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Original Research Article

A Randomized Controlled Study Assessing the Ease of Tracheal Intubation Between Supine and 25° Back-Up Positions When Using Two Video Laryngoscopes

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Abstract

Aim: The aim of the present study was to compare the ease of tracheal intubation between supine and 25° back-up positions when using two video laryngoscopes (VLS).

Methods: This randomised controlled study was conducted at ESIC Medical College, Bihta, Patna, Bihar, India for the period of 1 year. Written informed consent was obtained from all the participants to use their data for research and educational purposes. The study was conducted in agreement with the Declaration of Helsinki, 2013 and adherence to the Consolidated Standard of Reporting Trials (CONSORT) guidelines.

Results: There were male predominance in all the groups and in group K1 mouth opening was higher. The mean (SD) mIDS was less in the 25° backup position as compared to the supine position by using both the King Vision and the McGrath VLS. The ELM was required in eight and four patients in groups K1 and K2, respectively. In contrast, it was needed in seven and three patients in groups M1 and M2, respectively. 12 and 8 patients required tube rotation in groups K1M1 and K2M2, respectively. Both manoeuvres were used in three patients in group K1 and two in group M1. A total of 68% in group K1 versus 32% in group K2 who required airway manoeuvres, whereas 60% versus 28% of patients needed airway manoeuvres in M1 versus M2 during intubation. Calculating the total number of patients requiring manoeuvres in the 25° back-up and supine positions by using King Vision and McGrath VLS resulted in a risk ratio of 0.48, $P < 0.001$, 95% CI: 0.305–0.765, and an odds ratio of 0.24 with a 95% CI 0.10 − 0.55. The intubation time was shorter using the 25°back-up position compared to the sniffing position using both the King Vision and the McGrath. Intubation was accomplished on the first attempt in all the groups.

Conclusion: The 25° backup position is useful in providing ease of intubation using both the channelled (King Vision) and non-channelled (McGrath) VLS with less requirement of ancillary manoeuvres and shorter intubation time without complications.

Keywords: Endotracheal intubation; preoxygenation; sniffing; supine position; video laryngoscope

Introduction

The 'sniffing' position is traditionally considered the optimal head and neck position for direct laryngoscopy. [1,2] The Difficult Airway Society (DAS) 2015 guidelines state that the patient should be optimally positioned before induction of anaesthesia. [3,4] Therefore, when a patient is in the 'sniffing' position before induction of anaesthesia and the initial attempt at direct laryngoscopy proves difficult, most anaesthetists are likely to use the same position to proceed with video laryngoscopy. A suboptimal position could result in a 'wasted attempt' at laryngoscopy and further repeated attempts can be associated with poor outcomes. [5,6]

Video laryngoscopy is now widely used as a rescue technique for failed direct laryngoscopy. [7] The design of video laryngoscopy and the technique of video laryngoscopy differ from direct laryngoscopy.

Most video laryngoscopes have acute-angled blades with a camera positioned at the distal end of the blade, therefore, the placement of the tracheal tube is a video-guided procedure which differs from direct laryngoscopy. [8,9] The successful placement of the tracheal tube during video laryngoscopy may depend on several factors including the head and neck position. [10]

The ideal head and neck position for video laryngoscopy has not yet been described. Intuitively, the 'sniffing' position might not be advantageous when performing video laryngoscopy, as the need to align the three anatomical axes to obtain a direct view of the glottis is not necessary. One of the technical difficulties associated with video laryngoscopy is impingement of the tracheal tube or of the gum elastic bougie on the anterior wall of the trachea. [11] When this occurs soon after passing the tracheal tube or bougie through the vocal cords, it can result in a failed tracheal intubation attempt.

Data are available regarding the increase in the percentage of glottic opening (POGO) score and better endoscopy angles with a 25°back-up position compared to the supine position with direct laryngoscopy, and bed-up head elevated position has been proposed as the standard position in the general population using direct laryngoscopy.[12,13] However, data comparing the supine and 25°back-up positions for different VLSs, such as King Vision (channelled) and McGrath (non-channelled), are scarcely available.

The aim of the present study was to compare the ease of tracheal intubation between supine and 25° back-up positions when using two video laryngoscopes (VLS).

Materials and Methods

This randomised controlled study was conducted at Department of Anesthesiology, ESIC Medical College, Bihta, Patna, Bihar, India for the period of 1 year. Written informed consent was obtained from all the participants to use their data for research and educational purposes. The study was conducted in agreement with the Declaration of Helsinki, 2013 and adherence to the Consolidated Standard of Reporting Trials (CONSORT) guidelines.

We enrolled 200 adult patients of either gender of age 18–65 years, belonging to the American Society of Anesthesiologists (ASA) physical status classes I and II and modified Mallampati grading I and II requiring general anaesthesia with endotracheal intubation. The patients having difficult airways, morbid obesity, previous oral cavity surgeries, pre-existing tracheal or laryngeal pathology, patients requiring rapid sequence intubation, those not willing to participate, and pregnant females were excluded. The patients were randomised into two groups primarily and then into two sub-groups, each by computer-generated random numbers, which were sealed in sequentially numbered sealed opaque envelopes. In the K1 group, the trachea was intubated using a King vision VLS in the supine position, and in the K2 group, the trachea was intubated using a King vision VLS in the 25° back-up position. In the M1 group, the trachea was intubated using a McGrath VLS in the supine position. In the M2 group, the trachea was intubated using a McGrath VLS in the 25° backup position.

