possible complications were explained to all patients before the procedures. All patients or their relatives gave written informed consent that included the information about the acceptance of the procedure.

We excluded the patients who underwent FOB or EBUS previously, patients with tracheostomy, patients who did not give written informed consent to participate in the study, and the patients who did not want to answer the questionnaire after the procedure.

During the procedure, the arterial blood pressure, heart rate, and rhythm of all patients were monitored. Transcutaneous oxygen saturations of patients were followed up by pulse oximetry. Supplemental oxygen was given to all patients, and 95% oxygen saturation (SaO<sub>2</sub>) was achieved for all patients.

Anesthesia of the posterior oropharynx and both nares of the patients was achieved using 10% lidocaine. A total of 5 mL of 2% lidocaine was given in the form of nebulization before the procedures. In addition, for the anesthesia of the vocal cord and the tracheobronchial tree, 2% lidocaine was used. Midazolam was administered intravenously between 0.05 and 0.1 mg/kg doses. Midazolam doses were set according to patients' sedation level.

All operations were performed while the patients were in supine position. FOB procedures were performed by transnasal or transoral routes. All EBUS procedures were performed by the transoral route. Some of the FOB procedures were performed by less-experienced operators, and some of them were performed by experienced operators. However, less-experienced operators had been trained theoretically and practically about the FOB from the beginning of their education. All the EBUS procedures were performed by experienced operators. An operator who has been performing the FOB and EBUS for 5 years was defined as experienced.

A questionnaire was distributed to all patients before the procedures. Patients rated their anxiety level before

the procedure on this questionnaire. After the procedure, 2 hours later, patients rated their discomfort level during the procedure on the same questionnaire, and they also answered the question related to their willingness for repetition of procedures in the future.

We used a visual analog scale (VAS)<sup>6,7</sup> to evaluate the patients' anxiety and discomfort levels within the questionnaire. The VAS consisted of a 100 mm long horizontal straight line defined by anchors with verbal labels, the left end point (0 mm) indicating no discomfort and the right end point (100 mm) indicating overwhelming discomfort as well as anxiety. We determined the VAS score (1 mm = 1) by measuring the distance from the left end point to the mark made by the patient (Table 1). We evaluated the patients who answered 1 or 2 to question 3 to be willing for repetition of procedure in the future. The patients who answered 3 or 4 to question 3 were evaluated as unwilling. According to the patients' anxiety levels, patients were separated into two groups: the low anxiety group (less than the median of the VAS score) and the high anxiety group (the median of the VAS score or greater).

Since some of our patients were illiterate, we preferred to use a VAS. The patients easily marked their anxiety and discomfort levels on the chart when the question was read by the operator.

## Statistics

All statistical analyses were performed using SPSS for Windows (Version 17.0, SPSS Inc). A pilot study was carried out that included 45 patients. Based on these data, it was estimated that 250 patients were needed to have a power of 95% confidence interval. In addition, descriptive statistical methods (mean, standard deviation, median, frequency) and

**Table 1** Survey form

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Please, place a vertical mark on the horizontal line at the point corresponding to your subjective degree of 'anxiety' before bronchoscopy judged from your healthy condition and psycho-social background as a whole (0 (zero): lack of anxiety, and 100 (one hundred) a lot of anxiety status).

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Please, place a vertical mark on the horizontal line at the point corresponding to your subjective degree of 'discomfort' by bronchoscopy judged from your healthy condition and psycho-social background as a whole (0 (zero): lack of discomfort, and 100 (one hundred): too many disturbing state).

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Will you undergo bronchoscopy if the physician recommends it should be repeated?

1. Yes, I will do it.
  2. Yes, I will do it if it is necessary.
  3. No, I don't want to do it, but I will do it if the physician insists.
  4. No, I will never do it again.
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Student's *t*-test were used to compare percentage of groups' discomfort during the procedure and differences between the groups. The univariate  $\chi^2$  test was used to compare qualitative data. The results were evaluated with 95% confidence interval and were considered significant at  $p < 0.05$ . The factors affecting the patients' discomfort during the procedures as a result of univariate analysis were then reevaluated using multiple regression analysis to identify independent factors.

