



Original Article

Randomized clinical trial of trapezius squeezing test and jaw thrust as optimal indicators for Laryngeal mask airway insertion in adults under propofol anesthesia

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Abstract

Background: Laryngeal mask airway insertion requires a certain depth of anesthesia that blunts the airway reflexes. We compared the effectiveness of the trapezius squeezing test with that of the jaw thrust test as clinical indicators of adequate condition for laryngeal mask airway insertion in adults under propofol anesthesia.

Methods: In this randomized study, seventy adult patients undergoing surgery with general anesthesia maintained with laryngeal mask airway were randomly allocated to the group T (trapezius squeezing, n = 35) or the group J (jaw thrust, n = 35). The laryngeal mask airway was inserted immediately after the loss of response to trapezius squeezing or jaw thrust. We recorded successful and unsuccessful attempts. An unsuccessful attempt was defined as development of coughing, SPO₂ < 90%, body movements during or within one minute of laryngeal mask airway insertion and failed insertion of laryngeal mask airway. Preparation time for laryngeal mask airway insertion, blood pressure, and heart rate were recorded.

Results: The incidence of successful attempts was significantly higher in the group T than in the group J (p-value = 0.002). The time taken for preparation and insertion of laryngeal mask airway, arterial blood pressure and heart rate were comparable in both the groups.

Conclusion: This study has demonstrated that the trapezius squeezing test is a superior indicator of an adequate condition for laryngeal mask airway insertion compared to the jaw thrust test in adults.

Keywords: adult; general anesthesia; laryngeal mask airway; supraglottic airway devices; propofol

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Introduction

Laryngeal mask airway (LMA) have become an integral part of anesthetic care in airway management.¹ Adequate depth of anesthesia is necessary for successful insertion of LMA. Lighter planes of anesthesia during LMA insertion can result in coughing, gagging, body movements, breath holding, and even rejection of LMA.² The indicators which are used to measure the precise depth of anesthesia should be simple, repeatable, and accurate maneuver to perform.³ Various such indicators are loss of verbal contact, eyelash reflex, corneal reflex, loss of ability to hold light object, jaw relaxation, apnea, and jaw thrust maneuver.^{2,4} An alternative indicator such as trapezius squeezing test has been suggested as a useful indicator for LMA insertion.³

Trapezius squeezing test is a clinical test simple to perform in which 1–2 inches of full thickness trapezius muscle is held and squeezed for 1-2 seconds and response evaluated in the form of toe or body movement. A negative response to trapezius squeeze is depicted by the loss of toe or body movement. Trapezius squeezing test is free of side effects, repeatable and reproducible.² Although used extensively for grading consciousness; this test has rarely been used and studied as an indicator of the adequate depth of anesthesia for LMA insertion.

Till date, no study has been done comparing trapezius squeezing test and jaw thrust for assessing the depth of anesthesia under intravenous propofol. This may be a pioneer study comparing trapezius squeezing test and jaw thrust under propofol anesthesia in adult as clinical indicators of an adequate condition for LMA insertion.

Methods

This prospective, randomized, single-blinded, comparative study was conducted over a period of four months at Tribhuvan University Teaching Hospital (TUTH). The study was approved by institutional Ethical committee.

Seventy adult patients of age 18 to 65 years with ASA physical status I/II in whom anesthesia can be maintained in spontaneously breathing condition with an LMA were included in the study. Patients with predicted difficult airway, risk of aspiration, acute respiratory infection, psychiatric illness and allergic to propofol were excluded from the study.

The eligible patients were evaluated prior to surgery (pre-anesthetic check up). Written informed consent was taken. Age, sex, and weight of the patient were recorded. The patient was kept nil per oral at least 6 hrs prior to surgery. Premedication was given 2 hrs prior to surgery (Tab diazepam 5mg for weight <50 kg, 10mg for weight > 50 kg). In the preoperative room, intravenous access was secured with an 18 G cannula and IV drip was started with Ringer's lactate.

