ENDOBRONCHIAL ULTRASOUND-GUIDED LUNG BIOPSIES UNDER PROCEDURAL SEDATION- I-GEL OR PLMA- A COMPARATIVE STUDY

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ABSTRACT

BACKGROUND

Endobronchial ultrasound-guided lung biopsies require immobile patient, non-collapsing airway, stable haemodynamics and good oxygenation, clear exposure of glottis for passage of bronchoscope and good bite block. In pursuit of ideal supraglottic device, we compared clinical performance of PLMA and I-gel in our study.

The aim of this study was to compare the performance of PLMA and i-gel for endobronchial ultrasound (EBUS) guided lung biopsies of patients.

MATERIALS AND METHODS

This is a quasi-experimental study of 40 patients. The sample size was taken for convenience. With twenty patients posted for convex probe, EBUS TBNA lung biopsies were done with i-gel (Group I) and another twenty posted for radial probe EBUS biopsies were done with PLMA (Group II).

RESULTS

I-gel was easier to insert, and insertion time was less than for PLMA and bronchoscopic view of vocal cords was clear and superior to PLMA. Sore throat, dysphagia, dysphonia and blood staining of device cuff were not seen with I-gel.

CONCLUSION

I-gel is a superior alternative to PLMA and endotracheal tube for EBUS-guided lung biopsies in uncooperative, anxious, obese patients because of ease and rapid insertion, stable bite block, ease of fixation, non-collapsing airway, non-inflatable cuff, stable haemodynamics, no tissue injury and less serious post-procedure complications.

KEY WORDS

EBUS, TBNA, I-GEL, PLMA.

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BACKGROUND

EBUS is usually performed under procedural sedation and topical anaesthesia by spraying lidocaine in the posterior pharynx and 1 - 2 mL of 1% lidocaine can be installed through the working channel of bronchoscope during insertion and procedure and whenever patient coughs to anaesthetise mucosa of tracheobronchial tree. The use of a laryngeal mask airway allows access to upper paratracheal, subcarinal nodes which are not accessible with endotracheal tube in place. The size of endotracheal tube should be at least No. 8 or larger to accommodate the CP-EBUS bronchoscope.

Supraglottic device is planned when the patient is anxious, not cooperative, to prevent airway collapse, edentulous patients, obese patients, small lesion or lesion near great vessels demanding immobile patient.

Biopsy can be done with bronchoscopy, CT guidance, VATS (video-assisted thoracoscopic surgery). EBUS-guided biopsy is less invasive, and biopsy can be done under ultrasound and Doppler guidance with less complications as day case procedure.

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Radial Probe RP-EBUS

360 degrees image to the long axis of probe, cannot visualise ultrasound image while performing biopsy, chance of missing the lesion, decreased yield of specimen, useful in small peripheral lesions and airway wall invasion, Doppler is not possible during biopsy.

CP-EBUS

It is a 7.5 MHz convex probe inside a saline-inflatable balloon at the tip of the bronchoscope. The outer diameter of the bronchoscope tube is 6.3 mm. 60 degrees image to long axis of probe, TBNA transbronchial needle aspiration can be done, spot diagnosis by pathologist and Doppler is possible during biopsy. Biopsy is performed using a 22-G TBNA needle.

EBUS is used for diagnosis and staging of malignancy, infectious diseases tuberculosis, sarcoidosis, metastatic disease and airway wall invasion. White light bronchoscopy is done before EBUS to identify anatomical location of lesion, clear secretions and to check airway wall invasion. This minimally invasive procedure can be performed as day case procedure with less morbidity when compared with other invasive biopsy procedures. It provides real-time imaging of the surface of the airways, blood vessels, lungs and lymph nodes in difficult to reach inaccessible areas.

I-gel, supraglottic airway device 2007, made up of thermoplastic elastomer styrene, ethylene butadiene styrene,

soft gel-like feel, non-inflatable cuff,[1] perfect anatomical fit of supraglottic area, shape and softness adds to perfect fit and seal, gentle compression effect and less or no trauma during insertion and less chance of displacement once fixed.