A thorough pre-anaesthetic evaluation was done, including airway assessment and necessary laboratory investigations. All patients were kept nil by mouth for 8 h for solid food with clear liquids 2 h before the procedure. After receiving the patient at the operation theatre, the monitoring included pulse oximetry, non-invasive blood pressure, electrocardiogram, and capnography. Patients were given either supine (sniffing) or a 25° backup position according to their respective study groups. In the supine position, a 7-cm-high non-compressible pillow was kept under the head of the patient. The 25° backup position was achieved by raising the operating table to 25° from the horizontal position by flexing the torso at the hips by using the controls on the operating table so that the sternal notch and external auditory meatus were in the equal plane. The 25° angulation was checked using the 'protractor' app on the smartphone. For patients in group K, the King Vision channelled blade of appropriate size was mounted on the monitor, and the device's functionality was checked once by having a clear image on the monitor. Next, the appropriately sized tube was lubricated with lignocaine jelly, and the device was pre-loaded with the tube in the tube guiding channel of the blade. For patients belonging to group M, the blade of the appropriate size was mounted on the McGrath VL, and the performance of the device was checked by watching the clarity of the image on the monitor. Intravenous (IV) glycopyrrolate 5µg/kg, fentanyl 2µg/kg, and ondansetron 0.1 mg/kg were given as premedication 5 min before induction. After pre-oxygenation, induction of anaesthesia was carried out with IV propofol 2.5mg/kg and suxamethonium chloride 2 mg/kg as a neuromuscular blocking drug to facilitate tracheal intubation. The technique and device were followed as per randomisation for tracheal intubation. The first effective ventilation was confirmed by continuous square-form waveform capnography. The rest of the anaesthesia was continued as per standard protocol.

The study's primary outcome was to measure the ease of intubation by using mIDS. It is a predictor of difficult intubation, including seven parameters, namely the number of attempts, number of operators, number of alternative intubation techniques (e.g., use of a bougie and rotation of the VL blade or endotracheal tube or bougie), POGO

score, lifting force required, external laryngeal manipulation (ELM), and position of the vocal cords at intubation. These parameters were looked for during each intubation by using the VLS in the supine and 25° backup positions, and mIDS was calculated accordingly. Secondary outcomes measured were intubation time, number of intubation attempts, vital parameters, and complications, if any. Intubation time was considered as the time from the insertion of the VLS blade between the teeth until the first effective ventilation was confirmed by capnography. If the patient could not be intubated with optimisation manoeuvres or if >120 s were required to complete the procedure, it was reported as failed intubation. In such a situation, the patient would be intubated using a Macintosh laryngoscope and excluded from the study. A maximum of two attempts with the selected VLS were allowed before changing to another device. Complications such as desaturation (peripheral oxygen saturation <95%), bronchospasm, oropharyngeal trauma, and oesophageal intubation were also noted and managed accordingly.

Considering dropouts, we included 200 patients per group (50 patients/sub-group). The master chart was prepared in Microsoft Excel, and the values were noted as mean (SD) for parametric data and either numbers or percentages for non-parametric data. Statistical analysis was done using MedCalc software (version 19.2.6. Ostend, Belgium). An independent t-test was applied for parametric data such as mIDS, intubation time, and complications. The Chi-square test was used for categorical data such as ASA grading, gender, manoeuvres used during intubation, number of intubation attempts, and for calculating the risk ratio. The significance of the data was judged by the P value, and $P < 0.05$ was considered statistically significant.

Results

Table 1: Demographic and airway parameters

Parameter	Group K1	Group K2	Group M1	Group M2
Age (years)	41.5 (8.42)	40 (11.32)	39.06 (12.84)	40.12 (8.72)
Gender Male:Female	28:22	26:24	30:20	24:26
ASA physical status I/II	22:28	18:32	18:32	28:22
Mouth Opening (cm)	3.60 (0.50)	3.55 (0.51)	3.56 (0.49)	3.51 (0.49)
Mallampati Grade I	26	30	24	28
Grading Grade II	24	20	26	22
Thyromental distance (cm)	7.19 (0.44)	7.16 (0.43)	7.02 (0.55)	7.03 (0.46)

There were male predominance in all the groups and in group K1 mouth opening was higher.

