Comparison of "15 Degrees" vs "30 Degrees" Table Inclination on Intubation Parameters in Young Adults

Chandra Shekher Singh[1], Manisha Kesharwani[2], Yamini Gupta[3], Rachna Verma[4], Ajay Bhagoliwal[5], Veena Arora[6], Anil Kumar Verma[7], Prem Shankar[8]

[1, 2, 3, 4, 5, 6, 7, 8]Department of Anaesthesiology, G.S.V.M. Medical College, Kanpur, India

[2]Corresponding Author Email: *studyrelatedpdfs[at]gmail.com*

Abstract: ***Background and Aims**: Proper alignment of the oral, pharyngeal, and laryngeal axes is critical for successful endotracheal intubation. While the traditional approach uses head positioning, tilting the operating table may also aid glottic visualization. Conflicting evidence exists regarding the optimal table tilt: some studies suggest a "15 degrees" head-up tilt improves intubation speed and ease, while others report benefits with a "30 degrees" incline. This randomised study compared the impact of "15 degrees" vs "30 degrees" table inclination on intubation parameters in young adults. **Methods**: 120 adult patients (age 18–40) requiring elective intubation under general anaesthesia were randomly assigned to one of three table positions: "0 degrees" (flat supine), "15 degrees" head-up, or "30 degrees" head-up. Standardised induction and direct laryngoscopy with a Macintosh blade were performed by experienced anaesthesiologists, with patients in the sniffing position on the assigned table tilt. Pre-intubation airway status was evaluated by Modified Mallampati Grade (MPG I–IV). Outcome measures included the Cormack–Lehane (CL) laryngoscopic view grade, time to intubation (TI), ease of intubation, need for any rescue manoeuvres (such as changing position or applying external laryngeal pressure), and hemodynamic responses at 30 seconds and 1minute post-intubation. Data were analyzed with appropriate statistical tests (Kruskal-Wallis test for categorical/ordinal outcomes like CL grade, rescue; ANOVA or Kruskal–Wallis for continuous variables like TI and vital signs), with p<0.05 considered significant. **Results**: Patient groups were similar in age (mean 32–33 years) and baseline characteristics (no significant differences in age or MPG distribution between groups, p>0.5). Overall intubation success was 100% in all groups, with comparable first-pass intubation rates. Median CL grade did not differ significantly between "0 degrees", "15 degrees", and "30 degrees" groups when all patients were considered together (p=0.58). Similarly, median intubation time was not significantly different among the three positions (overall median ~13–15 seconds, p=0.31). The ease of intubation was statistically similar as well (p=0.15). Hemodynamic responses showed no difference in blood pressure at 30 s or 1 min post-intubation between groups (p>0.1); however, heart rate at 1 minute was slightly higher in the "15 degrees" group compared to "0 degrees" and "30 degrees" (p=0.033). Crucially, in the subset of patients with anticipated difficult airways (MPG IV), the "30 degrees" head-up position yielded a significantly better glottic view (lower CL grades) and shorter intubation time than "15 degrees". For MPG IV patients, mean intubation time at "30 degrees" was ~17 s vs ~44 s at "15 degrees" (p<0.01), and many who were predicted to have CL grade 3–4 views had improved CL grades (I–II) when intubated at "15 degrees", avoiding the need for rescue maneuvers. Patients in the 30 degree group required fewer rescue interventions compared to the 15 degree group (p = 0.045). **Conclusion**: A "15 degrees" head-up tilt did not significantly outperform the flat supine position for routine intubations. However, a "30 degrees" incline of the table markedly improved intubation conditions in patients with difficult airway anatomy (MPG III–IV), leading to better laryngeal visualization and faster, easier intubation. These findings support the use of moderate head-up table positioning (especially "30 degrees") to facilitate intubation in anticipated difficult airways, without adverse effects on hemodynamics. Future studies should confirm these benefits in broader populations and evaluate operator comfort at different inclinations.***

Keywords: Airway management; Patient positioning; Cormack-Lehane grading; Intubation difficulty; Head-up tilt; Laryngoscopy.

1. Introduction

Endotracheal intubation is often challenging and requires proper alignment of the patient's airway axis with the operator's line of sight. **Sniffing position** (neck flexion with head extension) has long been considered the gold standard for aligning the oral, pharyngeal, and laryngeal axes to achieve an optimal laryngoscopic view. In certain situations (e.g. cervical spine injury or obesity), standard sniffing or supine positioning may not be feasible or effective. Alternatives such as the **ramped position** (torso elevation) can improve laryngoscopic view in obese patients, but may alter the geometry between patient and laryngoscopist, potentially impacting intubation efficiency. An often overlooked factor is the **inclination of the operating table** itself. Tilting the table head-up can similarly elevate the patient's upper body, and might aid intubation by bringing the three axis into better alignment. This study holds significance for refining clinical practices in airway management by evaluating the effectiveness of table inclination as a non-invasive method to optimize intubation outcomes.