LMA by Archi Brain 1988, LMA ProSeal allows nasogastric tube and 50% higher sealing pressure without leak. Due to inflatable cuff,[2] LMA CTrach has built-in fibre optics for direct view of larynx. LMA supreme has built-in bite block. LMA air-Q Cookgas is almost equivalent to I-gel in clinical performance. Contraindications of supraglottic device: exclusion criteria include mouth opening of less than 2.5 cm, obstructed airway, gastro-oesophageal reflux, hiatus hernia, full stomach cases, obese BMI > 25, cervical spine disease and previous head and neck surgeries.

Contraindications to Biopsy

Arrhythmias, myocardial ischaemia, CHF, hypoxia, uncooperative patient, anticoagulant therapy, renal failure and thrombocytopenia. Complications of biopsy include irritation, cough, aspiration, airway trauma, sympathetic response, obstruction, laryngospasm, collapse of lung bronchospasm, haemorrhage and pneumothorax.[3,4]

Procedural sedation previously known as conscious sedation is administration of sedative or dissociative agents or narcotic analgesics to induce a state that allows the patient to tolerate unpleasant procedures while maintaining cardiorespiratory function and preserving the protective airway reflexes. EBUS instrument is expensive and pulmonologist needs non-collapsing patent airway and immobile patient during the procedure with good oxygenation and haemodynamics.[5,6] This procedure is done on day case basis and patient is discharged in few hours.

Aims and Objectives

To compare the performance of PLMA and I-gel for endobronchial ultrasound (EBUS) guided lung biopsies of patients.

MATERIALS AND METHODS

This is a Quasi experimental study where 40 patients are taken for convenience. With twenty patients posted for convex probe EBUS TBNA lung biopsies were done with I-gel (Group I) and another twenty posted for radial probe EBUS biopsies were done with PLMA (Group II). The sample size was taken for convenience for the study.

Both groups were compared with respect to time taken for insertion, manipulation, ease of insertion, attempts at insertion, movement during EBUS and procedure, maintenance of airway, laryngopharyngeal morbidity, post-procedure discomfort, cough, fibreoptic assessment of vocal cords, airway sealing pressure and other complications. Exclusion criteria include mouth opening of less than 2.5 cm, obstructed airway, gastro-oesophageal reflux, hiatus hernia, full stomach cases, obese BMI > 25, cervical spine disease and previous head and neck surgeries. All patients were advised to fast overnight and 7 took tab. alprazolam 0.25 mg orally night before procedural sedation.[7,8,9]

Sedation on EBUS was performed either under general anaesthesia or a pulmonologist in moderate sedation.

Oxygen by mask, glycopyrrolate 0.2 mg, midazolam 2 - 3 mg, fentanyl 100 to 150 µgm, propofol 60 - 80 mg until the verbal contact or apnoea, supraglottic device insertion, connected to Bain's circuit, only oxygen, spontaneous ventilation, supplemental oxygen through nasal prongs from different source, no nitrous oxide or inhalation agent, small incremental doses of propofol, fentanyl and topical lidocaine through working channel of bronchoscope whenever patient coughed or moved. Confirmation by auscultation for bilateral breath sounds and chest raise, absence of sounds over epigastrium on manual ventilation, ETCO2 and colour of the patient.[10,11]

Monitoring: Pulse, SpO2, ECG, supplemental oxygen via nasal prongs, eyes covered to prevent splashing of blood and saline, IV access and emergency drugs.

Statistical Analysis

Statistical analysis was performed using the SPSS 16.0 (Statistical Package for the Social Science for windows; Version 16.0, SPSS Inc., Chicago, USA). Results were analysed using student's t-test for categorical variables, Chi-square test was used. Qualitative variables were analysed using proportions. Quantitative variables were analysed using mean and standard deviation. 'P' value less than 0.05 was considered statistically significant.

RESULTS

Ease of insertion, insertion time, swaying during insertion, reverse sellicks help no. of manoeuvres, anatomical fit, autonomic response, ease of fixation, need for jaw support by assistant, blood staining of device, sore throat, throat pain, swaying during bronchoscopy check of device after insertion by bilateral raise of chest wall with manual bag ventilation, normal SpO2 and ETCO2, autonomic response, fibreoptic view of vocal cords.

