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Endobronşiyal Ultrasonografi Transbronşiyal İğne Aspirasyonun'da İ-gel Kullanımının Etkinliğinin Değerlendirilmesi

The efficiency of Using I-Gel During Endobronchial Ultrasonography Guided Transbronchial Needle Aspiration

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ÖZ

GİRİŞ ve AMAÇ: *Bu retrospektif çalışmanın temel amacı, endobronşiyal ultrasonografi eşliğinde trans-bronşiyal iğne aspirasyonunda (EBUS-TBNA) I-jel kullanımının postoperatif boğaz ağrısı üzerindeki performansını tanımlamaktı.*

YÖNTEM ve GEREÇLER: *Amerikan Anesteziyologlar Derneği (ASA) statüsü I-II yetişkin kriterlerini karşılayan kırk hasta 18-70 yaşları arasında olup EBUS-TBNA planlanmıştır. Grup E'ye endotrakeal tüp ve grup I'e I-jel uygulanmıştır. Tüm hastaların demografik verileri (cinsiyet, yaş ve vücut kitle indeksi), indüksiyon ve idame için kullanılan anestezi tipi, iyileşme süresi, işlem ve anestezi süresi kaydedildi. Ameliyat sırasında öksürük, desatürasyon ve kanama varlığı açısından anestezi kayıtları incelendi. Ameliyat sonrası komplikasyonlar (ses kısıklığı, boğaz ağrısı, kulak ağrısı, disfaji) hastalara ait servis takip formundan ameliyat sonrası 0 (T3), 2. (T4), 4. (T5) ve 24. (T6) saatlerde kaydedildi.*

BULGULAR: *T4 döneminde ET grubunda 10 hasta, I-jel grubunda 2 hasta ve T5 döneminde ET grubunda sekiz hasta, I-jelde 2 hasta boğaz ağrısı çekti. Grup ET'de 3 hastada ve grup I'de bir hastada T4 döneminde ses kısıklığı görüldü.*

TARTIŞMA ve SONUÇ: *Bu çalışmada sonuçlarımız boğaz ağrısı ve ses kısıklığının I-jel ile azaltılabileceğini göstermiştir. Aynı zamanda, I-jel uygulamasına bağlı hemodinamik yanıt endotrakeal entübasyondan daha düşüktü.*

Anahtar Kelimeler: *Endobronşiyal ultrasonografi eşliğinde trans-bronşiyal iğne aspirasyonunda, I-jel, boğaz ağrısı, ses kısıklığı, hemodinamik yanıt*

ABSTRACT

INTRODUCTION: *The primary aim of this retrospective study was to describe the performance of I-gel on postoperative sore throat due to endobronchial ultrasonography guided trans-bronchial needle aspiration (EBUS-TBNA).*

METHODS: *Forty patients meeting the criteria of American Society of Anaesthesiologists (ASA) status I-II adults were included who are aged 18–70 and scheduled for EBUS-TBNA. In Group E, endotracheal tube and in group I, I-gel were administrated. All patients' demographic data (gender, age, and body mass index), type of anesthesia used for induction and maintenance, recovery time, the duration of procedure and anesthesia were recorded. The anesthesia records were interviewed for the presence of coughing, desaturation, and bleeding during the operation. The postoperative complications (hoarseness, sore throat, earaches, dysphagia) were interviewed and recorded at 0 (T3), 2th(T4), 4th(T5) and 24th(T6) hr after the operation from patients care form.*

RESULTS: *Ten patients in the group E , 2 patients in the I-gel group at the T4 period and eight patients in the group E, 2 patients in I-gel were suffered from a sore throat at the T5 period. Three patients in group E and one patient in group I were suffered from hoarseness at the T4 period.*

DISCUSSION AND CONCLUSION: *In this study, our results showed that the incidence of sore throat and hoarseness could be reduced with I-gel. At the same time, hemodynamic response due to the I-gel application was lower than the endotracheal intubation.*

Keywords: *Endobronchial ultrasonography guided trans-bronchial needle aspiration, I-gel, sore throat, hoarseness, hemodynamic responses*

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INTRODUCTION

Supraglottic airway devices (SAD) for general anesthesia with the aim of airway control started with the production of classic laryngeal mask airway (LMA) in 1881, which is still widely used throughout the world because of the clinical practice of low stress, and light stress reaction (1, 2). An I-gel without sac is made of special material and does not need to be inflated. It's structure can prevent the epiglottis folding and airway obstruction (1, 3). Nasogastric tube can be inserted through i-gel for aspiration of gastric contents. In addition, endotracheal tube can be passed through i-gel due to its rigid airway patency (Figure 1).