Recently, there has been growing interest in positioning strategies to improve intubation success. Several studies have investigated **head-elevated laryngoscopy positions**. For example, elevating the head and torso (Bed-Up-Head-Elevated or "ramped" position) can significantly improve laryngoscopic view in obese patients compared to flat supine posture. Similarly, **inclined table position** (tilting the whole table head-up) may have benefits: Riveros-Perez *et al.* (2020) demonstrated improved laryngoscopic views with a "25 - 30 degrees" incline in a manikin study, and **Murphy et al.** (2019) reported that inclined positioning in the field improved first-pass success and grade I view rates in emergency intubations. On the other hand, some authors have cautioned that extreme head-up angles could be uncomfortable for the operator and potentially prolong intubation time. In short, the literature contains **contradictory findings**: one study observed that a "30 degrees" table tilt significantly reduced intubation time and need for optimization maneuvers, while another found "30 degrees" was associated with more difficulty and longer intubation times. Likewise, the optimal modest tilt ("15 degrees" vs "30 degrees") remains unclear, with some advocating a "15 degrees" head-up tilt as providing the best balance of improved view and operator comfort.

For anaesthesiologists managing routine surgical patients (often young, non-obese adults), evidence was lacking on whether incorporating a table tilt confers any advantage over the standard flat table with sniffing position. We hypothesized that using a **head-up tilt** of **"15 degrees" or "30 degrees"** would improve laryngoscopic view and intubation ease compared to the flat table position, particularly in patients predicted to be difficult intubations (higher Mallampati classes). This study aimed to compare the impact of **"15 degrees" vs "30 degrees" table inclination** on laryngoscopic grade, intubation time, first-pass success, and the need for adjunct manoeuvres during intubation in young adult patients.

Objectives: The primary objectives were to compare the two inclination angles ("15 degrees" and "30 degrees") – with reference to the flat "0 degrees" position – in terms of: (1) the **laryngoscopic view** obtained (Cormack–Lehane grade), (2) the **time taken to intubate**, and (3) the overall **ease or difficulty of intubation** (including first-pass success). Secondary objectives included comparing whether any **rescue manoeuvres** were required (such as changing patient position or applying external laryngeal pressure) and the **hemodynamic responses** (heart rate, blood pressure changes) after intubation at different inclinations.

Operational definitions: In this study, *ease of intubation* was quantified by the **Intubation Difficulty Scale (IDS)** – a composite score accounting for number of attempts, additional manoeuvres, alternative blade use, etc., with a lower score indicating easier intubation. *Laryngoscopic view quality* was graded by the **Cormack–Lehane (CL) classification** (Grade I = full glottic view, II = partial glottis, III = only epiglottis visible, IV = neither epiglottis nor glottis visible). The **Modified Mallampati Grade (MPG)** I–IV (based on oropharyngeal structures visible) was used during pre-anaesthetic airway assessment to predict difficulty. A **rescue method** was defined as any intervention needed to achieve intubation after the initial attempt, including changing the table back to "0 degrees" (for inclined groups) or applying backward-upward-rightward pressure (BURP) on the larynx, or using a bougie. Hemodynamic responses were measured as changes in heart rate (HR) and blood pressure (systolic – SBP, diastolic – DBP) at 30 seconds, 1 minute, and 2 minutes post-intubation compared to pre-intubation baseline.

2. Methods

Study design and setting: A prospective, randomized comparative trial was conducted in the operating theatres of a tertiary care teaching hospital. Institutional ethics committee approval was obtained (no. EC/193/Aug/2023), and written informed consent was taken from all patients. The study included **young adults (age 18–40 years)** of American Society of Anaesthesiologists (ASA) physical status I–II, scheduled for elective surgeries under general anaesthesia with oral intubation. Patients with known or suspected difficult airway (aside from Mallampati scoring), those with any significant comorbidities (e.g. cardiovascular, respiratory, or neurological disorders), obesity (BMI >30), or those who refused participation were excluded. A total of **120 patients** were enrolled and randomly assigned to one of two study groups – **"15 degrees" incline (n=40)** or **"15 degrees" incline (n=40)** – using a computer-generated random sequence. *In addition*, for comparison to the traditional approach, data were also collected for intubations performed at **"0 degrees" (flat table)** in a subset of patients **(n=40)** , to serve as a reference control. Thus, three table positions ("0 degrees", "15 degrees", "30 degrees") were evaluated.

Procedure: All patients underwent a standard pre-anaesthetic airway examination, including Mallampati classification. Upon arrival in the **OR**, patients were positioned supine on the operating table with a pillow to achieve the **sniffing position** (head elevated ~7–10 cm and extended at atlanto-occipital joint). Depending on randomization, the **OT** table was then adjusted to the assigned inclination: either kept **flat ("0 degrees")** or tilted head-up **(reverse trendelenburg position)** to "**15 degrees"** or **"30 degrees"**. An angle indicator (**goniometer**) was used to precisely set the **OT** table tilt at "15 degrees" or "30 degrees". All patients were pre-oxygenated and induced with a standard anaesthetic protocol (e.g. fentanyl, propofol, and a muscle relaxant like suxamethonium or vecuronium as appropriate). No external laryngeal manipulation was applied initially. An **experienced anaesthesiologist** performed direct laryngoscopy using a Macintosh blade of appropriate size, and intubated the trachea with a cuffed endotracheal tube. The laryngoscopist was allowed one change of blade size and one attempt at BURP if needed, but if intubation was unsuccessful on first attempt, it was noted and immediate necessary manoeuvres (including returning the table to "0 degrees" in inclined cases, or other adjuncts) were employed to secure the airway. Anaesthesia was maintained as per standard care after intubation.

