Original article

Access this article online
Website: www.cjisa.org

Comparative evaluation of glottic visualisation and ease of intubation using sniffing position and simple head extension during laryngoscopy in elective surgical procedures- a randomised prospective observational study

Address for correspondence:
Dr. Mahesh Kumar Sinha
Department of Anesthesiology and Critical Care, Ramkrishna Care Hospital, Raipur, CG.
Email: sinhamahesh@gmail.com

Vivek Mangal, Mahesh Kumar Sinha, Richa Nigam, Prafulla Agnihotri
Department of Anesthesiology and Critical Care, Ramkrishna Care Hospital, Raipur, CG.

ABSTRACT

Background and Aims: Maintenance of a patient airway is a fundamental responsibility of the anaesthesiologist and tracheal intubation remains one of the commonest means of establishing definitive airway. The Sniffing Position (SP) is traditionally recommended as the standard head position for optimal glottic exposure. However, intubation is sometimes easier with just simple cervical extension without inducing neck flexion. So, we conducted this study to evaluate the glottic visualisation and ease of intubation using sniffing position and simple head extension during laryngoscopy. **Methods:** Two hundred American Society of Anesthesiologists (ASA) physical grade I and II patients scheduled for surgery under general anaesthesia were randomly allocated to be intubated in sniffing position (Group I) or simple head extension (Group II). Glottic visualization and ease of intubation were assessed. **Results:** The baseline demographic variables and haemodynamic parameters were statistically comparable between the two groups. In Group I, there were more number of patients (62%) with Cormack and Lehane grade I as compared to Group II (40%) suggesting that glottic visualization was significantly better in sniffing position ($p<0.05$). On comparison of various intubation difficulty scale parameters in both the groups it was observed that intubation was easier in sniffing position as compared to simple head extension. The total Intubation Difficulty Scale score indicated that ease of tracheal intubation was significantly lower ($p<0.05$) in Group I as compared to Group II. **Conclusion:** sniffing position provides better glottic visualization and ease of intubation as compared to simple head extension during direct laryngoscopy and endotracheal intubation.

Key words: Laryngoscopy, intubation, sniffing position

INTRODUCTION

Maintenance of a patient airway is a fundamental responsibility of the anaesthesiologist. Tracheal intubation remains one of the commonest means of establishing an airway and the ability to maintain a good glottic visualisation during direct laryngoscopy is the major determinant of ease of intubation[1]. Proper positioning of the head and neck is essential for optimal laryngeal visualization during direct laryngoscopy. 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. The Sniffing Position (SP) is traditionally recommended as the standard head position for optimal glottic exposure[2]. In this position, the neck must be flexed on the chest, typically by elevating the head with a cushion under the occiput and extending the head on the

How to cite this article: Mangal V, Sinha MK, Nigam R, Agnihotri P. Comparative evaluation of glottic visualisation and ease of intubation using sniffing position and simple head extension during laryngoscopy in elective surgical procedures- a randomised prospective observational study Central Journal of ISA 2017;1(2):57-63.

atlanto-occipital joint. Advocates of the sniffing position maintain that it aligns the oral, pharyngeal, and laryngeal axis, allowing the line of vision to fall directly on the laryngeal inlet[3].

In 1936, Sir Ivan Magill described it as "sniffing the morning air" or "draining the pint of beer" and recommended placing a pillow under the occiput to raise the head and then to extend it to achieve the best laryngeal exposure. He was the first to describe the optimal head position for direct laryngoscopy as the position the head assumes when one wishes to sniff the air[4].

Bannister and Macbeth then introduced the Three Axis Alignment Theory (TAAT) in 1944 to explain the anatomical reasoning behind the superiority of SP[3]. They demonstrated that neck flexion aligns the pharyngeal and laryngeal axis, and head extension at the atlantooccipital joint aligns the oral axis with these 2 axis allowing the line of vision to fall on the glottis. Later, Horton et al measured the angle of neck flexion and that of head extension that resulted in best laryngeal exposure. The neck flexion angle was 35º and that of plane of the face extension was -15º to the horizontal. The head has to be raised between 31 and 71 mm (with a mean value of 55 mm) for optimal exposure[5].

Disadvantages and contraindications of the sniffing position include its inadequacy in obese patients to optimize glottis exposure in direct laryngoscopy, and the risk for spinal cord lesions in patients with known or suspected cervical spine injuries[6].

However, intubation is sometimes easier with cervical extension, e.g., by extending the head section of the operating table, or by removing the pillow 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[7].

The principal difference between sniffing position and simple head extension resides in inducing neck flexion on the thorax. In fact, in the non-obese patient with normal head extension, the simple maneuver of head extension against a flat surface will inevitably flex the neck, as demonstrated in an experimental study with use of Magnetic Resonance Imaging (MRI)[8].

METHODS

The study was a prospective randomized, comparative and single blind study. After ethical clearance and obtaining written and informed consent, 200 patients of either sex, aged 20-50 years, American Society of Anaesthesiologists (ASA) physical grade I and II scheduled for surgery under general anaesthesia were randomly allocated into two Groups using computer-generated random number table.

