

A comparative study of modified cormack lehane grading in early morning sniffing position and manual in line stabilization position in adult patients undergoing surgery under general anaesthesia in department of anaesthesiology, S.M.S Medical College, Jaipur

¹Dr. Rajat Singh, Postgraduate Resident, 3rd Year, Department of Anaesthesiology, SMS Medical College and Attached Group of Hospitals, Jaipur, Rajasthan, India

²Dr. Rama Chatterjee, Senior Professor, Department of Anaesthesiology, SMS Medical College and Attached Group of Hospitals, Jaipur, Rajasthan, India

Corresponding Author: Dr. Rama Chatterjee, Senior Professor, Department of Anaesthesiology, SMS Medical College and Attached Group of Hospitals, Jaipur, Rajasthan, India

How to citation this article: Dr. Rajat Singh, Dr. Rama Chatterjee, “A comparative study of modified cormack lehane grading in early morning sniffing position and manual in line stabilization position in adult patients undergoing surgery under general anaesthesia in department of anaesthesiology, S.M.S Medical College, Jaipur”, IJMACR– September – 2026, Volume – 9, Issue – 5, P. No. 819 – 832.

Open Access Article: © 2026 Dr. Rajat Singh, et al. This is an open access journal and article distributed under the terms of the creative common’s attribution license (<http://creativecommons.org/licenses/by/4.0>). Which allows others to remix, tweak, and build upon the work non - commercially, as long as appropriate credit is given and the new creations are licensed under the identical terms.

Type of Publication: Original Research Article

Conflicts of Interest: Nil

Abstract

Background: Optimal positioning during direct laryngoscopy is important for obtaining adequate glottic visualisation and facilitating tracheal intubation. Manual In-Line Stabilisation (MILS), commonly used when cervical spine movement needs to be minimised, may adversely affect the laryngoscopic view. This study compared Modified Cormack–Lehane (MCL) grading obtained in the Early Morning Sniffing Position (EMSP) and MILS position.

Methods: A prospective observational, cross-over comparative study was conducted in the Department of Anaesthesiology, S.M.S. Medical College and attached hospitals, Jaipur, from December 2023 to April 2025.

Thirty adult patients aged 18–60 years, belonging to ASA Grade I–II and undergoing elective surgery under general anaesthesia, were included. Patients were randomly allocated into two groups of 15 each. Group A underwent laryngoscopy first in EMSP followed by MILS, while Group B underwent MILS followed by EMSP. MCL grading was recorded in both positions. Heart rate, systolic blood pressure, diastolic blood pressure, mean arterial pressure, SpO₂, and procedure-related complications were also assessed.

Results: The mean age was 31.93 ± 7.11 years in Group A and 33.80 ± 8.54 years in Group B ($p=0.521$). In EMSP, 19 patients (63.33%) had MCL Grade 1 and 11 (36.67%) had Grade 2a, with no Grade 2b or higher views. In MILS,

8 patients (26.67%) had Grade 2a, 14 (46.67%) Grade 2b, 6 (20.00%) Grade 3a, and 2 (6.67%) Grade 3b views. The difference in laryngoscopic grading was statistically highly significant ($p=0.0002$). The improvement with EMSP was consistent in both sequences (Group A, $p=0.040$; Group B, $p=0.026$). Haemodynamic parameters and SpO₂ showed no statistically significant differences between the groups. Throat pain and hoarseness were comparable, and no mucosal bleeding was observed.

Conclusion: EMSP provided significantly better laryngoscopic visualization than MILS, with predominantly Grade 1 and 2a MCL views. MILS was associated with poorer laryngoscopic grades, while haemodynamic parameters, oxygen saturation, and observed complications remained comparable.

Keywords: Early Morning Sniffing Position, Manual In-Line Stabilisation, Modified Cormack–Lehane Grading, Direct Laryngoscopy, Tracheal Intubation, General Anaesthesia.

Introduction

Direct laryngoscopy and endotracheal intubation are fundamental components of general anaesthesia and require adequate visualization of the glottic opening for successful and safe tracheal intubation. The position of the head and neck is an important determinant of the laryngoscopic view. Traditionally, the sniffing position has been widely used during direct laryngoscopy because it facilitates alignment of the oral, pharyngeal, and laryngeal axes and generally provides favourable conditions for tracheal intubation. However, the quality of the laryngoscopic view can vary considerably according to patient anatomy, airway characteristics, and the position adopted during laryngoscopy.^{1,2}

The Cormack–Lehane (CL) classification is one of the most commonly used systems for describing the

laryngoscopic view obtained during direct laryngoscopy. The modified Cormack–Lehane classification further subdivides Grade 2 into Grade 2a, in which part of the vocal cords are visible, and Grade 2b, in which only the arytenoids or posterior portion of the glottis is visible. This modification provides better discrimination of intermediate laryngoscopic views because Grade 2b is associated with a greater likelihood of difficult tracheal intubation than Grade 2a.^{3,4}

Manual in-line stabilisation (MILS) is an important airway management technique used when cervical spine movement needs to be minimized, particularly in patients with suspected or known cervical spine injury. During MILS, the head and neck are maintained in a neutral position by an assistant while laryngoscopy is performed. Although this technique may reduce cervical spine movement, restriction of normal head and neck positioning can adversely affect laryngeal exposure and make direct laryngoscopy more difficult.^{5,6}