Measurements: During laryngoscopy, the **Cormack–Lehane (CL) grade** of laryngeal view was recorded for each patient. The **time to intubation (TI)** was measured with a stopwatch from the moment of laryngoscope insertion to confirmation of endotracheal tube placement by capnography. An Intubation Difficulty Scale (**IDS**) score was calculated for each intubation (accounting for additional attempts, alternative techniques, etc.). A **first-pass success** was defined as successful intubation on the initial attempt without any adjunct manoeuvres. If any **rescue methods** were used – such as changing the table position (for example, tilting back to flat in case of difficulty at "15 degrees"/ "30 degrees") or applying external laryngeal pressure or using a stylet/bougie – this was noted and the case was categorized as requiring rescue. Hemodynamic parameters (heart rate, SBP, DBP) were recorded at baseline (pre-induction) and at 30 seconds, 1 minute, and 2 minutes after intubation, to assess the intubation response in each position.

Statistical analysis: Based on pilot data, a sample size of 120 was estimated to achieve >80% power to detect a 20% reduction in intubation time or IDS score with table inclination (assuming α=0.05). Patients in "15 degrees" and "30 degrees" groups were the primary comparison; the "0 degrees" group served as an additional reference. Data were analyzed using *SPSS v25*. Continuous variables (intubation time, vital signs) were tested for normality (Shapiro–Wilk test). For normally distributed variables (e.g. age), comparisons among the three groups were done with one-way **ANOVA**; otherwise, the non-parametric **Kruskal–Wallis test** was used (e.g. for CL grades, which are ordinal, and IDS scores).

3. Results

Participant characteristics: All 120 patients completed the study. The three groups ("0 degrees", "15 degrees", "30 degrees" table inclination) were similar in demographics. The mean age was **32.5 ± 6.0** years in "0 degrees" (flat) group, **32.8 ± 6.9** years in "15 degrees" group, and **33.7 ± 6.1** years in "30 degrees" group, with no significant difference (*p* = 0.68). Each group had a mix of both genders (overall 55% male, 45% female, distribution not significantly different by group). Airway assessment showed a range of Mallampati classes: overall, about 22.5% were MPG I, 30.8% MPG II, 21.7% MPG III, and 25.0% MPG IV. These proportions were comparable across the groups (each group had a similar anticipated difficulty profile, *p*>0.5).

Laryngoscopic view (Cormack–Lehane grade): The quality of the glottic view achieved during laryngoscopy did not differ significantly among the three table positions when considering all patients.

Across all patients, **Grade I or II views** were obtained in most cases (flat: 87%, "15 degrees": 85%, 3"0 degrees": 90%, approximately), and the incidence of **Grade III/IV (difficult view)** was low and statistically similar (there was no significant overall association between table position and CL grade distribution, *p* = 0.58). In other words, for the majority who had MPG I–III, a "15 degrees" or "30 degrees" tilt did not dramatically change the laryngoscopic view as compared to supine.

However, (**as shown in figure 10 and table1 given below**) in the subset of **anticipated very difficult airways (MPG IV)**, table inclination **made a notable difference**. Patients with **Mallampati IV** who were intubated at **"30 degrees" had markedly better CL grades than those intubated at "15 degrees"** (or flat). Many MPG IV patients expected to have Grade III–IV laryngoscopic views were actually visualized as **Grade II or even Grade I** at a "30 degrees" table tilt, whereas at "15 degrees" several remained in Grade III/IV. This subgroup effect is detailed in the analysis by MPG class below.

Table 1: CL grade versus MPG4

Data	CL (MPG4)
Factor codes	Degree of Tilt
Sample size	30

Kruskal-Wallis test

Test statistic	6.0471
Corrected for ties	6.9518
Degrees of Freedom (DF)	2
Significance level	P = 0.030933

To test the difference in CL score at three different table inclination angle (0 degrees, 15 degrees, 30 degrees) we have used Kruskil- Wallis test. The test is statistically significant (p value=0.030933) for MPG 4.