## Results

In the study group, 174 (69.6%) patients were males and 76 (30.4%) were females. Their mean age was  $56.5 \pm 13.7$  years. A total of 214 (85.6%) patients underwent FOB and 36 (14.4%) underwent EBUS. The mean age was  $56.2 \pm 13.9$  years, the mean operation time was  $24.4 \pm 10.5$  minutes, and the mean preoperative anxiety score was  $52.7 \pm 33.4$  VAS of the FOB group. The mean age of the EBUS group was  $57.9 \pm 12.2$  years, the mean operation time was  $30.0 \pm 10.7$  minutes, and the mean preoperative anxiety score was  $38.3 \pm 32.8$  VAS (Table 2).

Although 48 (22.4%) patients in the FOB group stated no discomfort during the procedure, 166 (77.6%) stated a feeling of at least one of the following symptoms: coughing, nausea, choking, or others. In the EBUS group, 13 (36.1%) patients stated no discomfort during the procedure, 23 (63.9%) stated at least one symptom during the procedure (Table 3).

A median discomfort level of the FOB group during the procedure was 40 VAS. We divided the FOB group's patients into two groups: the low-discomfort group ( $<40$  VAS) and the high-discomfort group ( $\geq 40$  VAS). In the FOB group, female patients, patients with high preoperative anxiety, patients with longer procedure time, patients who received antihypertensive drugs due to preoperative hypertension, patients who received midazolam, patients with COPD, hospitalized patients, and the patients who were applied bronchial lavage, bronchoalveolar lavage (BAL), and transbronchial biopsy during the procedure had higher level of discomfort during the procedure ( $p < 0.05$ ). However, the operator's experience was not a factor that affected the patients' discomfort during the procedure ( $p > 0.05$ ; Table 4).

In patients who underwent EBUS, the median discomfort level was 27.5 VAS during the procedure. The patients were also divided into two groups: the low-discomfort group ( $<27.5$  VAS) and the high-discomfort group ( $\geq 27.5$  VAS; Table 5). In the EBUS group, the patients with high preoperative anxiety level and longer operation time had significantly higher discomfort during the procedure ( $p < 0.05$ ). While the mean discomfort level of the patients who underwent procedure as outpatients was  $39.0 \pm 27.9$  VAS, the mean dis-

**Table 2** General characteristics of the groups

Characteristics	FOB	EBUS	p-Value
Discomfort level during the procedure (median VAS)	40	27.5	–
Number of patients, n (%)	214 (85.6)	36 (14.4)	–
Mean age, years (mean $\pm$ SD)	$56.3 \pm 13.9$	$57.9 \pm 12.2$	0.013
Sex (n)			
Female/male	71/143	5/31	–
Anxiety level before examination (VAS) (mean $\pm$ SD)	$52.7 \pm 33.4$	$38.3 \pm 32.8$	0.01
Examination time (minutes) (mean $\pm$ SD)	$24.4 \pm 10.5$	$30.0 \pm 10.7$	0.005
Cigarette, n (%)	146 (68.2)	28 (77.7)	0.17
Additional diseases, n (%)	169 (78.9)	28 (77.7)	0.51
History of drug usage, n (%)	149 (69.6)	21 (58.3)	0.12
Preprocessing symptoms (cough/sputum, hemoptysis, shortness of breath, and others), n (%)	195 (91.1)	31 (86.1)	0.25
Premedication, n (%)	16 (7.4)	4 (11.1)	–
Bronchodilator	5 (2.3)	0 (0.0)	0.45
Antihypertensive	9 (4.2)	3 (8.3)	0.24
Anesthesia, n (%)			
Inhaler lidocaine	205 (95.7)	36 (100)	0.24
Midazolam	70 (32.7)	29 (80.5)	0.01
Operator, n (%)			
Experienced operator	174 (81.3)	–	–
Less-experienced operator	40 (18.7)	36 (100)	0.01
Insertion site, n (%)			
Nasal	192 (89.7)	–	–
Oral	22 (10.3)	36 (100)	0.01
Bronchoscopic interventions, n (%)			
Bronchial Lavage	153 (71.4)	35 (97.2)	0.01
Punch biopsy	63 (29.4)	–	–
Transbronchial biopsy	57 (26.6)	–	–
Bronchial brushing	87 (40.6)	–	–
TBNA	84 (39.2)	33 (91.3)	0.01
Bronchoalveolar lavage	63 (29.4)	–	–
Discomfort during the procedure, n (%)	166 (77.5)	23 (63.8)	0.07
Willingness to repeat the procedure, n (%)	149 (69.6)	31 (86.0)	0.08

**Abbreviations:** FOB, fiberoptic bronchoscopy; EBUS, endobronchial ultrasonography; VAS, visual analog scale; TBNA, transbronchial needle aspiration.