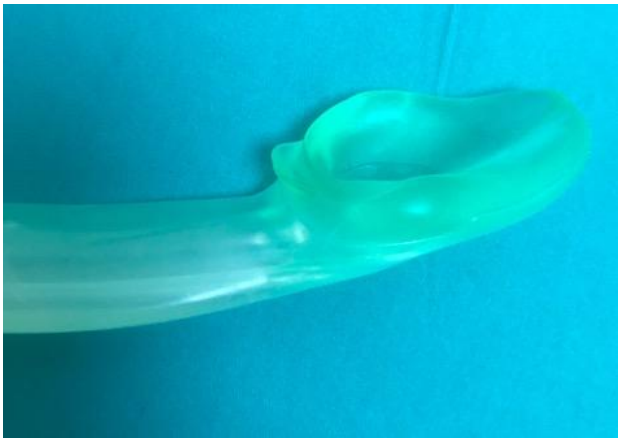

Figure 1. *Image of the I-gel*

Endobronchial ultrasonography (EBUS) is the procedure of examining the airway wall, structures outside the airway, and lungs with a probe protruding from the working channel of the bronchoscope. Bronchoscopy allows direct and indirect visualization of airway pathologies and the internal wall of the airway while endobronchial ultrasonography permits the examination of the airway wall, pathologies outside the wall, and mediastinal lymph nodes and even transbronchial needle biopsy (TBNA) during the procedure. Mediastinal tumors, heart, esophagus, and large vessels can also be evaluated with EBUS. The superiority of EBUS, which is accepted as an invasive procedure over radiological imaging methods, has also been proven (4). The bronchoscope used during the EBUS-TBNA procedure passes through the airway devices (I-gel 4-5, endotracheal tubes 8.5 and 9) with an internal diameter of > 6 mm that allows the operation to proceed.

The primary aim of this retrospective study was to describe the performance of I-gel on postoperative sore throat due to EBUS-TBNA. The secondary aims were to evaluate earache, swallowing difficulty, hoarseness, duration of the procedure and the hemodynamic responses due to airway management and the incidence of coughing, tooth clenching, desaturation and laryngeal spasms after the procedure.

MATERIALS AND METHODS

Institutional Ethics Committee approval and written informed consent (Ref no 58/31, 07/01/2019) were obtained. Written informed consent was obtained from all the patients. Forty-eight patients interviewed who meet the criteria of American Society of Anaesthesiologists (ASA) status I-II adults were included who are aged 18–70 and scheduled for endobronchial ultrasonography-guided trans-bronchial needle aspiration (EBUS-TBNA) under general anesthesia between 1 May 2018 and 31 December 2018. Patients with a history of hypertension, chronic pain, anti-hypertension, and anti-inflammatory treatment were excluded from the study, in addition to those who did not submit a written informed consent form. At the same time if patients had contraindications to the use of LMA such as body mass index more than 40 kg/m2, symptomatic hiatus hernia, or severe gastroesophageal reflux disease they excluded from the study. If a sufficient tidal volume could not be achieved by I-gel on the first attempt patients were excluded from the study.

Finally, 40 patients were allocated to Group E (n = 20) and Group I (n = 20) due to the choice of airway management technique. In Group E, endotracheal tube (ETT) and in group I, i-gel were administrated. Size selection of the i-gel depended on the patient's weight following the guidelines but endotracheal tube size was selected a size 8.5 for females and a size 9.0 for male patients according to gender (5). All cuff pressure of ET tubes were monitored with an analog manometer (VBM Medizinchnik, GmbH, Germany) and provided that recommended pressure between 20 and 30 cmH2O