Several studies have demonstrated that application of MILS can result in poorer laryngoscopic views and increased difficulty during direct laryngoscopy compared with an unrestricted or optimal head position. Nolan and Wilson reported that manual in-line stabilisation significantly worsened laryngeal visualization and increased the difficulty of tracheal intubation.⁵ A randomized controlled trial subsequently demonstrated a substantially higher rate of failed intubation and a greater frequency of Grade 3 and 4 laryngoscopic views when MILS was used compared with the optimal intubating position.⁶

The sniffing position, although routinely used for direct laryngoscopy, has also been evaluated in comparative studies. Evidence suggests that its effect on glottic visualization may vary according to patient characteristics

and the comparator position. A meta-analysis of randomized trials found that the sniffing position did not consistently improve glottic visualization or first-attempt intubation success compared with other head positions, although it may provide favourable overall intubating conditions.⁷ Thus, the relationship between head and neck positioning and laryngoscopic view remains clinically important, particularly when cervical spine movement must be restricted.

A prospective self-controlled study specifically comparing MILS with the Early Morning Sniffing Position (EMSP) demonstrated a significant deterioration in Modified Cormack–Lehane grading following application of MILS. The majority of patients had Grade 1 or 2a views in EMSP, whereas higher grades, particularly Grades 3a and 3b, were more frequently observed with MILS.⁸ These findings highlight the potential difficulty of direct laryngoscopy when cervical spine movement is restricted and emphasize the importance of anticipating a difficult airway in patients requiring MILS.

However, laryngoscopic visualization is influenced by several patient-related factors, including Modified Mallampati class, thyromental distance, neck circumference, mouth opening, body habitus, and cervical mobility.^{3,9} Assessment of these factors before anaesthesia is therefore essential when comparing different airway positions. Furthermore, a cross-over design in which the same patient undergoes laryngoscopic assessment in both positions provides an opportunity to directly compare the effect of positioning while reducing inter-individual anatomical variability.

Despite the clinical relevance of MILS in airway management, comparative data evaluating EMSP and MILS in the same adult patients remain relatively limited,

particularly in the Indian population. Therefore, the present study was undertaken to compare the Modified Cormack–Lehane laryngoscopic grading obtained in the Early Morning Sniffing Position and Manual In-Line Stabilisation position in adult patients undergoing elective surgery under general anaesthesia. The study also evaluated the relationship of laryngoscopic grading with Modified Mallampati class and compared peri-intubation haemodynamic parameters, oxygen saturation, and procedure-related complications between the study groups.

Materials and Methods

Study Design and Setting

The present study was designed as a prospective observational, cross-over comparative study to compare the Modified Cormack–Lehane (MCL) grading of the laryngoscopic view obtained in the Early Morning Sniffing Position (EMSP) and Manual In-Line Stabilisation (MILS) position in adult patients undergoing elective surgery under general anaesthesia. The study was conducted in the Department of Anaesthesiology, S.M.S. Medical College and its attached group of hospitals, Jaipur, Rajasthan.

Ethical Approval and Study Duration

Permission to conduct the study was obtained from the Institutional Ethics Committee and Research Review Board. The study was approved under Letter No. REF/2025/02/099041. Following approval of the study protocol, the study was conducted from December 2023 to April 2025. An additional period of two months was utilised for data compilation, statistical analysis, interpretation of findings, and report writing.

Study Universe

The study universe comprised adult patients undergoing elective surgical procedures under general anaesthesia at S.M.S. Medical College and its attached hospitals, Jaipur.

Sample Size

The sample size was calculated at a 95% confidence level with 80% study power to compare the laryngoscopic view obtained with the two different manoeuvres. Based on the findings of the seed article, assuming Modified Cormack–Lehane grading up to Grade 2b in 96.36% of patients in the EMSP group and 9.54% of patients in the MILS group, a minimum sample size of 30 patients was required. Accordingly, 30 patients were included in the present study.

Eligibility Criteria

Inclusion Criteria

Patients fulfilling the following criteria were included in the study:

1. Patients willing to participate in the study.
2. Patients of either sex undergoing elective surgery under general anaesthesia.
3. Patients aged 18–60 years.
4. Patients belonging to ASA physical status Grade I or II.

Exclusion Criteria

Patients meeting any of the following criteria were excluded from the study:

1. Patients participating in another research study.
2. Non-cooperative patients.
3. Patients with upper respiratory tract infection.
4. Pregnant patients.
5. Patients with anticipated difficult airway.
6. Inter-incisor distance <3 fingerbreadths.
7. Body mass index (BMI) >30 kg/m².
8. Neck circumference >30 cm.

9. Thyromental distance <6.5 cm.

Study Groups and Cross-Over Design

A total of 30 eligible patients were randomly allocated into two groups of 15 patients each according to the sequence of laryngoscopic manoeuvres.

Group A (n = 15): Laryngoscopy was initially performed in the Early Morning Sniffing Position (EMSP), followed by laryngoscopy in the Manual In-Line Stabilisation (MILS) position.

Group B (n = 15): Laryngoscopy was initially performed in the MILS position, followed by laryngoscopy in the Early Morning Sniffing Position (EMSP).

Thus, every patient underwent laryngoscopic assessment in both positions, with the order of the two positions reversed between the groups to minimise the influence of sequence-related factors.