**Table 3** Rates of discomfort during the procedures

Parameters	FOB, N (%)	EBUS, N (%)	Total, N (%)	p-Value
Presence of discomfort during procedure	166 (77.5)	23 (63.8)	189 (75.6)	0.07
Cough	162 (75.7)	22 (61.1)	183 (73.2)	0.06
Nausea	21 (9.8)	4 (11.1)	25 (10)	0.81
Choking feeling	52 (24.2)	5 (13.8)	57 (22.8)	0.16
Others	26 (12.1)	2 (5.5)	28 (11.2)	0.24

**Abbreviations:** FOB, fiberoptic bronchoscopy; EBUS, endobronchial ultrasonography.

comfort level of hospitalized patients was  $46.8 \pm 29.8$  VAS in the FOB group. This difference was statistically significant ( $p=0.04$ ).

**Table 4** Factors affecting the level of discomfort during FOB

Characteristics	Low discomfort group	High discomfort group	Total	p-Value
Discomfort level during the procedure (median VAS)	<40	≥40	–	–
Number of patients, n (%)	95/214 (44.4)	119/214 (55.6)	214 (100)	–
Mean age, years (mean±SD)	58.1±12.0	54.7±15.1	56.2±13.9	0.69
Sex (n)				
Female/male	22/73	49/70	71/143	0.05
Presence of respiratory symptoms before procedure, n (%)	83/95 (87.3)	112/119 (94.1)	195/214 (91.1)	0.08
Anxiety level before procedure (VAS) (mean±SD)	42.5±30.4	60.8±33.6	52.7±33.4	0.01
Examination time (minutes) (mean±SD)	22.1±10.3	26.3±10.4	24.4±10.5	0.03
Cigarette, n (%)	71/95 (74.7)	75/119 (63.0)	146/214 (68.2)	0.68
Additional diseases, n (%)	74/95 (77.8)	95/119 (79.8)	169/214 (78.9)	0.73
COPD	13/95 (13.6)	29/119 (24.3)	42/214 (19.6)	0.05
Hypertension	26/95 (27.3)	37/119 (17.2)	63/214 (29.4)	0.55
Psychiatric disorder	3/95 (3.1)	7/119 (5.8)	10/214 (4.6)	0.34
Previous drug usage, n (%)	63/95 (66.3)	86/119 (72.2)	149/214 (69.6)	0.34
Premedication, n (%)	3/95 (3.1)	13/119 (10.9)	16/214 (7.4)	0.03
Bronchodilator	2/95 (2.1)	5/119 (4.2)	5/214 (2.3)	0.84
Alprazolam	0/95 (0.0)	3/119 (2.5)	3/214 (1.4)	0.11
Antihypertensive	1/95 (1.0)	8/119 (6.7)	9/214 (4.2)	0.04
Anesthesia, n (%)	90/95 (94.7)	115/119 (96.6)	205/214 (95.7)	0.49
Inhaler lidocaine	90/95 (94.7)	115/119 (96.6)	205/214 (95.7)	0.49
Midazolam	23/95 (24.2)	47/119 (39.4)	70/214 (32.7)	0.01
Operator, n (%)				
Less-experienced operator	77/95 (81.1)	97/119 (81.5)	174/214 (81.3)	0.70
Experienced operator	18/95 (18.9)	22/119 (18.5)	40/214 (18.6)	0.46
Insertion site, n (%)				
Nasal	82/95 (86.3)	110/119 (92.4)	192/214 (89.7)	0.67
Oral	13/95 (13.7)	9/119 (7.6)	22/214 (10.3)	0.57
Bronchoscopic procedures, n (%)	91/95 (95.7)	119/119 (100)	210/214 (98.1)	0.02
Bronchial lavage	73/95 (76.8)	80/119 (67.2)	153/214 (71.4)	0.12
Punch biopsy	19/95 (20.0)	44/119 (36.9)	63/214 (29.4)	0.07
Transbronchial biopsy	15/95 (15.7)	42/119 (35.2)	57/214 (26.6)	0.00
Bronchial brushing	43/95 (45.2)	44/119 (36.9)	87/214 (40.6)	0.22
TBNA	39/95 (41.0)	45/119 (37.8)	84/214 (39.2)	0.63
Bronchoalveolar lavage	18/95 (18.9)	45/119 (37.8)	63/214 (29.4)	0.03

**Abbreviations:** FOB, fiberoptic bronchoscopy; VAS, visual analog scale; TBNA, transbronchial needle aspiration.

In the FOB group, 149 (69.6%) patients stated positive feelings related to repetition of FOB in the future, whereas 65 (30.3%) reported negative feelings. In the EBUS group, 31 (86.1%) patients reported positive feelings for repetition of EBUS in the future, and five (13.8%) reported negative feelings (Table 6).