in routinely. All pre-anesthesia documents and intraoperative anesthesia records were reviewed by study members. All patients' demographic data (gender, age, and body mass index), type of anesthesia used for induction and maintenance, recovery time, the duration of procedure and anesthesia were recorded. The anesthesia records were interviewed for the presence of coughing, desaturation, and bleeding during the operation. Patients in both groups did not receive any premedication. Patient heart rate (HR), noninvasive blood pressure [systolic blood pressure (SBP), diastolic blood pressure (DBP) and mean blood pressure (MBP)], bispectral index (BIS) (A-200 BIS monitoring system; Aspect Medical Systems, BIS XP; Framingham, MA, USA), and pulse oximetry values were recorded from the anesthesia form. Hemodynamic variables were recorded at one minute before (T1) and one minute after insertion (T2) of the airway device. On anesthetic management, all patients were pre-oxygenated for 2 min, and anesthesia was induced with propofol (2-2.5 mg/kg), fentanyl (1.5-2 mcg/kg) and rocuronium bromide 0.6 mg/kg. To provide consistent conditions, insertion of the I-gel and the endotracheal tube was administered by anesthesiologist (>2 yr experience) when the BIS was below 40 and kept stable throughout the study period. Correct insertion was assessed by proper chest expansion, the presence of a curved CO2 wave on the capnography, the absence of audible leak, and lack of gastric insufflation. The presence of gastric insufflation was determined by epigastric auscultation. After obtaining an effective airway, the device was connected to a circle breathing system (Primus, Drager, Lubek, Germany) with a catheter mount cap (Fig 2). The lungs were ventilated with a tidal volume of 6-8 mL/kg1, a respiratory rate of 12 breaths per minute, and an I: E ratio of 1:2 and peak airway pressure of approximately 12-20 cm H2O in volume-controlled mode. Anesthesia was maintained with 80-100 mcg/kg/min propofol and remifentanil infusion at a dose of 0.05-0.1 mcg/kg/min. Atropine 0,02 mg/kg (IV) and neostigmine 0.04 mg/kg (IV) were administered before extubation to all patients. Granisetron (40 mcg/kg) was administered for postoperative nausea and vomiting (PONV) prophylaxis to all patients just before the induction of anesthesia. Tramadol 100 mg iv infusion was administered approximately 15 minutes before the end of the procedure for postoperative analgesic treatment. The time of modified Aldrete scores> 9 was recorded from the anesthesia form. The postoperative complications (hoarseness, sore throat, earaches, dysphagia) were interviewed and recorded at 0 (T3), 2th (T4), 4th (T5) and 24th (T6) hr after the operation from patients care form. If the patients complained of sore throats and earaches, diclofenac sodium (75 mg) was applied i.v. in our routine practice.

Statistical methods

We used the SPSS 21.0 (SPSS, Inc, Chicago, IL, USA) statistical program for statistical analysis. Categorical data were compared using the chi-square or Fisher absolute test. Data were tested for normality using the Shapiro-Wilk test. To compare the two groups, we used the Student t-test and the Mann-Whitney U-test, for normally and not normally distributed data, respectively. Variance for multiple comparisons and Bonferroni correction for post hoc analysis were used for continuous variables, Pearson Correlation test was used to determine how one variable was affected as another variable. Statistical significance was set at $p < 0.05$.

RESULTS

Forty-eight patients were interviewed, and 44 patients who met the inclusion criteria were included in the study. One patient who could not be intubated with direct laryngoscopy at first attempt and 3 patients who could not be administrated I-gel were excluded from the study **(Figure 2).** Finally, 40 patients were analyzed.

Demographic data (age, gender, and body mass index), ASA status, recovery time, duration of procedure and anesthesia are demonstrated in **Table 1.** The duration of the procedure was 42.6 ±15.65 min and 35 ± 8.17 min for the ET group and the I-gel group, respectively (p =0.062). The duration of anesthesia was 48.6 ± 17.47 min and 49.55 ± 11.62 min for the ET group and I-gel group, respectively (p=0.109).

