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Comparison of Sniffing Position and Head-Neck Position for Direct Laryngoscope

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Abstract:
Background: Positioning of the patients head and neck for best visualization of glottis is the prime need before laryngoscopy and intubation. The study was conducted to compare traditional sniffing position with head elevation/neck flexion position to find out which position provides better laryngoscopy and intubation in patients undergoing elective surgery under general anaesthesia.
Materials and Methods: One hundred patients were randomly allocated to two groups. In Group I (n=50), laryngoscopy was done in sniffing position, while in Group II (n=50), laryngoscopy was done in simple head extension with head flat on operating table. Glottic visualization was assessed by Cormack-Lehane grading and Intubation Difficulty Scale.
Results: More patients in head extension group had better glottic visualization compared to those in sniffng position. There was statistically significant difference between the two groups as per Cormack and Lehane grading (p=0.04). The total Intubation Difficulty Scale score indicated that ease of tracheal intubation was significantly better (p=0.02) in Group II (head extension position) as compared to Group I (sniffing position).
Conclusion: *Simple head extension position is better than traditional sniffing position with regarding to ease of intubation as found by Intubation Difficulty Scale.*

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I. Introduction

During direct laryngoscopy, tracheal intubation remains one of the commonest means of establishing an airway and the ability to maintain a good glottic visualisation [1]. Placing the patient's head and neck in an optimal position is the first and perhaps most important manoeuvre that is done routinely before laryngoscopy and intubation. Sniffing position has been traditionally recommended as the standard head position for optimal glottic exposure [2]. In this position, the neck is flexed on the chest by elevating the head with a cushion under the occiput thereby extending the head on the atlanto-occipital joint. It aligns the oral, pharyngeal and laryngeal axes, allowing the line of vision to fall directly on the laryngeal inlet [3].

However, studies have demonstrated that sniffing position is inadequate in optimizing glottis exposure in direct laryngoscopy in obese patients and in patients with known or suspected cervical spine injuries [4].

Intubation is sometimes easier by extending the head section of the operating table, or by removing the cushion from beneath the patient's head and placing it behind the shoulders. These manoeuvres result in atlanto-occipital extension and extension of the cervical vertebrae, thereby inducing neck flexion on the thorax. In non-obese patient with normal head extension, the simple maneuver of head extension against a flat surface inevitably flexes the neck, as demonstrated in an experimental study with use of Magnetic Resonance Imaging (MRI) [5].

The present study was conducted to compare sniffing position with simple head extension for glottic visualization during direct laryngoscopy and ease of tracheal intubation in patients requiring general anaesthesia.

II. Materials and Methods

After ethical clearance and obtaining written and informed consent, 100 patients of either sex, aged 18-65 years, American Society of Anaesthesiologists (ASA) physical grade I and II scheduled for surgery under general anaesthesia with endotracheal intubation in the Government Medical College, Jammu were randomly allocated into two equal Groups. In Group I patients (n=50), laryngoscopy was done in sniffing position made by putting a non-compressible cushioned pillow of height 8 cm under the patient's occiput. At the time of laryngoscopy, head was extended on atlanto-occipital joint maximally. In Group II patients (n=50); laryngoscopy was done in simple head extension with head flat on operation table and head extended maximally on atlanto-occipital joint. After induction of anaesthesia, laryngocopy was performed in all the patients using Macintosh laryngoscope by an experienced anaesthetist.

Exclusion criteria included patients with ASA physical status III and above, with body mass index more than 30 kg/m^2, restricted neck movements, neck circumference >40 cm at thyroid cartilage level, mouth opening less than 3 fingers breadth, bucked teeth and edentulous, thyromental distance less than 6.5 cm, limitation of anterior and posterior movement of mandible, pathologic conditions associated with difficulties in laryngoscopy, such as malformation of the face, cervical spondylosis, tumours of airway, limitation of mandibular anterior-posterior movement and loose teeth were examined and ruled out.

Preanaesthetic check-up including a detailed history, general and systemic examination was done a day before surgery to rule out any medical illness. Airway assessment included: Modified Mallampati Grading (MPG), Inter-incisor gap or Inter-Incisor Distance (IID), Thyromental Distance (TMD), Amplitude of neck and head movements as described by Wilson et al. [6]. Temporomandibular Joint (TMJ) movement was assessed. Body Mass Index (BMI) was calculated and noted. All the patients were thoroughly investigated as per requirement of surgery routine investigations.