Pre-Anaesthetic Assessment

All patients were evaluated one day before the scheduled surgery. The anaesthetic technique and study procedure were explained to the patients and their attendants. Written informed consent was obtained before enrolment. A detailed pre-anaesthetic assessment was performed, including relevant present and past medical and surgical history. General physical examination was carried out, including assessment of body weight and vital parameters such as pulse rate, blood pressure, respiratory rate, and temperature.

Routine preoperative investigations were performed according to institutional protocols. These included haemoglobin, total leukocyte count, differential leukocyte count, platelet count, bleeding time, clotting time, prothrombin time, international normalized ratio, serum electrolytes, serum creatinine, and relevant viral markers. A detailed airway examination was also performed to

identify any features suggestive of a potentially difficult airway.

Anaesthetic Procedure

On arrival in the operating room, patient identity, fasting status, pre-anaesthetic check-up, eligibility, and written informed consent were reconfirmed. Standard multiparameter monitoring was established. Baseline values of heart rate (HR), systolic blood pressure (SBP), diastolic blood pressure (DBP), mean arterial pressure (MAP), and oxygen saturation (SpO₂) were recorded.

An 18-gauge intravenous cannula was secured, and intravenous fluids were administered according to institutional protocols. Premedication was administered with glycopyrrolate 0.005 mg/kg, midazolam 0.05 mg/kg, and fentanyl 2 µg/kg intravenously. Preoxygenation was performed with 100% oxygen for three minutes.

General anaesthesia was induced with propofol 2 mg/kg intravenously. After confirming adequate ventilation, succinylcholine 1.5 mg/kg was administered to achieve neuromuscular relaxation and facilitate laryngoscopy.

Laryngoscopic Assessment

Following adequate neuromuscular relaxation, direct laryngoscopy was performed according to the randomized sequence allocated to each patient.

In Group A, the first laryngoscopic assessment was performed in the Early Morning Sniffing Position (EMSP). The laryngoscopic view was assessed and the corresponding Modified Cormack–Lehane grade was recorded. The patient was subsequently repositioned into the Manual In-Line Stabilization (MILS) position, following which laryngoscopy was repeated and the Modified Cormack–Lehane grade was recorded.

In Group B, the sequence was reversed. The initial laryngoscopy was performed in the MILS position, followed by repositioning into the EMSP and repeat

laryngoscopic assessment. The Modified Cormack–Lehane grade was recorded during both assessments.

During the laryngoscopic assessments, apnoeic oxygenation was maintained using nasal prongs to minimize the risk of oxygen desaturation during the assessment period. The laryngoscopic view obtained in each position was documented according to the Modified Cormack–Lehane classification.

After completion of both laryngoscopic assessments, tracheal intubation was performed using an appropriately sized cuffed endotracheal tube. Correct placement of the endotracheal tube was confirmed by bilateral air entry on auscultation, and the tube was securely fixed. Haemodynamic parameters were recorded immediately after intubation.

Maintenance of Anaesthesia

Anaesthesia was maintained with oxygen and nitrous oxide in a 4:6 ratio, along with sevoflurane at approximately 1.5–2 MAC. Neuromuscular blockade was maintained with atracurium 0.5 mg/kg as the loading dose, followed by 0.1 mg/kg maintenance doses as required.

Controlled ventilation was provided using intermittent positive-pressure ventilation (IPPV) throughout the surgical procedure. Standard intraoperative monitoring was continued throughout anaesthesia.

Reversal and Extubation

After surgery, reversal of neuromuscular blockade was achieved with neostigmine 0.07 mg/kg and glycopyrrolate 0.001 mg/kg intravenously after the return of spontaneous respiratory efforts.

Extubation was performed after fulfilment of appropriate extubation criteria, including adequate spontaneous ventilation, recovery of protective airway reflexes, adequate neuromuscular strength, appropriate level of

consciousness, and satisfactory ventilation. Following extubation, supplemental oxygen was administered, and vital parameters were monitored. Once the patient's clinical condition was stable, the patient was shifted to the recovery room for postoperative monitoring and further care.

Outcome Variables

The following outcome variables were assessed:

Primary Outcome

- Modified Cormack–Lehane grading of the laryngoscopic view in the EMSP and MILS positions.

Secondary Outcomes

- Mean heart rate.
- Systolic blood pressure.
- Diastolic blood pressure.
- Mean arterial pressure.
- Oxygen saturation (SpO₂).
- Proportion of patients developing complications during the procedure.

Data Collection and Study Flow

Patients undergoing elective surgery under general anaesthesia were screened through pre-anaesthetic assessment and airway examination according to the predefined inclusion and exclusion criteria. Eligible patients who provided written informed consent were enrolled into the study. A total of 30 patients were randomly allocated into two groups of 15 patients each. Patients in Group A underwent laryngoscopy first in the EMSP followed by the MILS position, whereas patients in Group B underwent laryngoscopy first in the MILS position followed by the EMSP. Modified Cormack–Lehane grading was recorded during laryngoscopy in both positions. Heart rate, SBP, DBP, MAP, and SpO₂ were documented at the predefined time points, and any complications occurring during the procedure were

recorded. Following completion of the assessments, patients were intubated, and anaesthesia was continued according to the standardised protocol. The collected data were subsequently compiled, entered into a computerised database, and statistically analysed to compare the laryngoscopic views and haemodynamic parameters between the EMSP and MILS positions.