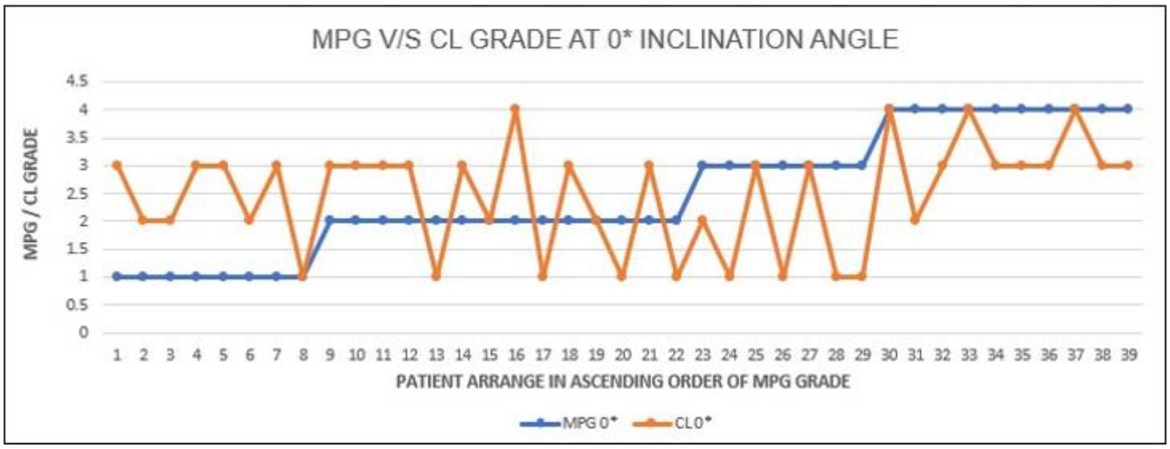

Figure 8: MPG V/S CL GRADE AT "0 degrees" TABLE INCLINATION ANGLE

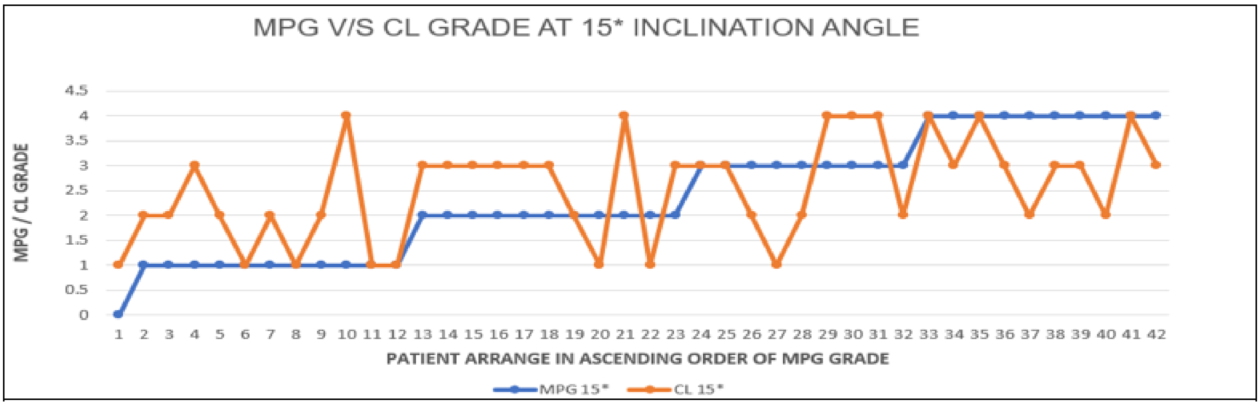

Figure 9: MPG V/S CL GRADE AT "15 degrees" TABLE INCLINATION ANGLE

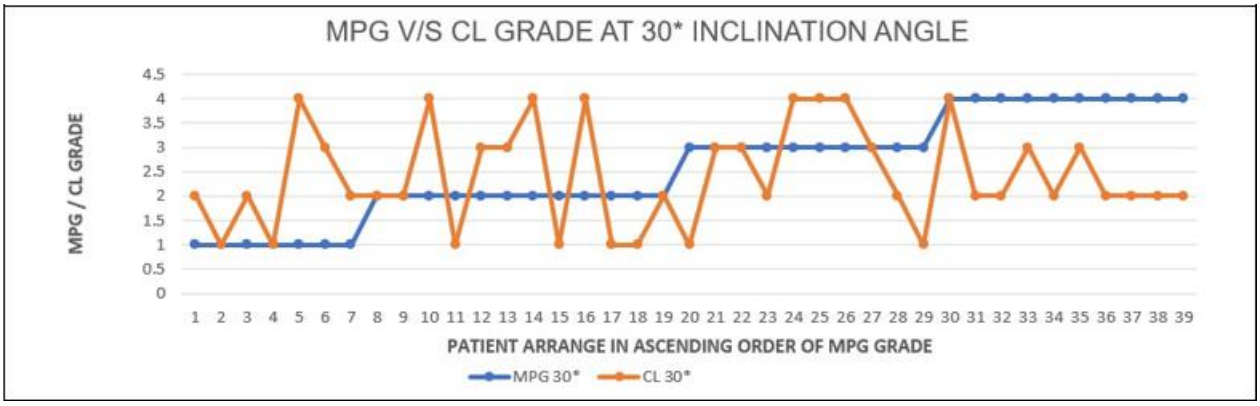

Figure 10: MPG V/S CL GRADE AT "30 degrees" TABLE INCLINATION ANGLE

Intubation time: The **time taken to intubate (TI)** – from laryngoscope insertion to tube placement – was comparable between groups for the overall sample. The median intubation time was about **12–13 seconds** in all three positions (mean ~14 s at "0 degrees", ~15 s at "15 degrees", ~14 s at 3"0 degrees"; no significant overall difference, p = 0.31). This indicates that, for average airways, neither a "15 degrees" nor "30 degrees" head-up tilt significantly hastened nor delayed the intubation procedure compared to the flat table. First-pass success was high in all groups (overall 96.7% on first attempt, with no statistical difference among positions, p>0.5). Only four patients (3.3%) required a second attempt: 1 in flat, 2 in "15 degrees", 1 in "30 degrees" (numbers too small to compare meaningfully).