Table 2: Study Parameters

Parameter	Group K1	Group K2	P	Group M1	Group M2	P
modified Intubation Difficulty Scale (mIDS)	0.90 (0.75)	0.46 (0.58)	0.022	0.72 (0.59)	0.32 (0.48)	0.018
Manoeuvres used for tracheal intubation						
External laryngeal manipulation	16	8	2	14	6	2
Tube rotation	12	8	2	12	8	2
Both	5	0	-	4	0	-
Total patients requiring						
Manoeuvres	34 (68%)	16 (32%)	0.01	30 (60%)	14 (28%)	0.02
Time	20.8 (4.48)	15.75 (4.27)	0.007	20.56 (6.88)	17.04 (4.84)	0.052
Number of attempts of intubation	1	1	1	1	1	1

The mean (SD) mIDS was less in the 25° backup position as compared to the supine position by using both the King Vision and the McGrath VLS. The ELM was required in eight and four patients in groups K1 and K2, respectively. In contrast, it was needed in seven and three patients in groups M1 and M2, respectively. 12 and 8 patients required tube rotation in groups K1M1 and K2M2, respectively. Both manoeuvres were used in three patients in group K1 and two in group M1. A total of 68% in group K1 versus 32% in group K2 who required airway manoeuvres, whereas 60% versus 28% of patients needed airway manoeuvres in M1 versus M2 during intubation. Calculating the total number

of patients requiring manoeuvres in the 25° back-up and supine positions by using King Vision and McGrath VLS resulted in a risk ratio of 0.48, P < 0.001, 95% CI: 0.305–0.765, and an odds ratio of 0.24 with a 95% CI 0.10 − 0.55. The intubation time was shorter using the 25°back-up position compared to the sniffing position using both the King Vision and the McGrath. Intubation was accomplished on the first attempt in all the groups.

Discussion

Tracheal intubation is essential in securing airway patency during general anaesthesia. Traditionally, the 'sniffing' position is the optimal head and neck position for direct laryngoscopy. [14,15] The benefits of providing better laryngeal exposure and decreasing the stress response enabled video laryngoscopes (VLSs) to be widely used for endotracheal intubation.[14] However, the literature describing the ideal head and neck position for video-laryngoscopy is still lacking. Different positions, such as supine (neutral or sniffing) or 25° backup positions, are used in clinical practice. [16,17] Originally, a 25° backup position was used in obese patients for difficult intubation as administration of oxygen in this position increases the margin of safety for induction of anaesthesia by achieving 23% higher oxygen tension and better intubating conditions with direct laryngoscopy with comfort for the anaesthesiologist. [18,19]

Pachisia et al [18] compared laryngeal view and intubating conditions in the sniffing position and position acquired by aligning the external auditory meatus and sternal notch horizontally by using an inflatable pillow (AM-S) and found a significant reduction in the intubation difficulty scale with improved Cormack Lehane grading of laryngeal view in the AM-S position using Macintosh laryngoscope. A study compared sniffing and neutral positions by using channelled (King Vision) and non-channelled (C-MAC) VLS and found comparable mIDS with lower POGO scores by using C-MAC VLS in a neutral position.16 According to Tsan et al [13] Macintosh laryngoscopy in the bed-up head elevated position provides a non-inferior laryngeal view to Glidescope laryngoscopy but is superior to the view acquired in the sniffing position among the general population. Lee et al [12] found a significantly increased POGO score while comparing the laryngeal exposure during direct laryngoscopy in the supine and 25° back-up positions (42.2% versus 66.8%). There were male predominance in all the groups and in group K1 mouth opening was higher. The mean (SD) mIDS was less in the 25° backup position as compared to the supine position by using both the King Vision and the McGrath VLS. The ELM was required in eight and four patients in groups K1 and K2, respectively.

In contrast, it was needed in seven and three patients in groups M1 and M2, respectively. 12 and 8 patients required tube rotation in groups K1M1 and K2M2, respectively. Both manoeuvres were used in three patients in group K1 and two in group M1. A total of 68% in group K1 versus 32% in group K2 who required airway manoeuvres, whereas 60% versus 28% of patients needed airway manoeuvres in M1 versus M2 during intubation. Calculating the total number of patients requiring manoeuvres in the 25° back-up and supine positions by using King Vision and McGrath VLS resulted in a risk ratio of 0.48, P < 0.001, 95% CI: 0.305–0.765, and an odds ratio of 0.24 with a 95% CI 0.10 − 0.55. The intubation time was shorter using the 25°back-up position compared to the sniffing position using both the King Vision and the McGrath. Intubation was accomplished on the first attempt in all the groups. Agaskar et al [20] demonstrated a better laryngeal view by using ELM in supine sniffing rather than in the 25° backup position. The use of manoeuvres also aids in the intubation time. Using both the VLSs, the intubation time was shorter in the 25°back-up position.

Turner et al [21] observed in the emergency department. that every 5° increase in the angle enhances the likelihood of first-pass success with a high success rate using VL compared to a direct laryngoscope, The limitations of our study included the selection of patients with Mallampati grading I and II and confined to planned surgeries. In addition, the results cannot be generalised to patients with difficult airways, obese and pregnant patients, or those requiring emergency surgeries. Furthermore, the same results cannot be extrapolated to VLSs other than King Vision and McGrath.

Conclusion

The 25° backup position is useful in providing ease of intubation using both the channelled (King Vision) and non-channelled (McGrath) VLS with less requirement of ancillary manoeuvres and shorter intubation time without complications.

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