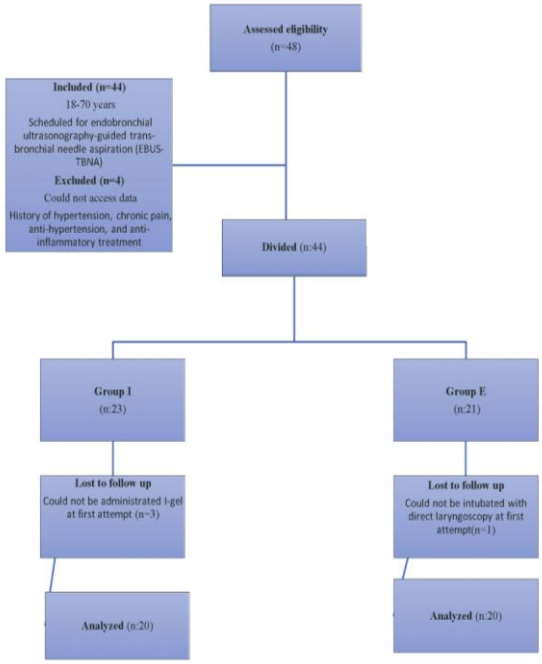

Figure 2. Flow diagram of study

Table 1. Demographic data			
	Group E (n=20)	Group I (n=20)	p
Age (year)*	62.55 ± 7.13	62.45 ± 6.96	0.994
Gender* **Female/ Male**	9/11	8/12	0.902
BMI (m^2/kg)**	25.6 ± 2.36	27.2 ± 4.92	0.343
Duration of procedure (min)**	42.6 ± 15.65	35 ± 8.17	0.062
Duration of anesthesia (min)**	48.6 ± 17.47	49.55 ± 11.62	0.109
Recovery time (Modified Aldrete scores >9)(min)**	11.9 ± 1.68	12.0 ± 1.16	0.781
***n and percentage (%),** ** mean ± standart deviation, p<0.05 significant**			

Intraoperative complications were demonstrated in **Table 2.** There were no patients who suffered from laryngospasm. Only 2 patients in group E and 1 patient in group I were suffered from bleeding (p>0.05). There were no differences in desaturation and extubation in both groups (p>0.05). Postoperative complications were demonstrated in **figure 3.** Ten patients in the ET group, 2 patients in the I-gel group at the T4 period and eight patients in the ET group, 2 patients in I-gel were suffered from a sore throat at the T5 period (p<0.05). There was no difference in all other periods (p>0.05) regarding sore throat. Three patients in group ET and one patient in group I-gel were suffered from hoarseness at the T4 period. At the same time, there were no differences in hoarseness, ear pain, and dysphagia in all periods (p>0.05).

Table 2. Intraoperative complications			
n	Group E (n=20)	Group I (n=20)	p
Bleeding	2	1	0.724
Coughing	0	0	-
Desaturation	1	2	0.564
Extubation	1	2	0.564
Laryngospasm	0	0	-
Pneumothorax	0	0	-

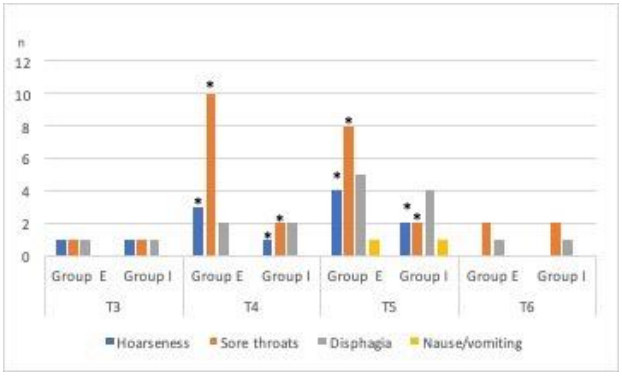

Figure 3. *Postoperative complications. (T3; in PACU, T4; after 2 hours of procedure, T5; after four hours of procedure, T6; after 24 hours of procedure, *p<0.05 for differences between groups)*

Data on SBP, DBP, MBP, and HR are demonstrated in **figure 4.** At the T1 period, HR was 70.95 ± 11.35 mmHg and 71.94 ± 10.34 mmHg in group ET and group i-gel, respectively (p=1.000). At the T2 period, HR was 78.55 ± 14.16 mmHg in group ET and 77.7 ± 13.62 mmHg in group I-gel (p=848). SBP was 108.9 ± 20.47 mmHg in group ET and 106.8 ± 18.23 mmHg in group I-gel (p=0.734) at T1 period but at T2 period SBP was 132.95 ± 19.03 mm Hg and 117.25 ± 17.89 mm Hg in group ET and group I-gel, respectively (p=0.011). DBP was 62.1 ± 12.42 mmHg in group ET and 66.15 ± 17.88 mmHg in group I-gel at the T1 period (p=0.411). At the T2 period, DBP was 79.3 ± 10.67 mmHg in group ET and 67.45 ± 10.94

mmHg in group I-gel (p=0.001). At the T1 period, MBP was 78.95 ± 14.46 mmHg and 79.65 ± 18.38 mmHg in group ET and group i-gel, respectively (p=0.894). At the T2 period, MBP was 98.45 ± 11.93 mmHg in group ET and 83.25 ± 15.84 mmHg in group I-gel (p=0.001).