We found that duration of the procedure and insertion site are factors independently affecting the patients' discomfort level during procedure in the study group at the end of the multivariate analysis. The patients' discomfort level was more when the procedure time was longer and the insertion site was the nasal route (Table 7).

When we separately evaluated the FOB and EBUS groups, sex, preoperative anxiety level, and insertion site were found to be the independent factors increasing the patients' discomfort level during the procedure in the FOB group. The discomfort level increased in female patients, in

patients with high preoperative anxiety level, and in patients whose insertion site was the nasal route (Table 8).

Evaluation of the 149 (69.6%) patients with positive feelings for repetition of procedure in the FOB group showed that 90 (60.4%) patients were in the low-discomfort group and 59 (39.6%) were in the high-discomfort group.

In the EBUS group, 32 (88.8%) patients had positive feelings for repetition of procedure, of whom 18 (56%) patients were in the low-discomfort group and 12 (44%) patients were in the high-discomfort group.

## Discussion

In this prospective study, we found that duration of the procedure and anxiety of the patients before the procedure are the major factors affecting the patients' comfort during both FOB and EBUS. Moreover, nasal insertion and female gender are the additional factors affecting the comfort of patients undergoing FOB.

**Table 5** Factors affecting the level of discomfort during EBUS

Characteristics	Low discomfort group	High discomfort group	Total	p-Value
Discomfort level during the procedure (median VAS)	<27.5	≥27.5	–	–
Number of patients, n (%)	18/36 (50)	18/36 (50)	36 (100)	1.0
Age, years (mean±SD)	57.8±14.4	57.9±9.5	57.8±12.1	0.67
Sex (n)				
Female/male	1/17	4/14	5/31	0.14
Anxiety level before procedure (VAS)	22.2±25.8	54.4±31.6	38.3±32.8	<b>0.01</b>
Presence of respiratory symptoms before procedure, n (%)	16/18 (88.8)	15/18 (83.3)	31/36 (86.1)	0.63
Examination time (min) (mean±SD)	26.8±9.1	33.0±11.1	29.9±10.6	0.39
Cigarette, n (%)	14/18 (77.7)	14/18 (7.7)	28/36 (77.7)	1.0
Additional diseases, n (%)				
COPD	4/18 (22.2)	2/18 (11.1)	6/36 (16.6)	0.37
Hypertension	7/18 (38.8)	9/18 (50)	16/36 (44.4)	0.50
Psychiatric disorder	0/18 (0)	0/18 (0)	0/36 (0)	–
Previous drug usage, n (%)	14/18 (77.7)	7/18 (38.8)	21/36 (58.3)	0.63
Premedication, n (%)	1/18 (5.5)	3/18 (16.6)	4/36 (11.1)	0.28
Bronchodilator	0/18 (0)	0/18 (0)	0/36 (0)	
Alprazolam	1/18 (5.5)	0/18 (0)	1/36 (2.7)	0.31
Antihypertensive	0/18 (0)	3/18 (16.6)	3/36 (8.3)	0.07
Anesthesia, n (%)				
Inhaler lidocaine	18/18 (100)	18/18 (100)	36/36 (100)	1.0
Midazolam	14/18 (77.7)	15/18 (83.3)	29/36 (80.5)	0.67
Bronchoscopic procedures, n (%)				
Bronchial lavage	17/18 (94.4)	18/18 (100)	35/36 (97.2)	0.31
TBNA	17/18 (94.4)	18/18 (100)	35/36 (97.2)	0.31

**Note:** The value in bold is statistically significant.

**Abbreviations:** EBUS, endobronchial ultrasonography; VAS, visual analog scale; TBNA, transbronchial needle aspiration.

