

Comparison of airway maneuvers (manual in line stabilization, modified jaw thrust, and conventional maneuver) for orotracheal intubation during direct laryngoscopy



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ABSTRACT

Background: During performing orotracheal intubation with direct laryngoscopy adequate laryngeal visualization depends on proper airway maneuvers. There are different types of airway maneuvers. **Aims and Objectives:** This study aimed to compare airway maneuvers; manual in line stabilization (MILS), jaw thrust, and conventional maneuver to assess better laryngeal visualization and ease of intubation among them and associated complications. **Materials and Methods:** This observational study was conducted in 90 adult patients. Patients divided into three groups. Laryngoscopy and intubation in Group M were done in MILS and in group J jaw thrust. In Group C, as conventional maneuver performed. Laryngeal visualization assessed using modified Cormack–Lehane grading and ease of intubation assessed using intubation time, number of attempts between these three groups. The data were compared using ANOVA test, Chi-square test. **Results:** While comparing between these groups better laryngeal visualization seen in jaw thrust group, while the MILS maneuver worsen the view. **Conclusion:** The present study concluded that jaw thrust maneuver improved the laryngeal visualization and conventional maneuver made intubation faster and easy.

Key words: Airway maneuver; Laryngeal visualization; Intubation; Direct laryngoscopy

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INTRODUCTION

Laryngoscopy and tracheal intubation are the key step for general anesthesia. Proper airway management considered golden step and its failure may lead to various adverse outcomes. Most important step before performing intubation is to place head and neck in proper place and various airway maneuvers applied for that. Recently, very few studies examined the effects of different airway maneuvers such as manual in line stabilization (MILS), jaw thrust, and conventional maneuvers on tracheal intubation.

This study aimed to compare various airway maneuvers the MILS, jaw thrust, and conventional maneuver to assess

better laryngeal visualization and ease of intubation among them. Secondary aim to assess any related complication to these airway maneuvers.

While performing MILS, an assistant grasp patient's mastoid with fingers of both hands and limit the movement of head and cervical spine during tracheal intubation.

During performing jaw thrust assistant place fingers behind each of mandible, displacing mandible forward and using thumbs to open the mouth during tracheal intubation.

During performing conventional position anesthetist applies flexion of neck with extension at atlanto-occiput

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joint with single hand and tracheal intubation will be performed after direct laryngoscopy. While performing intubation: intubation time number of attempts, Cormack–Lehane grading (CL) and overall success rate will be noted in each of these maneuvers. Very few studies investigated to compare these three maneuvers in existing knowledge.

Head extension considered potentially dangerous in patients with cervical spine injuries and failure to restrict head and neck movement increase incidence of secondary neurological deficit so MILS and jaw thrust maneuver done in neutral position to avoid cervical spine injury.¹

Jaw thrust maneuver relieves airway obstruction caused by posterior displacement of tongue into oropharynx during general anaesthesia² and improves visualization of larynx during laryngoscopy and makes intubation easy. The present study found ease of intubation and overall success rate among these three groups with the objective of number of attempts and intubation time taken during laryngoscopy in each group and comparison of laryngeal visualization using CL grading among each group.

This study compared these three maneuvers in adult patients with normal airway that is also very useful for emergency intubation, cervical spine injury, RTA patients, obstetrics patients, obese, and patients with difficult intubation³ Under general anesthesia due to decrease muscle tone chances of airway obstruction increase, so maneuvers to open airway required such as jaw thrust, head tilt, chin lift, and backward upward right-sided pressure (BURP) can be added to improve laryngeal view.^{4,5} Application of BURP, McCoy laryngeal blade, and mandibular advancement make difficult laryngoscopy easy.⁶⁻⁸

Aims

To assess ease of intubation among manual in line stabilization (MILS) group, jaw thrust group, and conventional group maneuver.

Objectives

- Number of attempts and intubation time taken in direct laryngoscopy among each group
- Comparison of Cormack–Lehane grading among each group
- Overall success rate among each group.