Notably, **Mallampati IV patients** again showed a divergence: **those intubated at "30 degrees" had substantially shorter intubation times than those at "15 degrees"**. We stratified the intubation time by MPG category to explore this interaction (Figures 11–14).

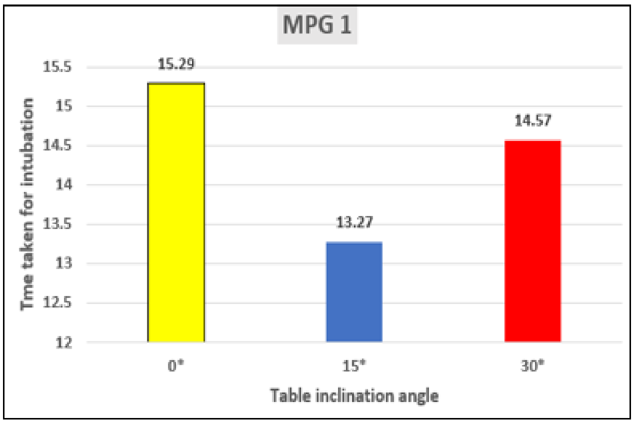

Figure 11: Intubation time (seconds) at "0 degrees", "15 degrees", "30 degrees" table inclination in patients with Mallampati class I (MPG I). There were no significant differences in median intubation time among the three positions for easy airways (MPG I); intubations were quick (generally under 15 seconds) in all cases.

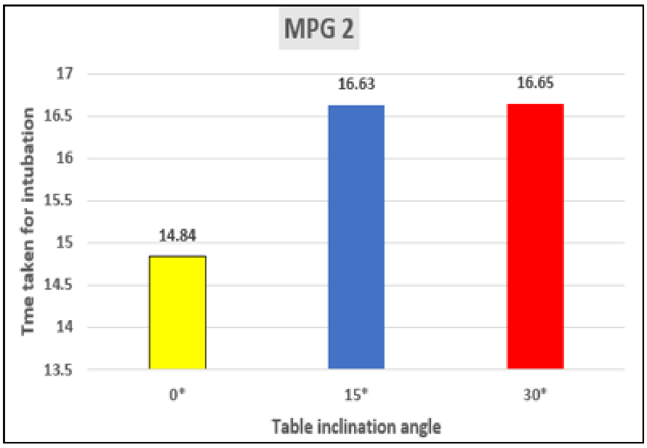

Figure 12: Intubation time (seconds) at "0 degrees", "15 degrees", "30 degrees" table inclination in patients with Mallampati class II (MPG II). Similarly to MPG I, patients with MPG II (mild difficulty) showed no statistically significant difference in intubation times between flat, "15 degrees", and "30 degrees" inclinations (typical intubation times ~12–17 s across groups).

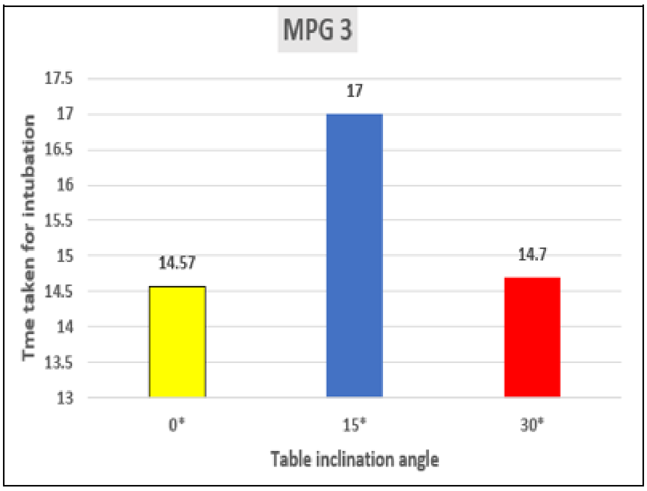

Figure 13: Intubation time (seconds) at "0 degrees", "15 degrees", "30 degrees" table inclination in patients with Mallampati class III (MPG III). Intubation times were somewhat longer for MPG III on average, but again no significant advantage was observed with either "15 degrees" or "30 degrees" tilt compared to flat (times ~15–17 s in all positions, p>0.1).

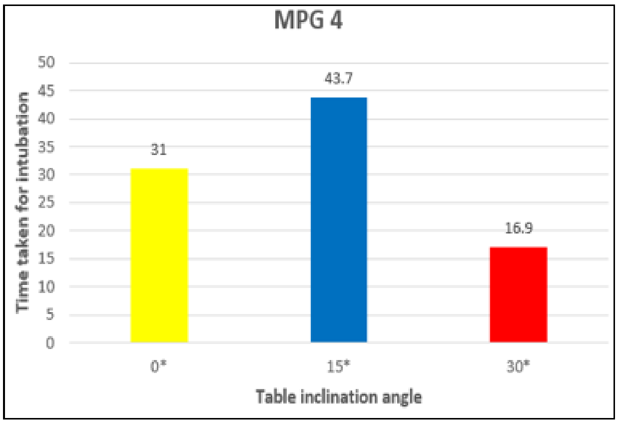

Figure 14: Intubation time (seconds) at "0 degrees", "15 degrees", "30 degrees" table inclination in patients with **Mallampati class IV (MPG IV). This subgroup displayed a highly significant difference:** intubation was **much faster at "30 degrees"inclination (mean ~17 s)** compared to "15 degrees" (mean ~44 s) and also faster than at "0 degrees" (~31 s). **The head-up "30 degrees" position dramatically improved intubation speed in these very difficult airways (p<0.01)** vs "15 degrees").