**Table 6** Willingness to repeat the procedure

Results	FOB, N (%)	EBUS, N (%)	Total, N (%)
Positive attitude to repeat the procedure	149/214 (69.6)	31/36 (86.1)	180/250 (72)
Negative attitude to repeat the procedure	65/214 (30.4)	5/36 (13.9)	70/250 (8)
Total	214/250 (85.6)	36/250 (14.4)	250 (100)

**Abbreviations:** FOB, fiberoptic bronchoscopy; EBUS, endobronchial ultrasonography.

**Table 7** Multivariate analysis of factors affecting patient discomfort level of all patients (FOB and EBUS)

Parameters	β	p-Value
Examination time (3–60 minutes)	–0.083	0.01
Insertion site	–0.558	0.05
Nasal: 1		
Oral: 0		

**Abbreviations:** FOB, fiberoptic bronchoscopy; EBUS, endobronchial ultrasonography; β: regression beta coefficient.

FOB and EBUS are invasive diagnostic methods in various pulmonary diseases. Patients can express their FOB or EBUS experience as a distressing and uncomfortable procedure. Most of the patients disagree to repeat the FOB or EBUS procedure because of their negative past experience. Nakaoka et al<sup>1</sup> stated that 30% of their patients underwent two or more FOB procedures, but 22.5% of the patients who

**Table 8** Multivariate analysis of factors affecting patient discomfort during FOB

Characteristics	β	p-Value
Sex	–0.134	0.05
Female: 0		
Male: 1		
Examination time (3–60 minutes)	0.037	0.087
Anxiety level before procedure	–0.022	0.037
Insertion site	–0.762	0.018
Nasal: 1		
Oral: 0		

**Abbreviations:** FOB, fiberoptic bronchoscopy; β: regression beta coefficient.

underwent FOB did not want to undergo FOB again. So, the first FOB or EBUS procedure that the patients underwent has a great significance to get a comfortable and well-remembered procedure.

Previous studies showed that the lower the degree of discomfort of patients during the FOB procedure, the higher their consent was for repetition of procedure.<sup>3,6,8</sup> Therefore, factors that can affect the patients' comfort during the procedure and their discomfort associated with the procedure should be investigated.

In the study of Hirose et al,<sup>7</sup> the patients had reported the following discomfort feelings: choking (90.7%), coughing (86.0%), sore throat (33.3%), chest pain (32.6%), and

pain during swallowing (62.8%) during FOB. Coughing was the main discomfort feeling during the procedure for FOB and EBUS groups in our study. While this rate was found to be 75.7% in the FOB group, it was 61.1% in the EBUS group. High incidence of coughing can be associated with the use of antitussive drugs in the FOB group. In the study of Stolz et al,<sup>9</sup> no meaningful difference was found between the coughing scores of the operator and the patients' discomfort level during the procedure. They concluded that the administration of nebulized lidocaine during FOB had no effect on the patients' discomfort due to the administration of hydrocodone to all patients and the antitussive effect of hydrocodone.<sup>9</sup> Steinfort and Irving prospectively investigated the patients' discomfort under conscious sedation during EBUS-transbronchial needle aspiration (TBNA).<sup>10</sup> Coughing had been found the most common complaint (71%) in their study. In our study, coughing was found in 61.1% of the patients in the EBUS group.

The median discomfort level of the patients was 40 VAS in the FOB group and 27.5 VAS in the EBUS group. The higher level of discomfort in the FOB group was considered to be due to the higher number of interventions (Bronchial lavage, punch biopsy, transbronchial biopsy, and others) in the FOB group, and fewer interventions (Bronchial lavage and EBUS-TBNA) were performed during EBUS.

Our study found that the experience of operator had no effect on the patients' discomfort level in the FOB group. This can be due to the training (theoretical and practical) of less-experienced operators on FOB since the start of their education and the availability of experienced operators in the bronchoscopy unit when the less-experienced operator performs the procedure. Similar to our study, Hirose et al<sup>7</sup> found no correlation between the operator's experience and patient satisfaction.

Although we did not investigate in our study, previous studies showed that the time that was spent by the operator to explain the nature of the procedure including how it will be applied and how sampling will be done to the patients was more important than the operator's experience on the patients' discomforts and their satisfaction.<sup>7,11</sup> However, Uzbek et al,<sup>12</sup> in their prospective study, investigated the patients' preoperative anxiety levels according to the standard and detailed disclosure to the patients before the FOB and they investigated its effect on patient satisfaction. They found that the patients' preoperative anxiety levels had been increased two times when the patients are preoperatively informed in detail about the procedure and its complications. They concluded that informing the patients in detail before the FOB had no positive effect on patients' satisfaction.<sup>12</sup>