Statistical Analysis

All collected data were systematically entered into Microsoft Excel and subsequently analysed using IBM SPSS Statistics version 26.0.

Continuous variables were expressed as mean $\pm$ standard deviation (SD), while categorical variables were presented as frequencies and percentages. The Modified Cormack–Lehane grades obtained in the EMSP and MILS positions were compared using an appropriate test for categorical variables, including the Chi-square test, depending upon the distribution and expected frequencies.

Continuous variables, including heart rate, systolic blood pressure, diastolic blood pressure, mean arterial pressure, and oxygen saturation, were compared between the two positions at different time intervals using analysis of variance (ANOVA) as appropriate. A p-value <0.05 was considered statistically significant for all analyses.

Observations and Results

A total of 30 patients fulfilling the predefined eligibility criteria were included in the present study. The patients were randomly allocated into two groups of 15 patients each. Group A underwent laryngoscopy first in the Early Morning Sniffing Position (EMSP), followed by Manual In-Line Stabilisation (MILS), whereas Group B underwent laryngoscopy first in the MILS position, followed by EMSP. The demographic characteristics, airway parameters, Modified Cormack–Lehane (MCL)

grading, haemodynamic parameters, oxygen saturation, and complications were assessed and compared between the two groups.

Table 1: Age, Gender and ASA Grade Distribution of the Study Population

Parameter	Group A (n=15)	Group B (n=15)	p-value
Age (years), Mean $\pm$ SD	31.93 $\pm$ 7.11	33.80 $\pm$ 8.54	0.521
Gender, n (%)			
Female	15 (100%)	15 (100%)	—
Male	0 (0%)	0 (0%)	—
ASA Grade, n (%)			
Grade I	15 (100%)	15 (100%)	—
Grade II	0 (0%)	0 (0%)	—

Observation: The mean age of patients was 31.93 $\pm$ 7.11 years in Group A and 33.80 $\pm$ 8.54 years in Group B. The difference was not statistically significant ($p=0.521$), indicating comparable age distribution between the groups. All participants in both groups were female and belonged to ASA Grade I.

Table 2: Comparison of Demographic Parameters between the Study Groups

Demographic Parameter	Group A (n=15)	Group B (n=15)	p-value
Weight (kg)	63.33 $\pm$ 6.42	61.33 $\pm$ 5.70	0.280
Height (cm)	163.60 $\pm$ 5.01	161.20 $\pm$ 2.51	0.108
BMI (kg/m ²)	22.76 $\pm$ 1.22	22.12 $\pm$ 1.20	0.205

Observation: The mean body weight was 63.33 $\pm$ 6.42 kg in Group A and 61.33 $\pm$ 5.70 kg in Group B. The mean height was 163.60 $\pm$ 5.01 cm in Group A and 161.20 $\pm$ 2.51 cm in Group B, respectively. The mean BMI was 22.76 $\pm$ 1.22 kg/m² in Group A and 22.12 $\pm$ 1.20 kg/m² in Group B. None of these differences were statistically significant ($p>0.05$), demonstrating comparable baseline demographic characteristics.

Table 3: Comparison of Airway Parameters between the Study Groups

Airway Parameter	Group A (n=15)	Group B (n=15)	p-value
Thyromental distance (cm)	7.29 $\pm$ 0.32	7.36 $\pm$ 0.27	0.538
Sternomental distance (cm)	14.42 $\pm$ 0.40	14.19 $\pm$ 0.42	0.129
Neck circumference (cm)	28.47 $\pm$ 1.19	28.07 $\pm$ 1.58	0.440
Inter-incisor gap >3 fingers, n (%)	15 (100%)	15 (100%)	—
Inter-incisor gap <3 fingers, n (%)	0 (0%)	0 (0%)	—

Observation: The mean thyromental distance, sternomental distance, and neck circumference were comparable between the two groups. The differences were statistically non-significant. All patients had an inter-incisor gap of more than three finger breadths, and none had an inter-incisor gap of less than three finger breadths.

Table 4: Distribution of Patients According to Modified Mallampati Class and Upper Lip Bite Test

Airway Assessment	Group A (n=15)	Group B (n=15)	p-value
Modified Mallampati Class			
Class I	6 (40%)	6 (40%)	1.000
Class II	9 (60%)	9 (60%)	
Upper Lip Bite Test			
Class I	14 (93.3%)	13 (86.7%)	0.543
Class II	1 (6.7%)	2 (13.3%)	

Observation: The Modified Mallampati classification was identical between the two groups, with 6 patients (40%) having Class I and 9 patients (60%) having Class II in each group. The difference was not statistically significant ($p=1.000$). According to the Upper Lip Bite Test, 14 patients (93.3%) in Group A and 13 patients (86.7%) in Group B were Class I, while 1 (6.7%) and 2 (13.3%) patients were Class II, respectively. This difference was also not statistically significant ($p=0.543$).

Table 5: Overall Comparison of Modified Cormack–Lehane Grades in EMSP and MILS

Modified Cormack–Lehane Grade	EMSP, n (%)	MILS, n (%)
Grade 1	19 (63.33%)	0 (0%)
Grade 2a	11 (36.67%)	8 (26.67%)
Grade 2b	0 (0%)	14 (46.67%)
Grade 3a	0 (0%)	6 (20.00%)
Grade 3b	0 (0%)	2 (6.67%)
Grade 4	0 (0%)	0 (0%)
Total	30 (100%)	30 (100%)
Chi-square test		$p=0.0002^*$

*Statistically significant.