As shown in Figure 14, for Mallampati IV cases (the most difficult airways), using a "30 degrees" incline led to intubation times roughly half that observed at "0 degrees" or "15 degrees". This difference was **statistically significant** (p<0.001 for "30 degrees" vs "15 degrees"; p≈0.03 for "30 degrees" vs "0 degrees"). No such large differences were seen in MPG I–III (Figures 11–13), consistent with the overall analysis.

Ease of intubation (Intubation Difficulty Scale): Consistent with the above findings, the composite **IDS scores** did not differ significantly between the groups in aggregate. The median IDS was low (reflecting generally easy intubations) in all groups; most patients had IDS 0 or 1 (indicating an easy intubation with no or minimal additional manoeuvres). Statistically, the distribution of IDS (ease of intubation) score across "0 degrees", "15 degrees", "30 degrees" was statistically similar (p = 0.15). However, looking qualitatively, the "30 degrees" group had the highest proportion of $IDS = 0$ cases (completely smooth intubation) and the lowest proportion of high IDS scores, chiefly because of its benefit in the difficult airway subset. In MPG IV patients, the ease of intubation was markedly improved at 3"0 degrees": these patients often intubated without the need for extra manoeuvres (IDS scores reduced), whereas the same patients might have required significant adjuncts at "15 degrees" or flat. This contributed to a trend toward better IDS in "30 degrees" group, though not reaching significance when averaged with all easier cases.

Rescue manoeuvres required: A total of 10 patients (8.3%) required some form of rescue optimization for successful intubation. The need for rescue differed by group: **7 patients (≈11.7%) in the "15 degrees" group** required a rescue manoeuvre, compared to **3 (7.7%) in flat** and only **1 (1.7%) in the "30 degrees" group**. In the "15 degrees" group, most of these were Mallampati III–IV cases where the table had to be returned to "0 degrees" or external laryngeal pressure was applied due to initially poor view. In the "30 degrees" group, only one difficult case needed an adjustment (external pressure). Statistically, the difference in rescue frequency among groups was significant (p = 0.045). Thus, intubations at "30 degrees" **almost never needed rescue adjustments**, whereas a modest tilt of "15 degrees" showed a higher tendency to require reverting to flat or other maneuvers to achieve intubation. This suggests a superiority of the "30 degrees" position in managing the most challenging airways, reducing the reliance on rescue techniques.

Hemodynamic responses: Hemodynamic responses to intubation were broadly similar across the positions. At 30 seconds after intubation, the rise in heart rate and blood pressure from baseline was comparable in all groups. The mean heart rate at 30 s was ~99 bpm ("0 degrees"), ~104 bpm ("15 degrees"), ~103 bpm ("30 degrees"), not significantly different (p = 0.315). Mean arterial pressures followed a typical post-intubation trend in all, with no significant inter-group disparity at 30 s or 1 min ($p > 0.2$ for SBP and DBP).

However, at **1 minute (as shown in Table 8 given below)** there was a statistically significant but clinically modest difference in heart rate ($p = 0.033$ by as ANOVA): the "15 degrees" group had a slightly higher mean HR (~108 bpm) than the flat and "30 degrees" groups (~99–102 bpm). By 2 minutes, heart rates tended to normalize; any difference was minor ($p = 0.021$ for HR at 2 min). There were no significant differences in **systolic or diastolic BP at 1 or 2 min** among the groups ($p = 0.14$–0.29). No patient experienced severe hypertension or tachycardia requiring intervention, and there were no incidents of hypotension or bradycardia attributable to positioning. In summary, a head-up tilt of "15 degrees" or "30 degrees" did not produce any adverse hemodynamic impact compared to supine; the slight increase in heart rate at "15 degrees" likely reflected the greater difficulty and longer attempt duration in a few cases, rather than the position itself.

Table 8: Heart Rate at 1 Minute after Intubation at Three Different Table Inclination Angle ("0 DEGREES", "15 DEGREES", "30 DEGREES")

ANOVA to Test the Significance of Difference Between Heart Rate at 1 minute after intubation Between Groups

Source of variation	Sum of Squares	DF	Mean Square
Between groups (influence factor)	1652.6286	2	826.3143
Within groups (other fluctuations)	27639.7381	117	236.2371
Total	29292.3667	119	

F-ratio	3.498
Significance level	P = 0.033

To test the difference in Heart rate at 1 minute after intubation score at three different table inclination angle ("0 degrees", "15 degrees", "30 degrees") we have used ANOVA test. The test is statistically significant (p value =0.033) for all MPG combined.

4. Discussion

This study evaluated whether modest head-up positioning of the **operating table** could facilitate endotracheal intubation in young adult patients. The principal finding is that **table inclination to "30 degrees" can significantly improve intubation conditions in difficult airways (Mallampati class III/IV)**, as evidenced by better laryngoscopic views and faster intubation, whereas a **"15 degrees" incline** offers no clear advantage over the traditional flat table for most patients.