MATERIALS AND METHODS

This observational study approved by the Hospital Ethical Committee. After taking ethical clearance, this study was conducted at VMMC and Safdarjung Hospital, New Delhi, India. A total of 90 adult aged 18–60 years with American society of Anesthesia physical status I or II

undergoing elective surgery under general anesthesia with orotracheal intubation were included in the study. Patients with anticipated difficult intubation, modified Mallampati oropharyngeal view class 3/4, neck swelling, burns and neck contracture, face abnormalities, obesity, pregnant females, short neck, patients with history of snoring and bronchial asthma, difficult bag, and mask ventilation excluded from the study. After taking written informed consent from each patient all patients, total sample size n=90 were allocated into three groups: Group I – MILS: (n=30), Group II: jaw thrust (n=30), and Group III: Conventional (n=30).

• Group M –MILS

A trained assistant applied MILS from the left side grasping the patient's mastoid with fingers of both hands and limit the movement of head and cervical spine during tracheal intubation.

• Group J-jaw thrust

A trained assistant applied jaw thrust by placing fingers behind each side of mandible, displacing mandible forward, and using thumbs to open mouth.

• Group C-conventional (sniffing position)

Anesthetist who intubated trachea applied flexion of neck with extension at atlanto-occiput joint¹ by placing non-compressible pillow under the patient head.

One of the maneuvers was applied before intubation which was selected by computer generated random number table; then, trachea was intubated after direct laryngoscopy. One day before surgery pre-anesthetic check-up done that documented detailed history and examination. Airway assessment done by noting modified Mallampati score, mouth opening (inter incisor gap), thyromental distance (TMD), and neck circumference (NC). After obtaining written and informed consent, patient's characteristics including age, weight, height, and body mass index (BMI) were recorded.

On day of surgery, the following standard monitors and basal parameters such as heart rate, blood pressure (BP), SpO₂, and electrocardiography (ECG) were recorded on arrival to operation theatre. The patient was premedicated with injection midazolam 0.02 mg/kg. Each patient was preoxygenated with 100% oxygen for 3 min. General anesthesia induced with intravenous injection fentanyl 1.2–2 mcg/kg and inj. Propofol 1.5–2 mg/kg until loss of verbal command. After check ventilation, neuromuscular blocking agent inj. Vecuronium 0.1 mg/kg was given. Hemodynamic parameters including SpO₂ and ECG were monitored. The patient ventilated with O₂ (33%), N₂O (66%), and isoflurane (0.6–0.8%).

In this study, assessment done in two parts. In first part, laryngeal visualization done using modified CL grading^{3,4} during laryngoscopy with Mac Intosh laryngoscope using one of three maneuvers. The CL grades show laryngeal visualization during laryngoscopy.^{3,4}

The CL grade is defined as follows:

- 1 = Vocal cord fully seen
- 2 = Vocal cord partially seen
- 3a = only epiglottis seen and obscuring the glottis opening but can be lifted up and away from posterior pharyngeal wall
- 3b = only epiglottis seen and close to posterior pharyngeal wall so there is little space between epiglottis and posterior pharyngeal space
- 4 = Epiglottis obscured

In second part, tracheal intubation done with direct laryngoscopy and intubation difficulty assessed using intubation time, number of attempts, and failure to intubate. Intubation time was noted as interval from laryngoscopy to confirming tracheal tube position by EtCO₂ value or chest auscultation. Total number of attempts noted, only two attempts allowed and after that MILS, jaw thrust removed and next maneuver converted to conventional maneuver to intubate trachea.⁵⁻⁷ If assistance required during intubation such as BURP (Backward, Upward, rightsided pressure on cricoid cartilage) use of stylet, bougie, change of blade (larger blade or Mac coy blade), fiber optic bronchoscopic intubation, and C Mac video laryngoscopy were noted.⁸⁻¹⁰

The hemodynamic changes of patient noted during induction, laryngoscopy, intubation, post-intubation (at 5 min and 10 min), and assessed by independent observer. After intubation, the patient was put on controlled ventilation and anesthesia was maintained on O₂: N₂O (33: 67%) with sevoflurane (0.4–0.6%) and top up dose inj. vecuronium given whenever required and ventilated with tidal volume 8 mL/kg and EtCO₂ maintained 30–35 mmHg. At the end of surgery, 100% O₂ given and patient reversed with IV neostigmine 50 mcg/kg, IV glycopyrrolate 10 mcg/kg, and trachea extubated. Postoperatively, pulse, BP, SpO₂, and ECG monitored.