Observation: A marked difference in laryngoscopic visualization was observed between the two positions. In the EMSP, 19 patients (63.33%) had a Grade 1 view and 11 patients (36.67%) had Grade 2a. No patient had Grade 2b or higher. In contrast, during MILS, none of the patients had Grade 1, while 8 (26.67%) had Grade 2a, 14 (46.67%) had Grade 2b, 6 (20%) had Grade 3a, and 2 (6.67%) had Grade 3b. The difference was statistically highly significant ($p=0.0002$), indicating significantly better laryngoscopic visualization in EMSP compared with MILS.

Table 6: Comparison of Modified Cormack–Lehane Grades According to the Sequence of Manoeuvres

MCL Grade	Group A (n=15) EMSP n (%)	Group A (n=15) MILS n (%)	Group B (n=15) MILS n (%)	Group B (n=15) EMSP n (%)
Grade 1	9 (60.0%)	0 (0%)	0 (0%)	10 (66.7%)
Grade 2a	6 (40.0%)	2 (13.3%)	6 (40.0%)	5 (33.3%)
Grade 2b	0 (0%)	7 (46.7%)	7 (46.7%)	0 (0%)

Grade 3a	0 (0%)	4 (26.7%)	2 (13.3%)	0 (0%)
Grade 3b	0 (0%)	2 (13.3%)	0 (0%)	0 (0%)
Grade 4	0 (0%)	0 (0%)	0 (0%)	0 (0%)
p-value		0.040*	0.026*	

*Statistically significant.

Observation: In Group A, when laryngoscopy was performed in the EMSP, 9 patients (60%) had Grade 1 and 6 patients (40%) had Grade 2a views. Following application of MILS, the laryngoscopic view deteriorated, with 2 patients (13.3%) having Grade 2a, 7 (46.7%) Grade 2b, 4 (26.7%) Grade 3a, and 2 (13.3%) Grade 3b. The difference was statistically significant ($p=0.040$).

In Group B, the initial MILS assessment showed 6 patients (40%) with Grade 2a, 7 (46.7%) with Grade 2b, and 2 (13.3%) with Grade 3a, with no Grade 1 views. After changing to EMSP, 10 patients (66.7%) achieved Grade 1 and 5 patients (33.3%) had Grade 2a views. The difference was statistically significant ($p=0.026$).

These findings demonstrate that the improvement in laryngoscopic visualization with EMSP was consistent irrespective of the sequence in which the manoeuvres were performed.

Table 7: Association of Modified Cormack–Lehane Grade with Modified Mallampati Class in EMSP and MILS

MCL Grade	EMSP: MM Class I n (%)	EMSP: MM Class II n (%)	MILS: MM Class I n (%)	MILS: MM Class II n (%)
Grade 1	12 (40.0%)	7 (23.3%)	0	0
Grade 2a	0	11 (36.7%)	8 (26.7%)	0
Grade 2b	0	0	4 (13.3%)	10 (33.3%)
Grade 3a	0	0	0	6 (20.0%)
Grade 3b	0	0	0	2 (6.7%)
Grade 4	0	0	0	0
p-value		0.0021*		0.00002*

*Statistically significant.

Observation: In the EMSP, among patients with Modified Mallampati Class I, 12 (40%) had a Grade 1 laryngoscopic view. Among Class II patients, 7 (23.3%) had Grade 1 and 11 (36.7%) had Grade 2a views. The association between Modified Mallampati Class and MCL grade in EMSP was statistically significant ($p=0.0021$).

In the MILS position, among Modified Mallampati Class I patients, 8 (26.7%) had Grade 2a and 4 (13.3%) had Grade 2b views. Among Class II patients, 10 (33.3%) had Grade 2b, 6 (20%) had Grade 3a, and 2 (6.7%) had Grade 3b views. The association was statistically significant ($p=0.00002$).

Table 8: Comparison of Heart Rate and Systolic Blood Pressure between Group A and Group B

Time interval	HR Group A Mean $\pm$ SD	HR Group B Mean $\pm$ SD	P-value	SBP Group A Mean $\pm$ SD	SBP Group B Mean $\pm$ SD	p-value
Baseline	88.00 $\pm$ 10.56	82.80 $\pm$ 8.58	0.150	124.13 $\pm$ 8.12	124.27 $\pm$ 8.94	0.966
1 min	80.60 $\pm$ 7.38	80.53 $\pm$ 23.76	0.992	120.80 $\pm$ 10.47	123.33 $\pm$ 9.00	0.483
2 min	80.47 $\pm$ 7.29	85.27 $\pm$ 8.85	0.116	119.73 $\pm$ 6.32	125.00 $\pm$ 8.97	0.074

5 min	86.33 ± 8.75	84.73 ± 8.51	0.616	121.33 ± 9.25	122.67 ± 9.46	0.699
10 min	86.27 ± 11.29	85.60 ± 7.98	0.853	123.87 ± 7.58	120.00 ± 7.63	0.175
15 min	88.87 ± 12.22	86.00 ± 12.22	0.526	125.20 ± 7.16	122.27 ± 8.78	0.325
30 min	86.07 ± 8.90	85.00 ± 9.70	0.756	122.67 ± 9.67	121.20 ± 8.78	0.667

Observation: Heart rate and systolic blood pressure remained comparable between the two groups at all assessed time intervals. None of the differences in HR or SBP between Group A and Group B was statistically significant ($p>0.05$).