In the operating theater, pulse oximetry, electrocardiogram, noninvasive arterial blood pressure were attached and recorded (Baseline).

Patients were locally randomized in operating room into two groups by sealed envelope method: trapezius squeezing test, group T (n=35) and jaw thrust, group J (n=35). After the sealed envelopes were opened by consultant anesthesiologist to decide for patients' allocation, the investigator was then informed to perform the test.

Preoxygenation was done via face mask with oxygen at 5 liters/min for three minutes. After preoxygenation, propofol 10 mg intravenously was given to the patient every five seconds until the negative test to either trapezius squeezing test or jaw thrust test, performed at intervals as described below. In the group T, as soon as the patient lost verbal contact the trapezius squeezing test was performed by squeezing the full thickness trapezius muscle for 1 to 2 seconds. Trapezius squeezing test was done every ten seconds till it became negative. In group J, the jaw thrust was done by grasping and lifting the angles of the lower jaw with both hands, one on each side, while displacing the mandible forward. The jaw thrust test was done every ten seconds till it became negative. After a negative response to trapezius squeezing or jaw thrust test as determined by attending consultant anesthesiologist, a well lubricated, appropriate size classic LMA according to body weight was inserted. All laryngeal mask insertion and the tests were performed by the same investigator.

The response of the patient to LMA insertion was classified as either 'successful' or 'unsuccessful' attempt by consultant anesthesiologist. 'Successful' attempt was identified if there was no coughing, SPO₂ ≥ 90%, absence of body movement during or within one minute of LMA insertion. Development of coughing, SPO₂ < 90%, body movements during or within one minute of LMA insertion and failed insertion of LMA was regarded as 'unsuccessful' attempt. The preparation time for LMA insertion was measured from propofol administration to the negative trapezius squeezing test or jaw thrust test. Effective ventilation and correct alignment of LMA was determined by observing chest wall movement, auscultation, and capnography. Heart rate, blood pressure, and SPO₂ were recorded before the induction of anesthesia (baseline), immediately after the negative response to test (preinsertion) and one minute after LMA placement (postinsertion).

Coughing during LMA insertion was graded in the following manner:⁵

- 1- None.
- 2- Less than or equal to two coughs.

3- More than two coughs.

The patient's body movement during LMA insertion was graded as follows.⁶

1- None.

2- Slight movement of the upper and/or lower extremities.

3- Moderate movement including the trunk.

4- Failed insertion of the LMA with a marked movement

LMA, if could not be inserted at the first attempt after a negative test, the patient was further managed accordingly at the discretion of consultant anesthesiologist. However, the condition during LMA insertion was only graded at the first attempt. After LMA insertion, anesthesia was maintained with oxygen, isoflurane and fentanyl at 1-2mcg/kg.

Hemodynamic values were recorded before the induction of anesthesia (baseline), immediately after the negative response to test (preinsertion) and one minute after LMA placement (postinsertion).

The primary outcome measure of the study was to assess the response of the patient to LMA insertion as a successful or unsuccessful attempt. The preparation time, heart rate and blood pressure were secondary outcome measures of the study. The sample size was worked out as total 70 patients to achieve significance to be between 80% and 50 % success rates at a level of $p < 0.05$ and power of 0.8. Data were collected in preformed data collection sheet and were analyzed using statistical package for the social sciences (SPSS) software version 20 using appropriate statistical tests. Independent samples test was used for analysis of age wise distribution, weight wise distribution, preparation time taken for LMA insertion and hemodynamic parameters. Chi-Square test was used for analysis of gender wise distribution, the incidence of a cough and movement and response to LMA insertion. A p-value of < 0.05 was interpreted as statistically significant.