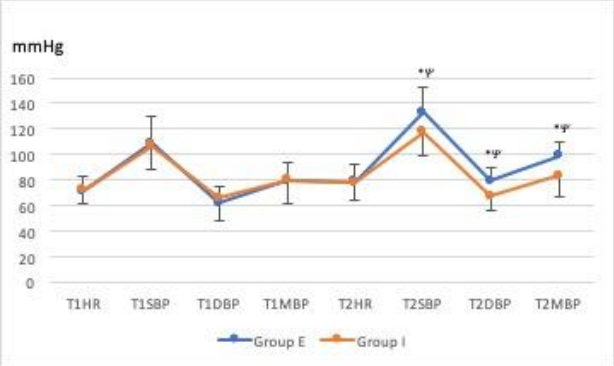

*Figure 4. Hemodynamic variables (T1; one minute before airway device insertion, T2; one minute after airway device insertion,*p<0.05 for differences between groups, ⍰p<0.05 compared to baseline values, HR: Heart rate, SBP: Systolic blood pressure, DBP: Diastolic blood pressure, MBP: Mean blood pressure)*

DISCUSSION

In this study, our results showed that the incidence of sore throat and hoarseness could be reduced by using the i-gel. We also found that hemodynamic response due to i-gel application was lower than with endotracheal intubation.

Depending on the size of the airway device used, there can be many complications, including vocal cord trauma. In particular, postoperative sore throat occurs in 21% to 74% of ET intubation cases (6-8). The use of a supraglottic airway device (SAD) occurs in around 49% of cases (9). Venugopal et al. (10) showed that postoperative sore throat was 61% higher in the endotracheal (ET) intubation patient group. In addition, Dhanda et al. (11) showed that the frequency of sore throat in the early postoperative period was significantly lower in the i-gel patient group compared to the ET patient group. In the current study, we observed that 70% of patients in the E group developed sore throats during the postoperative period. We think that this rate is higher due to the longer EBUS-TBNA processing time in the E group and the larger number of tubes used. Since ETT size is compatible with the bronchoscope, the procedure is directly related to the airway and the manipulation of the bronchoscope. However, the incidence of postoperative sore throat was decreased due to the use of a SAD such as the i-gel. In our current study, 25% of patients in the i-gel group had sore throats. This low rate may be related to the use of the i-gel without the cuff, which could have prevented inflammation due to lack of cuff pressure.

Postoperative pharyngeal complications were associated with high cuff pressure in SADs, which emphasized that they could be avoided if the pressure was maintained within the recommended ranges. In their study, Seet et al. (12) used a LMA, and the incidence of postoperative hoarseness was found to be lower in the pressure-limited group (5.2% vs. 15%). Furthermore, Safaien et al. found that the incidence of hoarseness was lower in the LMA group compared to the ETT group (3% vs. 21%, respectively). Bing et al. (24) used a classic LMA, and the incidence of dysphagia was found to be approximately 54% at two hours when all patients were compared. On the contrary, Venugopal et al. (10) found the incidence of dysphagia to be 24% in the LMA group. In this study, we found the incidence of hoarseness to be 10% and dysphagia to be 26% in the i-gel group. We believe the rate is higher than in the literature because the procedure directly related to the airway and to the manipulation of the bronchoscope within the airway.

The i-gel has been used frequently in airway management because of its rigid lumen and high placement success. Polat et al. (13) demonstrated that the first-time placement rate in the i-gel group was nearly 89.8%. Moore et al. (14) used a flexible bronchoscope for i-gel and FastTrack LMA intubations, and they provided a faster and more flexible bronchoscope image in the i-gel group. Piccioni et al. (15) reported that only two patients (5.1%) experienced i-gel displacement during the EBUS procedure, but no patients experienced difficulty during desaturation or ventilation. They also found that it took 60 seconds to place the bronchoscope. In this study, although no patients experienced desaturation or displacement, we found that only three patients were not placed the first time, and the success rate was nearly 90% (three

patients were excluded). We also found that the treatment time of the two groups was shorter in the i-gel group. We believe that this is due to the easy manipulation of the bronchoscope and the lack of difficulty in bronchoscopy.