After baseline vitals were noted, all the patients were pre-medicated prior to surgery with injection glycopyrolate 0.2 mg and injection fentanyl 2 μg/kg. Routine monitoring including three lead surface electrocardiogram (ECG), heart rate, pulse oximetry (SPO_2) and non-invasive blood pressure monitoring was done.

Following pre-oxygenation with 100% oxygen for three minutes, all the patients were given injection propofol titrated to loss of response to verbal commands and neuromuscular blocker injection succinyl choline 2 mg/kg. Laryngoscopy was performed in all the patients using Macintosh laryngoscope by an experienced anesthetist, competent with respect to airway management to ensure the consistency of the technique. Glottic visualization during laryngoscopy was assessed using duration of laryngoscopy. Laryngoscopy was considered prolonged if its duration exceeded 15 seconds.

Glottic visualisation was assessed by Cormack-Lehane grading and Intubation Difficulty Scale (IDS) Score (Table 1). Complications, like fall of SPO_2 and dysrhythmias during laryngoscopy were noted. Anaesthesia was maintained by using nitrous oxide (60%), oxygen (40%), isoflurane and injection vecuronium (0.1 mg/kg). At the end of surgical procedures, the residual effect of neuromuscular blocking agent was reversed with injection neostigmine 0.05 mg/kg and injection glycopyrolate 0.01 mg/kg body weight.

All the patients were extubated after they responded to verbal commands and had adequate spontaneous respiration and shifted to post-anaesthesia care. All the parameters were recorded in the predesigned proforma and statistically analysed at the end of study.

Descriptive statistics were calculated for continuous variables as mean, standard deviation and for categorical variables as frequency distribution and percentage. Unpaired t test (for continuous variables) and chi-square test for categorical variable were used to see the significance difference between the groups. SPSS 20.0 for Windows statistical software was used. A p-value of <0.05 was considered significant.

III. Results

The baseline demographic variables were statistically comparable between both, Group I and Group II (Table 2). Mouth opening, hyomental distance, thyromental distance and sternomental distance were statistically comparable in the two groups (Table 3).

Number of patients (60%) with Cormack and Lehane grade I were significantly more in Group II (head extension position) as compared to Group I (sniffing position) (38%) suggesting that glottic visualization was significantly better in head extension position. Similarly, partial glottic view was less in Group II (40%) as compared to much higher percentage (62%) in Group II. There was statistically significant difference between the groups regarding glottic visualization as per Cormack and Lehane grading (p=0.04) (Table 4).

On comparison of various intubation difficulty scale parameters in both the groups it was observed that intubation was easier in neck extension as compared to sniffing position. No supplementary attempt (N1) and supplementary operator (N2) was required in either of the two groups. Alternate intubation technique (N3) was required in more number of patients in Group I (10%) as compared to only 6% in Group II. Similarly it was seen that head extension position (60%) was better than sniffing position (36%) with regard to glottis visualization and tracheal intubation as indicated by Cormack-Lehane grading (N4). It was seen that increase lifting force (N5) for glottis visualization was required more in Group I (42%) as compared to only 12% in Group II. External laryngeal manipulation (N6) was required in 10% patients of Group I as compared to only 4% in Group II. None of the patient in either group had vocal cords in adducted position (N7). The total Intubation Difficulty Scale score indicated that ease of tracheal intubation was significantly better (p=0.02) in Group II (head extension position) as compared to Group I (sniffing position) (Table 5).

IV. Discussion

In order to have optimum visualization of glottis during direct laryngoscopy and intubation, proper position of the patient's head and neck is the key to its success. The results of the present study showed better visualization of glottis, improvement in Cormack-Lehane grading (p = 0.04), and superior IDS (p = 0.02) on head extension position over sniffing position during direct laryngoscopy and tracheal intubation in patients requiring general anesthesia. This iss in agreement with Levitan et al. who studied seven cadavers using a straight laryngoscopy blade and concluded that increasing head extension and laryngoscopy angle (neck flexion) significantly improves percentage of glottic opening (POGO) scores during laryngoscopy [7]. In another study by Adnet et al., sniffing position was compared with simple head extension for laryngoscopic view reported no significant advantage of sniffing position in improvement of glottic visualization [2]. Lee et al. examined laryngeal exposure in the head-flat position and in the 25^0 backup position in 40 non-obese adult patients. The authors reported an improvement in the POGO score from 42.2% in the head-flat position to 66.8% in the backup position [8].