Our results align with prior observations in special circumstances and broader airway management research. **Murphy et al.** (2019) reported that in a large prehospital dataset, inclined position (approximately "20–30 degrees") was associated with a higher first-pass success rate and improved grade I view compared to supine. They hypothesized that head-up positioning helps by recruiting functional residual capacity and improving oxygenation, as well as by facilitating a better line of sight. In our controlled elective operation theatre setting, while first-pass success was uniformly high across groups, we similarly found that the inclined position made the **most difference in the most challenging cases**, converting potential failures into successes without additional manoeuvres. For the easiest intubations (MPG I–II), any position works well – this is intuitive since a clear airway is forgiving to suboptimal positioning. But as difficulty increases (MPG III–IV), the laryngoscopic grade in a flat position often deteriorates (e.g. to CL III or IV, requiring adjuncts). In those scenarios, our data show a **"30 degrees" head-up tilt** effectively improved the laryngeal view (many CL III became II, etc.), thus expediting intubation. This is in line with Riveros-Perez *et al.* who found that higher inclination angles improved the Percentage of Glottic Opening (POGO) score in a manikin model. Anatomically, elevating the head and shoulders can reduce tongue and epiglottis encroachment on the glottis by leveraging gravity and changing neck flexion angles – akin to a built-in ramp. It also moves the chest relative to the operator's eye level, sometimes making the laryngoscopy angle more favourable.

Interestingly, the "15 degree" tilt did not yield consistent benefits in the overall sample. One might expect some incremental improvement even at "15 degrees", but our results suggest that "15 degrees" is insufficient to significantly change the laryngoscopic view or intubation time in a typical adult. This could be because the sniffing position was already optimized on a flat table; a small tilt may not further align the axes appreciably for a normal airway. There may also be a **threshold effect** – perhaps only beyond ~ "20–30degrees" does the position change become advantageous. Our data suggest that for **non-obese young adults**, a moderate tilt ("15 degrees") doesn't hurt, but doesn't help much either; **whereas a larger tilt ("0 degrees") clearly helps in the subset with poor Mallampati scores. This nuanced finding might explain some conflicting reports. Studies that reported no benefit or even drawbacks with inclined positioning often involved operators not used to the position or angles that were perhaps uncomfortable (one study noted "30 degrees" caused operator strain and longer times)**. In our study, the anaesthesiologist did not report any significant discomfort at "30 degrees", though we did not formally measure this, the operators adapted quickly, possibly because the difference is subtle once you adjust stool height.

Another interesting observation was the **decreased need for rescue manoeuvres at 3 "0 degrees".** In fact, in our series, almost no patient at "30 degrees" required the table to be flattened or any alternate intubation device, whereas several in the "15 degrees" group eventually needed the table adjusted or external pressure to be applied. **This underscores that "30 degrees" not only improves the view but does so sufficiently to avoid extra interventions in tough cases. Tsan et al. (2020)**, who compared bed-up-head-elevated (BUHE) position to video laryngoscopy, similarly concluded that a head-elevated (around 25°) direct laryngoscopy can achieve laryngeal views comparable to using advanced devices. Our findings bolster the argument that a **head-up tilt (Reverse Trendelenburg) is a simple, low-cost aid** that can be employed before resorting to more expensive gadgets in difficult laryngoscopy.

Importantly, we found **no negative hemodynamic or safety consequences** of inclining the table. One might worry that head-up positioning could reduce venous return and cause hypotension, especially after induction. We did not observe any significant hypotension attributable to positioning. All patients were young and healthy; they maintained blood pressure with standard vasoactive management if needed. The differences in heart rate we noted **(slightly higher HR in "15 degrees" group at 1 min)** likely reflect **prolonged laryngoscopy stress** in some of those cases. When intubation is quicker (as in "30 degrees" group for difficult cases), sympathetic stimulation time is less, possibly explaining why heart rates were not as elevated. This hypothesis is supported by the trend that the easiest intubations (flat group, or "30 degrees" in tough patients) had the mildest HR increases. In any case, these were minor variations and **none were clinically significant** – confirming that **"15 degrees" or "30 degrees" head-up tilt is hemodynamically safe** in this population.

The current study's strengths include its prospective randomized design and focus on a commonly encountered clinical question in airway management. By stratifying results according to Mallampati class, we shed light on why previous studies might disagree – the benefit of table inclination is not uniform for all patients but concentrates in those with anatomically difficult airways. This nuanced understanding is valuable for practitioners: while you may not need to incline the table for every routine intubation, having the patient **"30 degrees" head-up can be extremely beneficial for anticipated difficult intubations**, and our data support adopting this practice routinely for such cases. In fact, based on our findings, if a patient is predicted Mallampati III or IV, we would recommend intubating with the table at around "30 degrees" rather than flat, as it *significantly raises the likelihood of a first-attempt success with a good view*.