EBUS-TBNA can be performed under local anesthesia, moderate or deep sedation, or general anesthesia to increase patient comfort and make the procedure more tolerable (16). Although many centers follow their own protocol, the American Association of Chest Physicians (ACCP) has indicated that moderate or deep sedation during the procedure is acceptable (17). Casal et al. (18) compared 149 patients under moderate sedation or general anesthesia. Four patients in the general anesthesia group experienced minor complications related to anesthesia compared to 21 patients in the sedation group, but no major complications or deaths were encountered with any patient. In this study, general anesthesia was used for all patients, and the depth of anesthesia was monitored by BIS. We did not find any difference in intraoperative complications in either group. Adequate muscle relaxation can be achieved with general anesthesia, which prevents the cough reflex observed in sedated patients and prevents complications such as laryngospasm and hypoxia. At the same time, the accumulation of secretions during the procedure may cause bronchospasm by causing airway obstruction in the extubation phase. In our current study, tracheal aspiration was performed under deep anesthesia before extubation. Due to these reasons, we did not see any laryngospasm, bronchospasm, or hypoxia either intraoperatively or postoperatively.

In general anesthesia, there are different hemodynamic responses during many periods. Hypotension during induction and hypertension during laryngoscopy are the most common responses. In a study by Kovac (19), a maximum increase in blood pressure due to laryngoscopy was observed, and he emphasized that a maximum heart rate increase may occur due to intubation. Tang et al. (1) compared hemodynamic data in two different groups of patients undergoing posterior fossa surgery over three different periods. In the ETT group using the i-gel, fewer hemodynamic changes were encountered compared to the direct laryngoscopy group. In this study, hemodynamic data were evaluated over two different periods. While there was no difference in hemodynamic data at baseline, we received a less hyperactive response in the i-gel group after the airway device was used. During a traditional laryngoscopy, the force transferred to the base of the tongue is stated to be approximately 40 Newtons (20, 21). For this reason, we believe that we saw fewer hemodynamic changes during the EBUS-TBNA procedure in patients with limited reserves of malignancy and intestinal lung disease because we avoided laryngoscopy-induced force by instead using the i-gel.

Although EBUS-TBNA was initially used for lung cancer staging, it has now become a standard procedure for the diagnosis of mediastinal and hilar lymphadenopathy (22). Taking a biopsy during the procedure takes longer and is difficult because the ETT causes the bronchoscope to remain in the midline. This issue is particularly apparent in the masses located in the upper mediastinum where the vision of the bronchoscope is closed by the ETT, and the tube should be pulled higher. Steinfort et al. (23) found that the procedure time was longer in the general anesthesia group. Additionally, Casal et al. (18) found the procedure time to be 23.2 ± 14.6 min in the general anesthesia group and 16.1 ± 9.4 min in the sedation group. However, they stated that the procedure for patients in the sedation group might have been shorter due to patient unrest. In addition to unwanted extubation, all of these damages the tracheal mucosa and cause complications such as bleeding and postoperative sore throat. In this study, we found that the duration of the procedure in the ETT group was 42.6 □ 15.65 min and 35 ± 8.17 min in the i-gel group, although there was no significant difference between the two groups ($p = 0.062$). We believe that these periods, which were longer than the in literature, occurred because the specialists behaved in a controlled and careful manner due to the general anesthesia and the large number of samples taken. The difference between the two groups was that i-gel usage is more comfortable because the bronchoscope can move more easily, which allows for better imaging on the vocal cord level.

Limitations of the study

There are some limitations of this retrospective study. For one, we could not compare our results to the effects of other SAD types because they were not administered to patients. Prospective studies are needed in the future because different results could be obtained by using different types of airway management devices.

CONCLUSION

In conclusion, postoperative sore throat can be prevented by the use of the i-gel rather than an endotracheal tube, and this would increase patient comfort. The less frequent hemodynamic changes in i-gel usage could result in a lower increase of oxygen consumption, and this would prevent the occurrence of cardiac complications. Endobronchial ultrasound-guided transbronchial needle aspiration is a relatively new method, and there is a need for larger, randomized prospective patient group studies using an increased variety of clinical applications. Additionally, future research should study the safety of anesthesia methods and airway devices that may be used during the procedure in order to assess the complications and management of these devices.

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