3 insertions at first attempt without resistance
2 insertions at first attempt with resistance
1 insertion at second attempt
0 insertion failed
Table I. Insertion of Device Score

1 complete clear view of vocal cords
2 only arytenoids visible
3 only epiglottis visible
4 no laryngeal structures visible
Table II. Fibreoptic View of Vocal Cords through Device[3, 4]

Variables	Group-I I-Gel (20)	Group-II PLMA (20)	P value
Insertion time	10.2 +/- 1.814	10.2 +/- 1.814	0.001(s)
Ease of insertion 3 first attempts 2 with resistance 1 second attempt 0 failed	 16 (80%) 4 (20%) 0 0	 12 (60%) 8 (40%) 0 0	0.016
Manoeuvring No 1 2 or more	 18(90%) 2 (10%)	 14 (70%) 6 (30%)	0.002

Fibreoptic scoring 1 clear view glottis 2 arytenoids 3 epiglottis 4 no structures	18 (90%) 2 (10%)	15 (75%) 5 (25%)	0.018
Swaying of device	0/20	8/20	
Blood staining of device	0	7 (35%)	
Sore throat	0	8 (40%)	
Dysphagia	0	8 (40%)	
Cough after removal of device	4 (20%)	8 (40%)	0.001
Ease of fixation	Stable, no swaying	Swaying during procedure	

Results- mean insertion time 10.2 +/- 1.814 seconds with I-gel and 10.2 +/- 1.814 seconds with PLMA. No manipulations were required in 18/20 (90%) of cases with I-gel and 14/20 (70%) cases with PLMA. One manipulation was required to place the device in 2 (10%) of I-gel cases and 6 (30%) PLMA cases.[12]

Fibreoptic bronchoscope view of glottis structures was of clear view in 18 (90%) of I-gel and 15 (75%) of PLMA cases. Blood staining of device after removal in 35%, sore throat in 40% and dysphagia in 40% of cases of PLMA due to cuff inflation (volume and pressure effect) on pharyngolaryngeal mucosa.

DISCUSSION

Transient cough was observed with both devices after removal. Pneumothorax and collapse were not noted in check x-rays of chest. Propofol induced hypotension noted in few cases was corrected by fluid load. Cough and movement during procedure were managed with boluses of propofol and topical lidocaine. Through working channel of bronchoscope, cuff-related side effects of PLMA like blood stained cuff, dysphagia, voice change, and throat pain were not observed with I-gel.[13]

Fixation and stable secure airway was better with I-gel because of in-built bite block, stiff stem, pharyngeal contour and anatomical fit. There was no swaying of the bronchoscope during procedure, which is a common complaint by pulmonologist with PLMA. NG tube is not placed, as ventilation is not controlled. Spontaneous with oxygen was allowed. Nitrous oxide and inhalational agent were not used in procedural sedation, so no irritation or inflation of stomach were absent.

Haemodynamics were not altered significantly during the procedure, except of hypotension related to propofol in 20% cases of both groups. SPO^2 was not altered in both groups during procedure.

Minimal bleeding occurred during TBNA biopsy in four out of forty cases and controlled with adrenaline spray through working channel of bronchoscope.

Reported complications are agitation, cough, hypoxia, laryngeal injury, fever, bacteraemia and infection, bleeding, pneumothorax and broken equipment becoming stuck in the airway. Rescue in haemorrhage suction, adrenaline spray, endotracheal intubation, controlled ventilation, bronchial blocker and blood transfusion. Mediastinal abscess has been reported as a case report. Complications related to upper airway local anaesthesia are laryngospasm, laryngeal oedema, bronchospasm, methemoglobinaemia and cardiac arrhythmias. Complications attributable to procedural sedation are respiratory depression, cardiovascular instability, vomiting and aspiration. Continuous monitoring of cardiac rhythm, heart rate, respiratory rate, oxyhaemoglobin saturation and blood pressure is usually done after the procedure until the effects of sedation and upper airway anaesthesia have been resolved. Eating and drinking can be resumed once the gag reflex returns. A chest radiograph was performed following the procedure to evaluate complications, such as pneumothorax. Outpatients must have stable vital signs, be alert and oriented with baseline ambulation status before discharge.[14,15]

In our study, I-gel performed well when compared to PLMA in ease and rapid insertion, non-collapsing airway, stable bite block, no cuff related trauma and less post-procedure complications.

CONCLUSION

I-gel is a superior alternative to PLMA and endotracheal tube for EBUS-guided lung biopsies in uncooperative, anxious and obese patients because of ease and rapid insertion, stable bite block, ease of fixation, non-collapsing airway, non-inflatable cuff, stable haemodynamics, no tissue injury and less serious post-procedure complications.

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