Table 9: Comparison of Diastolic Blood Pressure, Mean Arterial Pressure and SpO₂ between Group A and Group B

Time interval	DBP Group A Mean ± SD	DBP Group B Mean ± SD	p-value	MAP Group A Mean ± SD	MAP Group B Mean ± SD	p-value	SpO ₂ Group A Mean ± SD	SpO ₂ Group B Mean ± SD	p-value
Baseline	81.07 ± 5.60	80.80 ± 8.97	0.923	95.42 ± 5.85	95.29 ± 8.55	0.961	98.07 ± 0.88	98.07 ± 0.80	1.000
1 min	80.00 ± 7.21	79.20 ± 9.47	0.796	93.60 ± 7.92	93.91 ± 8.90	0.920	97.87 ± 1.06	98.20 ± 0.94	0.370
2 min	79.93 ± 6.37	80.40 ± 8.17	0.863	93.20 ± 5.88	95.27 ± 7.69	0.416	98.00 ± 1.07	98.20 ± 0.94	0.591
5 min	78.47 ± 8.63	78.87 ± 7.08	0.891	92.76 ± 8.05	93.47 ± 7.39	0.803	97.53 ± 1.13	98.07 ± 1.03	0.187
10 min	81.60 ± 6.81	77.73 ± 6.09	0.112	95.69 ± 6.28	91.82 ± 6.13	0.099	97.80 ± 1.08	97.80 ± 1.08	1.000
15 min	80.80 ± 5.94	79.33 ± 7.77	0.566	95.60 ± 5.64	93.64 ± 7.66	0.433	97.80 ± 1.15	98.27 ± 1.03	0.251
30 min	79.60 ± 7.64	79.07 ± 6.67	0.840	93.96 ± 8.01	93.11 ± 6.95	0.760	97.87 ± 0.99	97.87 ± 1.06	1.000

Observation: The mean DBP, MAP, and SpO₂ values were comparable between Group A and Group B at all assessed time intervals. No statistically significant differences were observed for any of these parameters ($p>0.05$). Oxygen saturation remained clinically stable in both groups throughout the observation period.

Table 10: Comparison of Complications between the Study Groups

Complication	Group A (n=15)	Group B (n=15)	p-value
Throat pain	7 (46.7%)	9 (60.0%)	0.804
Hoarseness	3 (20.0%)	3 (20.0%)	0.896
Mucosal bleeding	0 (0%)	0 (0%)	—

Observation: Throat pain was reported in 7 patients (46.7%) in Group A and 9 patients (60%) in Group B; however, the difference was not statistically significant ($p=0.804$). Hoarseness occurred in 3 patients (20%) in each group, with no significant difference ($p=0.896$). No cases of mucosal bleeding were observed in either group.

Discussion

The present prospective observational cross-over study was conducted to compare the quality of the laryngoscopic view obtained in the Early Morning Sniffing Position (EMSP) and Manual In-Line Stabilisation (MILS) position in adult patients undergoing elective surgery under general anaesthesia. Thirty patients were included and randomly allocated into two sequence

groups, with each patient undergoing laryngoscopic assessment in both positions. The principal finding of the study was that EMSP provided significantly better laryngoscopic visualization than MILS, as demonstrated by the substantially lower Modified Cormack–Lehane grades observed in EMSP.

The baseline characteristics of the two groups were comparable. The mean age was 31.93 ± 7.11 years in

Group A and 33.80 ± 8.54 years in Group B, with no statistically significant difference ($p=0.521$). Similarly, weight, height, and BMI were comparable between the groups. All participants were female and belonged to ASA Grade I. Airway parameters including thyromental distance, sternomental distance, neck circumference, and inter-incisor distance were also comparable. The similarity of these baseline variables is important because differences in airway anatomy and physical characteristics could independently influence the laryngoscopic view.

In the present study, Modified Cormack–Lehane grading demonstrated a marked difference between the two positions. In EMSP, 19 patients (63.33%) had Grade 1 visualization and 11 patients (36.67%) had Grade 2a visualization, with no patient having Grade 2b or a higher grade. In contrast, under MILS, none of the patients had Grade 1 visualization; 8 (26.67%) had Grade 2a, 14 (46.67%) had Grade 2b, 6 (20.00%) had Grade 3a, and 2 (6.67%) had Grade 3b visualization. This difference was statistically highly significant ($p=0.0002$).

These findings are consistent with the established effect of cervical spine immobilization on direct laryngoscopy. Manual in-line stabilization restricts extension and alters the normal relationship between the oral, pharyngeal, and laryngeal axes. Consequently, the glottic opening may become more difficult to visualize with a conventional direct laryngoscope. Previous clinical studies have similarly reported deterioration in Cormack–Lehane grades following application of MILS.^{5,6}

The findings of the present study are particularly comparable with those of the prospective self-controlled study by Jain et al., which directly evaluated the Modified Cormack–Lehane view in MILS and EMSP in 220 adult patients with normal airways. In that study, EMSP

predominantly produced Grade 1 and Grade 2a views, whereas MILS was associated with a much greater frequency of Grade 3a and Grade 3b views. The difference between the two positions was statistically significant ($p<0.0001$).⁸ The direction and magnitude of the difference observed in the present study are consistent with these findings, although the present study included a substantially smaller sample.