Statistical analysis

With reference to the previous studies, statistical analysis was performed using SPSS (Statistical Package for the Social Science Program) for windows version 17.0. The minimum required sample size with 80% power of study and 5% level of significance is 15 patients in each study group. To lower the margin of error, sample size of 30 will be taken in each group. Total number of cases in this study taken n=90. Categorical variables presented in numbers, percentage, and

continuous variables presented as mean±SD and median. Quantitative variables were compared using ANOVA test/Kruskal–Wallis test and qualitative variables were compared using Chi-square/Fisher's exact test. P<0.05 considered as statistically significant.

RESULTS

Total 90 patient screened and enrolled for the study and no patient drop out reported, all 90 patients participated in this present study. Patients divided in three groups according to airway maneuvers. Among all three groups, there were no significant differences and all groups were comparable according to baseline demographic data (age, sex, height, BMI, and weight) and airway characteristics (mouth opening, TMD, NC, mouth opening, and Mallampati class) with P>0.05 presented in Table 1.

Basal hemodynamic parameters were comparable among the three groups as no statistically significant differences were seen in hemodynamic parameters including heart rate, systolic BP, diastolic BP, and mean arterial BP with P>0.05 presented in Table 2.

There were statistically significant differences noted in modified CL grade between these airway maneuvers. This study found that jaw thrust maneuver improved the laryngeal visualization most that followed by conventional and MILS maneuver. Modified CL grade 1 was seen in 76.7% patients in Group J as against 63.3% patients in Group C and 0 patient in Group M. More number of patients of modified CL grade 2 and 3 seen in Group M as compared to Group C and Group J presented in Table 3.

This study results also showed that there was significant difference in intubation time among three groups. The time of intubation with conventional maneuver (14.03 s) was shortest time compared to jaw thrust (15.3 s) maneuver that followed by MILS (17.7 s) presented in Table 4.

Overall success rate of tracheal intubation was not significantly different among the three groups. In Group M, two patients required Mc coy and two patients require C Mac for tracheal intubation and in Group C only one patient require fiber optic intubation and in Group J no optimization required.

DISCUSSION

Adequate laryngeal visualization and smooth tracheal intubation is mainstay of general anesthesia. Any complication in this may lead to intubation failure. This study evaluated and compared manual in line stabilization, jaw

Table 1: Characteristics and airway assessment data in patients undergoing tracheal intubation using MILS, jaw thrust maneuver, and conventional maneuvers. Values are mean (SD) or number

Variables	Group M (n=30)	Group J (n=30)	Group C (n=30)	P-value
	Mean (SD)	Mean (SD)	Mean (SD)	
Age	35.47 (11.30)	32.67 (11.79)	29.43 (9.19)	0.103
Height (cm)	162.00 (6.8)	162.33 (9.68)	164.30 (6.90)	0.479
Weight (kg)	53.03 (8.61)	56.47 (10.79)	56.80 (9.49)	0.253
BMI	20.32 (2.68)	21.53 (2.73)	25.83 (6.22)	0.346
Sex; M/F	18/12	16/14	17/13	0.873
Thyromental Distance (cm)	7.10 (0.57)	7.07 (0.42)	7.14 (0.47)	0.844
Mouth opening (cm)	4.86 (0.33)	4.76 (0.19)	4.82 (0.23)	0.292
Neck circumference (cm)	35.18 (2.07)	34.47 (2.11)	34.57 (2.14)	0.377
Mallampatti grading: ½	19/11	15/15	18/12	0.424