Results

Demographic data were comparable in both the groups (Table 1). The differences between two groups with respect to the incidence of a cough ($p = 0.019$) and body movement ($p = 0.019$) were statistically significant (Table 2). There was unsuccessful insertion of LMA in 21 patients in group J and 8 patients in group T. The difference between the response to LMA insertion in two groups was statistically significant ($p=0.002$) (Table 3). The preparation time taken for insertion of the LMA in group J was 80.5 ± 19.3 seconds when compared to 81.1 ± 14.6 seconds in group T and it was not statistically significant ($p = 0.879$).

Table 1: Demographic distribution

Parameter	Group J (n = 35)	Group T (n = 35)	p value
Mean Age(yrs) ± SD	31.7 ± 12.1	29.8 ± 10.67	0.486
Gender			0.810
Male	20 (57%)	19 (54%)	
Female	15 (43%)	16 (46%)	
Mean Body Weight (kg) ± SD	57.05 ± 9.19	57.9 ± 7.5	0.671

Table 2: Incidence of Coughing and Movement

Parameter	Grade	Description	Group J(n=35)	Group T(n=35)	p value
Cough	1	No cough	20	29	0.019
	2	≤2 cough	7	4	
	3	>2 cough	8	2	
Movement	1	None	25	31	0.023
	2	Slight movement of upper and lower extremities	4	4	
	3	Moderate movement including trunk	5	0	
	4	Failed insertion of LMA with marked movement	1	0	

Table 3: Response to LMA insertion

Response	Group J (n = 35)	Group T (n = 35)	p value
Successful insertion	14 (40%)	27 (77%)	0.002
Unsuccessful insertion	21 (60%)	8 (33%)	

All patients remained hemodynamically stable during the procedure.

Discussion

Assessment of the depth of anesthesia is fundamental to anesthetic practice. One of the objectives of modern anesthesia is to ensure adequate depth of anesthesia without overdosing the patients with potent drugs. There appears to be increasing evidence that anesthesia depth measurement improves the quality of anaesthesia.⁷ Deep anesthesia is essential to obtund airway reflexes and hemodynamic responses and for obtaining optimal conditions for LMA insertion.

During LMA insertion airway complications like coughing, gagging, hiccups or aspiration are encountered by anesthesiologists.⁸ However, after the suppression of airway reflexes with adequate anesthesia, LMA can be inserted smoothly. An ideal method detecting optimal anesthetic depth for LMA insertion must be repeatable, easy to perform and harmless to the patient. The assessment of depth of anesthesia during LMA insertion involves the observation of responses after application of the stimulus. Many clinicians use loss of verbal contact and eyelash reflex or jaw relaxation as a clinical marker of optimal anesthetic depth.⁴

There have been very few studies²⁻⁴ on trapezius squeezing test predicting the depth of anesthesia for LMA insertion till date. Our study was performed to compare trapezius squeezing test and jaw thrust as indicators for laryngeal mask airway insertion in adults. The primary objective of our study was to compare the effectiveness of the trapezius squeezing test and the jaw thrust, measured in terms of successful or unsuccessful insertion. Our study shows that the trapezius squeezing test is a reliable and useful clinical indicator assessing the adequate depth of anesthesia for LMA insertion in adults.

Successful insertion of LMA requires an adequate depth of anesthesia either by inhalational or intravenous anesthesia. To date, for LMA insertion, propofol is the intravenous drug of choice as it provides rapid relaxation.⁹ No study has been conducted with propofol as induction agent comparing trapezius squeezing test and jaw thrust. All of the studies have been done with sevoflurane.²⁻⁴ Several studies have shown that the induction of anesthesia via sevoflurane and propofol are comparable.^{10,11} Even some study has found propofol being superior to sevoflurane for insertion of the LMA.¹⁰ This study may be the first study to compare trapezius squeezing test and jaw thrust using propofol for LMA insertion.