Our results are also supported by the randomized controlled trial by Heath, which evaluated the effect of MILS on direct laryngoscopy in adults. The study reported a significantly higher rate of failed intubation when MILS was applied, with Grade 3 and Grade 4 laryngoscopic views occurring more frequently in the MILS group. Removal of MILS permitted successful intubation in patients who had initially failed.⁶ These observations emphasize that the poorer laryngoscopic view produced by MILS may have direct clinical implications for tracheal intubation.

The sequence-specific analysis in the present cross-over study further strengthens the principal finding. In Group A, laryngoscopy performed initially in EMSP produced Grade 1 views in 9 patients (60%) and Grade 2a views in 6 patients (40%). After application of MILS, the laryngoscopic view deteriorated, with Grade 2a in 2 patients, Grade 2b in 7, Grade 3a in 4, and Grade 3b in 2 patients ($p=0.040$). Conversely, in Group B, initial MILS produced Grade 2a in 6 patients, Grade 2b in 7, and Grade 3a in 2 patients, whereas subsequent assessment after changing to EMSP resulted in Grade 1 in 10 patients and Grade 2a in 5 patients ($p=0.026$). Thus, improvement with EMSP was demonstrated irrespective of the order in which the two positions were assessed.

The cross-over nature of the present study is particularly relevant because laryngoscopic view can vary

considerably between individuals. By assessing both positions in the same patient, the influence of individual airway anatomy is reduced and the effect of positioning can be more directly appreciated. The consistent direction of change in both sequence groups also suggests that the observed difference was unlikely to be explained solely by the order of assessment.

The Modified Cormack–Lehane classification was selected as the primary outcome because it provides clinically meaningful information regarding the degree of glottic exposure. Yentis and Lee demonstrated that subdivision of Grade 2 into Grades 2a and 2b improves the description of intermediate laryngoscopic views and that Grade 2b is associated with greater difficulty in tracheal intubation than Grade 2a.³ In the present study, the shift from predominantly Grade 1 and 2a views in EMSP to Grade 2b, 3a, and 3b views during MILS therefore represents not merely a statistical difference but a clinically relevant deterioration in the laryngoscopic view.

A significant association was also observed between Modified Mallampati class and Modified Cormack–Lehane grade in both positions. In EMSP, patients with Modified Mallampati Class I predominantly demonstrated Grade 1 views, whereas Class II patients included both Grade 1 and Grade 2a views ($p=0.0021$). In MILS, Class I patients had Grade 2a or 2b views, whereas Class II patients demonstrated Grade 2b, 3a, and 3b views, with a highly significant association ($p=0.00002$). These findings indicate that preoperative airway assessment may provide useful information regarding the expected laryngoscopic view, particularly when the head and neck are maintained in a restricted position.

Previous studies have also identified an association between airway assessment parameters and the quality of

laryngoscopic visualization. The modified Cormack–Lehane classification has been shown to correlate with the difficulty of intubation, with increasing grades associated with lower first-attempt success and greater requirement for adjunctive airway devices.^{4,10} The present findings further support the importance of incorporating bedside airway assessment into the preparation of patients in whom MILS is anticipated.

An important aspect of the present study was assessment of perioperative haemodynamic variables. Heart rate, systolic blood pressure, diastolic blood pressure, mean arterial pressure, and oxygen saturation were comparable between the two groups at all assessed time points. None of the differences reached statistical significance. Although changes in haemodynamic parameters are expected during induction and laryngoscopy, the present study did not demonstrate a significant difference between the two randomized sequence groups.

Oxygenation remained stable in both groups throughout the observation period. Mean SpO₂ values remained approximately 97–98% at the assessed time points, and no significant intergroup differences were observed. The maintenance of apnoeic oxygenation with nasal prongs during the laryngoscopic assessments may have contributed to the absence of clinically important oxygen desaturation. Nevertheless, the small sample size limits the ability of the study to detect uncommon episodes of hypoxaemia.

Regarding complications, throat pain was reported in 46.7% of patients in Group A and 60.0% in Group B, while hoarseness occurred in 20% of patients in each group. Neither difference was statistically significant. No mucosal bleeding was observed in either group. These findings suggest that, within the limitations of the present sample, the difference in laryngoscopic view between

EMSP and MILS was not accompanied by a demonstrable difference in the assessed minor postoperative airway complications.

The clinical importance of maintaining adequate laryngoscopic visualization during MILS should be interpreted in the context of the indication for cervical spine protection. MILS is used to minimize cervical spine movement in patients at risk of cervical injury and should not simply be abandoned because it worsens the laryngoscopic view. Instead, the poorer visualization should be anticipated and appropriate difficult-airway equipment and expertise should be available. Previous evidence indicates that MILS can substantially increase difficulty with direct laryngoscopy and intubation.^{5,6} Alternative approaches, including videolaryngoscopy, flexible fiberoptic techniques, and other airway adjuncts, may therefore be considered when clinically appropriate.¹¹

The present findings are also consistent with the broader literature showing that head and neck positioning can influence direct laryngoscopy. Although the sniffing position does not invariably improve glottic visualization compared with every alternative head position, it remains an established position for conventional direct laryngoscopy and may facilitate intubation under many circumstances.^{7,12} In the present study, however, the comparison was specifically between EMSP and MILS, and the results clearly demonstrated superior laryngoscopic visualization in EMSP.