We found that the mean preoperative anxiety level of the FOB group was  $52.7 \pm 3.4$  VAS, whereas the preoperative mean anxiety level of the EBUS group was  $38.3 \pm 32.8$  VAS. Preoperative anxiety levels of patients were significantly higher in the high-discomfort groups in both the FOB and EBUS groups. Mitsumune et al<sup>6</sup> also found a similar result in their study. Preoperative anxiety level of the high-discomfort group was found to be significantly higher in their study. They also reported that the patients' discomfort levels were increased when the procedures were performed by the less-experienced operator in the high-anxiety group. They found that patients' discomfort levels were parallel to preoperative anxiety levels. Their study also reported that the high-discomfort group received less care from experienced operators and that caused to increase the patients' preoperative anxiety level.<sup>6</sup>

Our study found no meaningful effects of the patients' additional diseases and the drugs previously used on the discomfort levels of patients in the FOB and EBUS groups. A study by Hirose et al<sup>7</sup> also found no meaningful correlation between the patients' health conditions and their discomfort during the procedure. Lechtzin et al in their study stated that the patients' comfort during the procedure and their overall health condition were independent predictive factors for the repetition of the procedure. They showed that the patients' overall health conditions positively affected the toleration of the patients.<sup>11</sup> Our study found that patients who underwent procedures as outpatients tolerated the procedure better; on the other hand, hospitalized patients felt more discomfort during the procedures. This was attributed to higher preoperative anxiety level of the patients due to their other medical diseases.

Our study found that the procedure time was significantly longer in the high-discomfort group in the FOB group. In a study by Steinfort et al,<sup>10</sup> they investigated patients' comfort during EBUS-TBNA. Mean procedure time was found to be  $31.0 \pm 8.0$  minutes, and 98% of the patients stated that they would repeat the procedure in their study. In our study, the mean procedure time of the high-discomfort group in the EBUS group was  $30.0 \pm 10.7$  minutes, and 31 (86.1%) of all cases had positive feelings for repetition of the EBUS. In Hirose et al's<sup>7</sup> study, procedure time had no effect on the discomfort level of the patients during the procedure.

In a study by Choi et al, the effect of insertion via the nasal and oral routes on the patients' satisfaction was investigated during FOB. Patients in the nasal insertion group stated to have higher discomfort during the application of anesthesia and during insertion. In addition, the nasal insertion group had a higher level of coughing and shortness of breath. The authors did not find any differences between the groups in

willingness for the repetition of procedure.<sup>13</sup> In our study, we found that nasal route in the FOB group was an independent risk factor increasing the patient's discomfort level. This was attributed to the fewer number of patients who received FOB via oral route in the FOB group.

Hirose et al<sup>7</sup> reported that male patients felt less discomfort during FOB in their study, and they were more willing for the repetition of procedure. Likewise, Poi et al<sup>14</sup> and Putinati et al<sup>3</sup> stated that female patients were more anxious and had more discomfort during the procedure.<sup>7</sup> Similar to the previous studies, we also found that female patients had higher discomfort level in the FOB group. This was attributed to female patients being more anxious preoperatively. No differences were found between the males' and females' discomfort levels in the EBUS group in our study.

In our study, willingness for the repetition of procedure was 69.6% in the FOB group and 86.1% in the EBUS group, respectively. Lechtzin et al<sup>15</sup> reported that 71% of their patients definitely agreed to repeat the procedure, 22% could have to repeat the procedure, and 7% definitely disagreed to repeat the procedure in their study. Higher number of patients had positive feelings for the repetition of procedure in the EBUS group. This was attributed to the fewer number of interventions and the lack of irritating interventions such as transbronchial biopsy, bronchoalveolar lavage, and punch biopsy during EBUS.

One of the limitations of our study was the lack of a scale to evaluate the patients' overall health conditions instead of examining them for the presence of additional diseases. Another limitation was the lack of evaluation of the operator-dependent factors. Despite the evaluation of the operator's experience, the operator's skill, the ability to relieve the patients' anxiety, and the time which the operator spent to inform the patients preoperatively about procedure were not evaluated in our study.

## Conclusion

The use of a questionnaire including the measurement of patients' anxiety level will help to identify the patients who

will have more discomfort during FOB and EBUS before procedure. According to patients' anxiety level, the operator can prefer the oral route or can shorten the procedure time with less intervention.

## Disclosure

The authors report no conflicts of interest in this work.

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