The demographic characteristics of the patients in both the jaw thrust and trapezius group were comparable in our study. There was no significant difference in patient distribution in terms of age, gender, and weight between the two groups. Successful LMA insertion requires attenuation of the hypopharyngeal and laryngeal reflexes.¹⁰ An adverse response like coughing during LMA insertion is undesirable. In our study, we have found a significant decrease in the incidence of a cough in trapezius squeeze group as compared to jaw thrust group ($p = 0.019$). This finding is similar to study done by Chang CH et al³ who compared trapezius squeezing test with jaw thrust test using sevoflurane.

Laryngeal mask airway insertion is done without any muscle relaxant; however, it requires a sufficient depth of anesthesia.⁶ Body movement during LMA insertion can cause rejection of LMA.² In our study, there was less incidence of body movement in trapezius group after insertion of LMA ($p = 0.023$). A similar result was observed by Chang CH et al³ when comparing trapezius squeezing

test with jaw thrust. Townstead R et al.¹² obtained the optimal condition for LMA insertion in 76% patients with jaw thrust using fentanyl and propofol as an induction agent. Similarly, Drage MP et al¹³ suggested that jaw thrust is a reliable marker of successful LMA insertion in adults with an 87% success rate, which was higher than that in this study (40%). The reason behind such big difference in success rate of jaw thrust may be attributed to the combined use of fentanyl and propofol in their study whereas our study used propofol only as sole induction drug. Kodaka et al.¹⁴ also demonstrated more success rate of LMA insertion with less body movement with propofol-fentanyl compared to the propofol-saline group.

Trapezius squeezing test, checked by squeezing the trapezius muscle and observing the motor response, is one of the methods to assess the anesthetic depth during LMA insertion. Our study had shown the significantly higher number of successful insertions of LMA in trapezius squeezing group as compared to jaw thrust group (77% vs. 40%). These observations are comparable to the study of Chang CH et al.³ Thus, the trapezius squeezing test had better predicted the sufficient anesthetic depth for LMA insertion preventing complications such as cough and patient movement.

The Preparation time for LMA insertion as noted from propofol administration to the negative trapezius squeezing test or jaw thrust test was comparable in both the group. The mean time was 81.1 ± 14.6 (SD) seconds in trapezius squeezing group and in jaw thrust group it was 80.5 ± 19.3 (SD) seconds ($p = 0.879$). Preparation time of sixty to ninety seconds after routine propofol induction has provided excellent placement condition for LMA insertion in study done by Sheu R et al.¹⁵ The insertion time from sevoflurane inhalation induction to LMA insertion when guided by the trapezius squeezing test and jaw thrust test was 4.1 minutes and 2.5 minutes respectively in Chang CH et al.³ study. Shorter time for LMA insertion in our study was due to faster onset of induction with propofol. There was no evidence of laryngospasm, gagging, breath holding reported during the insertion time of LMA in both of study groups.

Both the groups exhibited stable hemodynamic profiles. In our study we didn't use bolus dose of propofol, this could be the reason behind stable hemodynamic seen in our patients in both the groups. Stokes et al.¹⁶ also noted that decrease in the rate of administration decreases not only the dose of propofol but also the degree of adverse hemodynamic events. Postoperative problems like pain at squeeze site and evidence of trauma like ecchymosis were not noticed in any group.

Our study has several limitations. First, our findings may not apply to other insertion techniques (such as the laryngoscope-guided technique) or other laryngeal mask airway devices (such as the intubating LMA), as the level of stimulation may be different. Second, our findings may not apply to other induction agents, particularly those that

are less effective at obtunding upper airway reflexes, such as thiopentone.¹⁷ Third; we did not determine the optimal level of jaw thrust and the squeezing power for trapezius squeezing test. However, all the tests were conducted by a single investigator in order to maintain the uniformity.

Trapezius squeezing test can be used as a reliable and safe indicator for assessing the depth of anesthesia for insertion of laryngeal mask airway under propofol anesthesia. The use of trapezius squeezing test is recommended as it provides more consistent information with a higher rate of successful insertion of LMA in adults.

Informed consent: Informed consent was obtained from all the participants included in the study.

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