It is believed that in the sniffing position the oral, pharyngeal, and laryngeal axes are aligned, while, in the present study as Cormack-Lehane grading improved (p = 0.04), lifting force of the laryngoscopic blade required was less suggesting better alignment of these axes in further neck flexion. However, Adnet et al. using magnetic resonance imaging, found that it is not possible to achieve anatomic alignment of the laryngeal, pharyngeal, and the mouth axes in the neutral, simple head extension, or the sniffing position.

Our study results showed significant advantage of further head extension over sniffing position in obtaining better intubating conditions. The total IDS was better in patients with head extension position as compared to sniffing position (p = 0.02). Of the seven variables of IDS, N2 (number of operators), N4 (CLG), N5 (lifting force), and N6 (laryngeal pressure) had favourable results in patients with head extension position. This is inconsistence with Hochman and coauthors, who studied the effects of neck positioning, on the force required for optimal laryngeal exposure. They concluded that increasing head extension and neck flexion increased the incidence of full laryngeal exposure with less required force [9]. In our study, a significant number of patients intubated in the sniffing position required more than one operator, external laryngeal manipulation, and use of increased force during laryngoscopy compared to those intubated in the head extension position.

Sniffing position is traditionally considered as a standard position for intubation. Horton et al. measured the angle of neck flexion in standard sniffing position. The mode value of angle was 35^0 to the horizontal [10]. In our study, mean angle of neck flexion in SP was 36.56° and in further HE was 46.62°, which improved the glottic visualization.

V. Conclusion

Simple head extension and further flexion of the neck provides better glottic visualization, less number of operators, less laryngeal pressure and lifting force required for intubation over traditional sniffing position as assessed by IDS. In the study, head extension was clinically and statistically found to be significant over sniffing position.

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Table 1. Intubation Difficulty Scale (IDS) score

Class	Parameter	Score
N1	No supplementary attempt required	0
	Any supplementary attempt required	1
N2	No supplementary operator required	0
	Any supplementary operator required	1
N3	No alternative intubation technique used	0
	Any alternative intubation technique used	1

N4	Cormack and Lehane Grade 1	0
	Cormack and Lehane Grade 2	1
	Cormack and Lehane Grade 3	2
	Cormack and Lehane Grade 4	3
N5	No subjectively increased lifting force required during Laryngoscopy	0
	Subjectively increased lifting force required during Laryngoscopy	1
N6	No external laryngeal manipulation required	0
	Optimal external laryngeal manipulation required	1
N7	Vocal cords are abducted	0
	Vocal cords are adducted blocking the tube passage	1
	Vocal cords not visualized	2

Table 2. Demograpic profile of two groups

Variable	**Age in years Mean ± SD**	**BMI (kg/m^2) Mean ± SD**	**Male/Female No.**
Group I (n=50)	36. 38 ± 9.82	24.98 ± 2.34	23/27
Group II (n=50)	35.83 ± 8.17	25.21 ± 1.98	24/26

Table 3. Mouth opening, hyomental distance, thyromental distance and sternomental distance in the two groups

Variable	**Group I (n=50) Mean ± SD**	**Group II (n=50) Mean ± SD**
Mouth opening (mm)	60.54 ± 5.49	60.72 ± 6.01
Hyomental distance (mm)	53.17 ± 3.21	52.98 ± 2.91
Thyromental distance (mm)	85.49 ± 6.78	85.88 ± 6.92
Sternomental distance (mm)	167.39 ± 12.38	166.82 ± 13.18

Table 4. Comparison of Cormack and Lehane Grading between the two groups

Cormack and Lehane Grade	**Group I (n=50) No. (%)**	**Group II (n=50) No. (%)**	**Statistical inference**
1	19 (38.00)	30 (60.00)	χ^2=4.00; p=0.04; Significant
2	26 (52.00)	18 (36.00)	
3	5 (10.00)	2 (4.00)	
4	0	0	

Table 5. Comparison of total IDS score between the two groups

Total IDS Score	**Group I (n=50) No. (%)**	**Group II (n=50) No. (%)**	**Statistical inference**
0	18 (36.00)	30 (60.00)	χ^2=4.84; p=0.02; Significant
1	17 (34.00)	10 (20.00)	
2	10 (20.00)	8 (16.00)	
3	4 (8.00)	0	
4	0	0	
5	1 (2.00)	2 (4.00)	

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