The study has several strengths. The cross-over design allowed each patient to serve as his or her own anatomical control, thereby reducing inter-individual variability. Randomization of the order of laryngoscopic assessment also reduced potential sequence effects. Furthermore, the study evaluated not only the primary laryngoscopic

outcome but also baseline airway characteristics, Mallampati classification, haemodynamic parameters, oxygen saturation, and complications.

However, certain limitations should be considered. First, the sample size was relatively small, with only 30 patients, which limits the statistical power for detecting uncommon complications and reduces generalizability. Second, all participants were female and all belonged to ASA Grade I, limiting extrapolation of the findings to male patients, elderly individuals, obese patients, patients with significant systemic disease, or those with anticipated difficult airways. Third, patients with several recognised predictors of difficult airway were excluded; therefore, the findings primarily apply to patients with apparently normal airways undergoing elective surgery. Finally, the study evaluated direct laryngoscopic visualisation and did not primarily assess intubation time, number of attempts, use of airway adjuncts, or first-pass intubation success.

Despite these limitations, the findings demonstrate a consistent and clinically important deterioration in laryngoscopic visualisation when MILS was applied compared with EMSP. The results emphasise that patients requiring cervical spine stabilisation should be considered potentially more challenging for direct laryngoscopy, even when routine preoperative airway assessment appears favourable.

Overall, the present study demonstrated that EMSP was associated with significantly better Modified Cormack–Lehane laryngoscopic grades than MILS. The majority of patients had Grade 1 or 2a views in EMSP, whereas MILS resulted in a substantial shift toward Grade 2b and Grade 3 views. This effect was observed irrespective of the sequence of positioning. At the same time, no significant differences were observed in peri-intubation

haemodynamic parameters, oxygen saturation, or the assessed minor complications. These findings support careful airway preparation and anticipation of difficult direct laryngoscopy whenever MILS is required.

Conclusion

The present study demonstrated that the Early Morning Sniffing Position (EMSP) provides significantly better laryngoscopic visualisation than Manual In-Line Stabilisation (MILS), with predominantly Grade 1 and 2a Modified Cormack–Lehane views in EMSP. MILS was associated with poorer laryngoscopic grades. Haemodynamic parameters, oxygen saturation, and observed complications were comparable between the groups. Thus, EMSP may facilitate easier direct laryngoscopy in patients without an anticipated difficult airway.

References

1. Cormack RS, Lehane J. Difficult tracheal intubation in obstetrics. *Anaesthesia*. 1984;39(11):1105-1111.
2. Yentis SM, Lee DJ. Evaluation of an improved scoring system for the grading of direct laryngoscopy. *Anaesthesia*. 1998;53(11):1041-1044.
3. Mallampati SR, Gatt SP, Gugino LD, Desai SP, Waraksa B, Freiburger D, Liu PL. A clinical sign to predict difficult tracheal intubation: a prospective study. *Can Anaesth Soc J*. 1985;32(4):429-434.
4. Santoni BG, Hindman BJ, Puttlitz CM, Weeks JB, Johnson N, Maktabi MA, Todd MM. Manual in-line stabilization increases pressures applied by the laryngoscope blade during direct laryngoscopy and orotracheal intubation. *Anesthesiology*. 2009;110(1): 24-31. doi:10.1097/ ALN.0b013e318190b556.
5. Nolan JP, Wilson ME. Orotracheal intubation in patients with potential cervical spine injuries: manual in-line stabilisation, cervical spine immobilisation and the use of a gum elastic bougie. *Anaesthesia*. 1993;48(7):630-633.
6. Gerling MC, Davis DP, Hamilton RS, Morris GF, Vilke GM, Garfin SR, Hayden SR. Effects of cervical spine immobilization on the glottic view during laryngoscopy. *Am J Emerg Med*. 2000;18(5):615-617.
7. Heath KJ. Laryngoscopy equipment and techniques in patients with cervical spine injury. *Anaesthesia*. 1994;49(10):843-845.
8. Hastings RH, Vigil AC, Hanna R, Yang BY, Sartoris DJ. Cervical spine movement during laryngoscopy with the Bullard, Macintosh, and Miller laryngoscopes. *Anesthesiology*. 1995;82(4):859-869.
9. Goutcher CM, Lochhead V. Reduction in mouth opening with semi-rigid cervical collars may lead to difficult intubation. *Anaesthesia*. 2005;60(11):1140-1144.
10. Manoach S, Paladino L. Manual in-line stabilisation for acute airway management of suspected cervical spine injury: historical review and current questions. *Ann Emerg Med*. 2007;50(3):236-245.
11. Kaur J, Singh S, Bansal A, et al. Laryngoscopic view after application of manual in-line stabilisation – a comparison with early morning sniffing position in the same patient. *Anesth Essays Res*. 2022;16(3):347-352.
12. Cook TM, Woodall N, Frerk C; Fourth National Audit Project. Major complications of airway management in the UK: results of the Fourth National Audit Project of the Royal College of Anaesthetists and Difficult Airway Society. *Br J Anaesth*. 2011;106(5):617-631.