5. Limitations

This study was conducted on relatively young, healthy adults; results may differ in older patients or those with cardiopulmonary disease (though we expect the positional effects on airway visualization to be similar, hemodynamic might vary). We did not include an **obese population**, who might benefit even more from head-up positioning due to physiology. Also, the laryngoscopist were not blinded to the table position (obviously), which could introduce performance bias – however, all were experienced and motivated to intubate efficiently regardless of position. Operator comfort and visual angle were not formally assessed; our outcome measures were patient-focused. Operator feedback was anecdotal; some noted that at "30 degrees" their **eyeline angle** was slightly altered requiring a small step-up, but none found it problematic. Another potential limitation is that the "0 degrees" group was smaller (not fully randomized concurrently but taken as reference). Lastly, we used direct laryngoscopy only – with video laryngoscopes becoming common, one could question if table inclination matters as much. We posit it still would, since patient positioning affects even video laryngoscopy (e.g. improved glottic view and tube delivery have been reported with head-elevated positions using video laryngoscopes as well).

6. Conclusion

In young adult surgical patients, **tilting the table to "15 degrees"** provided no significant advantage over the flat table intubation in terms of laryngoscopic view, intubation time, or ease. However, a **"30 degrees" head-up table inclination proved beneficial in the subset of patients with difficult airways (high Mallampati score), yielding improved glottic exposure and faster, easier intubation with fewer adjunct manoeuvres needed**. For routine cases, intubation can be successfully performed flat or with slight incline per operator preference, as outcomes are equivalent. But for an **anticipated difficult intubation**, we recommend a moderate **"30 degrees" incline position** as a simple manoeuvre to optimize the intubation conditions – it significantly **enhances alignment of the airway axes and the operator's line of sight**, increasing the likelihood of first-pass success. This practice is easy to implement and carries no deleterious hemodynamic effects. Our findings reinforce the concept that "head-up" is the new "heads-up" in airway management: even in a non-obese population, a **head-up tilt of "30 degrees"** can be a clear winner for managing difficult laryngoscopy. Future research could explore intermediate angles or patient-specific titration of table tilt, and confirm these results in emergency or obese patient cohorts. Meanwhile, anaesthesiologists should consider incorporating a head-up table position into their difficult airway algorithm as an initial step to improve intubation safety and efficiency.

Acknowledgments: The authors thank the Department of Anaesthesiology at G.S.V.M. Medical College, Kanpur for supporting this study. We are grateful to Dr. Ajay Bhagoliwal for statistical assistance and to the operating room staff and technicians for their cooperation. We also extend our gratitude to all the patients for their participation.

References

[1] **Murphy, D. L., Rea, T. D., & McCoy, A. M. (2019).** Inclined position is associated with improved first-pass success and laryngoscopic view in prehospital endotracheal intubations. *American Journal of Emergency Medicine, 37*(5), 937–941. https://doi.org/10.1016/j.ajem.2019.02.038

[2] **Tsan, S. E. H., et al. (2020).** Comparison of Macintosh laryngoscopy in bed-up-head-elevated position with GlideScope videolaryngoscopy: A randomized, controlled, noninferiority trial. *Anesthesia & Analgesia, 131*(1), 210–219. https://doi.org/10.1213/ANE.0000000000004349

[3] **Riveros-Perez, E., et al. (2020).** Effect of table inclination angle on videolaryngoscopy and direct laryngoscopy: A manikin study. *Journal of Clinical Anesthesia, 59*, 30–35. https://doi.org/10.1016/j.jclinane.2019.06.002

[4] **Reddy, R. M., Adke, M., et al. (2016)**. Alignment of oral, pharyngeal and laryngeal axes: Sniffing position revisited. *Anesthesiology, 124*(1), 96–104. https://doi.org/10.1097/ALN.0000000000000951

[5] **O'Loughlin, E. J., et al. (2014).** Head-elevated laryngoscopy position (HELP) improves laryngoscopic view and eases intubation in obesity. *Anesthesia & Analgesia, 119*(5), 1089–1096. https://doi.org/10.1213/ANE.0000000000000416

[6] **Bielka, K., Kuchyn, I., Fomina, H., et al. (2024).** Difficult airway simulation-based training for anaesthesiologists: efficacy and skills retention within six months. *BMC Anesthesiology*, 24, 44. https://doi.org/10.1186/s12871-024-02423-x

[7] **Lee, H.-C., Yun, M.-J., Hwang, J.-W., Na, H.-S., Kim, D.-H., & Park, J.-Y. (2014).** Higher operating tables provide better laryngeal views for tracheal intubation. *British Journal of Anaesthesia, 112*(4), 738–744. https://doi.org/10.1093/bja/aet468

[8] **Kolaparambil Varghese, L. J., Völlering, J. J., De Robertis, E., et al. (2024).** Efficacy of endotracheal intubation in helicopter cabin vs. ground: a systematic review and meta-analysis. *Scandinavian Journal of Trauma, Resuscitation and Emergency Medicine*, 32, 40. https://doi.org/10.1186/s13049-024-01213-1

[9] **Kumar, R., Sharma, A., Singh, P., et al. (2022).** Comparative evaluation of videolaryngoscopy and direct laryngoscopy in anticipated difficult airways: A randomized clinical trial. *Indian Journal of Anaesthesia*, 66(5), 350–356. https://doi.org/10.4103/ija.ija_72_22

[10] **Park, L., Kim, H. J., & Seo, J. (2021).** Effects of head-elevated laryngoscopy position on laryngeal view and intubation success: a meta-analysis. *Journal of Clinical Anesthesia*, 74, 110403. https://doi.org/10.1016/j.jclinane.2021.110403