BP: Blood pressure, BMI: Body mass index, MILS: Manual in line stabilization

Table 2: Comparison of basal hemodynamic parameters among the group

Variables	Group M (n=30) Mean±SD	Group J (n=30) Mean±SD	Group C (n=30) Mean±SD	P-value
Heart rate/min	78.00±12.43	76.83±11.34	76.87±11.91	0.911
Systolic BP (mmhg)	119.00±7.26	118.00±6.45	121.67±6.58	0.245
Diastolic BP (mmhg)	74.60±6.40	71.53±8.80	74.17±6.85	0.229
Mean arterial BP (mmHg)	89.73±6.33	87.00±6.21	87.93±6.82	0.277

BP: Blood pressure

Table 3: Comparison of Cormack–Lehane grading among the group

Cormack – Lehane grading	Group			Group M versus group J	Group J versus group C	Group C versus group M
	Group M	Group J	Group C			
	Frequency (%)	Frequency (%)	Frequency (%)			
1	0 (0.0)	23 (76.7)	19 (63.3)	0.001	0.399	0.001
2	19 (63.3)	7 (23.3)	8 (26.7)	0.004	1.000	0.009
3a	7 (23.3)	0 (0.0)	2 (6.70)	0.011	0.492	0.146
3b	4 (13.3)	0 (0.0)	1 (3.3)	0.112	1.000	0.353
4	0 (0.0)	0 (0.0)	0 (0.0)	1.000	1.000	1.000
Total	30 (100)	30 (100)	30 (100)	1.000	1.000	1.000

Table 4: Comparison of intubation time among the groups

Intubation attempt	Group M (Mean±SD)	Group J (Mean±SD)	Group C (Mean±SD)
Time of 1 st intubation attempt	17.77±2.85	15.30±2.51	14.03±1.79
Time of 2 nd intubation attempt	18.53±3.48	NIL	16.00±2
Number of total attempts 1/2/fail	13/17/0	30/0/0	27/3/0

thrust in comparison to conventional maneuver for tracheal intubation during direct laryngoscopy in adult patients.

In this present study, laryngeal visualization assessed by modified CL grade and compared between all three groups and the main result of this study was that jaw thrust improved the laryngeal view and the MILS manoeuver worsened the laryngeal view. Intubation time with the conventional maneuver was shorter compare to the other maneuver.

In this study, most common technique used for tracheal intubation was direct laryngoscopy. Despite recent advances, curved laryngoscope blade Mac Intosh remains most

popular gold standard device for tracheal intubation.^{11,12} The use of Mac Intosh laryngoscope clears the airway combining the effects of jaw thrust and lingual traction, although it is difficult to introduce and manipulate its blade if patients have limited mouth opening and neck extension and its use also associated with higher incidence of airway trauma sore throat. MILS of cervical spine is an integral part of airway management for dealing trauma patients.^{12,13} Although manual inline stabilization makes laryngoscopy grade higher and required more assistances, it is an integral part of airway management when dealing with cervical spine trauma patient to prevent neurological complications, can be use in obese and in neurosurgery patient with

traction; hence, difficult airway kit should always be ready. These results also supported by the previous studies done by as described by von Esmarch¹⁴ jaw thrust performed by grasping and lifting the angles of lower jaw with both hands while displacing mandible forward while clinician facing patient's head.¹⁵ jaw thrust expands soft-tissue around the glottis and improves visualization of the larynx¹⁶ as mandibular advancement lifts the epiglottis upward through the anatomic connection.¹⁷ In conventional maneuver positioning in sniffing position approximate alignment of three anatomic axes oral, pharyngeal and laryngeal with cervical flexion and head extension at atlanto-occipital joint. Nolan and Wilson studied in 157 patients and reported significant increase in proportion of CL grade 2 and 3 when MILS was used.¹⁸ Health KJ. Studied in 50 patients with MILS and 50 patients without MILS and found that incidence of CL grade 3, 4 increased with MILS.¹⁹ Hasting and wood reported that CL grade changed from grade 1 to grade 3 in 14% patients when MILS applied.¹ Santoni et al., reported that MILS increases number of attempts and rate of difficult tracheal intubation.²⁰ All these above studies along with this study assessed that incidence of CL grade 2 and 3 markedly found on application of MILS.

This study also resulted that intubation time was shorter when patients positioned in conventional maneuver compared to jaw thrust and MILS. Although there was no significant difference in intubation time between Group C and Group J.

Mean time taken for of first attempt in Group M was 17.7 ± 2.85 (s), whereas in Group J mean time was 15.3 ± 2.25 s, while, in Group C, mean time taken was 14.03 ± 1.79 s which was minimum among group.

This study showed that though time taken for intubation is decreased in conventional group, but jaw thrust group provides better laryngeal view in 1st attempt as no second attempt required out of 30 cases, 100% intubation was in 1st attempt in Group J. This study supported by few studies Liu et al., found that head in extension position is best position for laryngeal visualization and intubation,²¹ although in contrast Park et al., found improved view of laryngeal visualization seen during neutral position.²²

The present study also assessed that few alternative techniques required for intubation and no intubation failure reported among any group in Group M 13 (43.3%) patients got intubated in 1st attempt and 17 (56.7%) patient's required 2nd attempt out of 30 patients, respectively. There was no 2nd attempt in Group J all 30 patients got intubated in 1st attempt, whereas only 3 (10.0%) unanticipated 2nd attempts required in Group C rest in 27 patients out of 30 got intubated in 1st attempts.

This study also found that alternative technique assistance including bougie, BURP, bougie+BURP, and stylet+BURP were statistically insignificant among the groups with $P > 0.05$. Stylet used in 19 (63.3%) patients out of 30 in Group M, in Group J stylet used in 3 (10%) patients out of 30 patients, and in Group C also 3 (10%) patients required stylet as assistance out of 30 patients. Maximum patient in Group M required stylet for intubation in each group. Overall success rate among each group was 100% in each group and there was no failed intubation in any of the group.

Limitations of the study

This study has few limitations. First, anesthesiologist could not blind to airway manipulations and this may lead to potential biases.

Second, this study involved patients with normal airway those not expected to have difficult intubation. It may be possible that these maneuvers may be less successful in patients with difficult intubation.

Third, subjective scales used to assess the outcome that may lead to subjective error. Forth, trained anesthetist required to perform these maneuvers.

We concluded that including fiberoptic bronchoscope, C MAC videolaryngoscope, McCoy laryngeal blade, stylet, and bougie should always be ready whenever MILS is applied, expert opinion of senior anesthetist should always be taken. We, further, conclude that jaw thrust maneuver improves Cormack–Lehane grade, can be used during anticipated difficult airway situations.

We strongly recommend proper plan should be made for cervical spine stabilization cases and more studies should be done over manual inline stabilization so that it comes into more practice and whenever needed in cervical spine trauma can be performed successfully, airway kit should always be ready including fiberoptic bronchoscope, C MAC video laryngoscope, McCoy laryngeal blade, stylet, bougie whatever available, two parson technique should be taught to junior O.T technicians, and call for help especially in difficult MILS cases expert opinion of senior anesthetist should always be taken. Proper plan should be formulated before shifting patient of cervical spine injury for surgery.

CONCLUSION

This present study concluded that jaw thrust maneuver improved the laryngeal visualization than conventional and MILS maneuver, so jaw thrust position may be recommended as the initial airway maneuver for better laryngeal visualization

for orotracheal intubation during laryngoscopy. This study also concluded that conventional maneuver made intubation faster and easy compared to jaw thrust and MILS maneuver. Hence, this study recommends the conventional maneuver for faster and easy tracheal intubation.

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Authors' Contributions:

SaK and **VD**- Definition of intellectual content, Prepared first draft of manuscript, implementation of study protocol, data collection, data analysis, manuscript preparation and submission of article; **ShK** and **VSD**- Concept, design, clinical protocol, manuscript preparation, editing, and manuscript revision; **VD**- Statistical Analysis and Interpretation, Review Manuscript, Coordination and Manuscript revision.

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