In Group I patients, 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; 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 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 65 mm (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.

Pre anaesthetic 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.[9] 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 Inj. glycopyrolate 0.2mg and Inj. fentanyl 2 µg /kg. Routine monitoring including three lead surface electrocardiogram (ECG), heart rate, pulse oximetry (SPO2) and non-invasive blood pressure monitoring was done.

The patients were randomly divided in two groups of 100 each.

Group I (Sniffing position)-Patients were placed supine and a non compressible cushioned pillow of 8 cm height was placed under the head. At the time of laryngoscopy, the head was extended on the atlanto-occipital joint maximally.

Group II (Simple head extension)-Patients were placed supine without the pillow. The head was extended maximally on the atlanto-occipital joint at the time of laryngoscopy.

Following pre oxygenation with 100% oxygen for three minutes, all thepatients 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 laryngoscopeby an anesthetist having over four years experience in anaesthesiology, and 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 view and IDS Score (Table 1) were recorded. Complications, like fall of peripheral oxygen saturation and dysrhythmias during laryngoscopy were noted. Anaesthesia was maintained by using nitrous oxide (60%), oxygen (40%), isoflurane and inj. vecuronium (0.1 mg/kg). At the end of surgical procedures, the residual effect of neuromuscular blocking agent was reversed with inj. Neostigmine 0.05mg/kg and inj. glycopyrolate 0.01mg/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 proforma attached and statistically analysed at the end of study. Descriptive statistics were calculated for continuous variables as Mean, Standard deviation, Median and for categorical variables as frequency distribution and percentage. Student Unpaired t test (for continuous variables) and Chi square test for categorical variable were used to see the significance difference between the groups. SPSS14.0 for windows statistical software used.

Table 1: Intubation Difficulty Scale (IDS)

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 & Lehane Grade 1	0
	Cormack & Lehane Grade 2	1
	Cormack & Lehane Grade 3	2
	Cormack & Lehane Grade 4	3
N5	Lifting Force During Laryngoscopy	
	No subjectively increased lifting force required during Laryngoscopy	0
	Subjectively increased lifting force required during Laryngoscopy	1
N6	External Laryngeal pressure for improved glottis visualization	
	No external laryngeal manipulation required	0
	Optimal external laryngeal manipulation required	1
N7	Position of Vocal cords at intubation	
	Vocal cords are abducted	0
	Vocal cords are adducted blocking the tube passage	1
	Vocal cords not visualized	2

RESULTS

Data from two hundred patients were analysed, hundred in each group. The baseline demographic variables and baseline haemodynamic parameters (HR, SBP, DBP, SPO2) were statistically comparable in between the two groups. It was also observed that the parameters like thyromental distance, atlanto-occipital joint movement, inter-incisor distance and temporo-mandibular joint movement did not influence glottic visualization and tracheal intubation. The differences observed were only because of position of the head during laryngoscopy and intubation.

In Group I, there were more number of patients (62%) with Cormack and Lehane grade I as compared to Group II (40%) suggesting that glottic visualization was significantly better in sniffing position. Similarly, partial glottic view was less in Group I (sniffing position) as compared to much higher percentage (60%) in Group II (simple head extension). Thus there was statistically significant difference between the groups regarding glottis visualization as per Cormack and Lehane grading ($p<0.05$). Similarly both the groups showed statistically significant difference with regard to modified Cormack and Lehane grading ($p<0.05$) thereby indicating that sniffing position was better for glottis visualization and tracheal intubation.

On comparison of various intubation difficulty scale parameters in both the groups it was observed that intubation was easier in sniffing position as compared to simple head extension. No supplementary attempt (N1) and supplementary operator was required in either of the two groups. Alternate intubation technique (N3) was required in more number of patients in Group II (12%) as compared to only 5% in Group I. Similarly it was seen that sniffing position (62%) was better than simple head extension (40%) with regard to glottis visualization and tracheal intubation as indicated by CL grading (N4). It was seen that increase lifting force (N5) for glottis visualization was required more in Group II (46%) as compared to only 11% in Group I. This difference was highly statistically significant ($p<0.001$). External laryngeal manipulation (N6) was required in 19% patients of Group II as compared to only 9% in Group I. 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 lower ($p<0.05$) in Group I as compared to Group II.

DISCUSSION

Laryngoscopy and endotracheal intubation are considered as the most critical events in the patients who are subjected to surgery under general anaesthesia. In most of the circumstances difficult laryngoscopy correlates to poor glottic visualization. Proper positioning of the head and neck during laryngoscopy and endotracheal intubation is the first and the foremost manoeuvre that is routinely done for optimizing the laryngeal view for the prevention of complications related to laryngoscopy and intubation.

The sniffing position so far has been recommended as the standard and optimal position for direct laryngoscopy and endotracheal intubation. In the recent times, the superiority of the sniffing position over the other head and neck positions has been questioned.

The present study was carried out to evaluate whether sniffing position provides better glottic visualization and ease of intubation compared to simple head extension during direct laryngoscopy and endotracheal intubation.

The technique of induction of anaesthesia and drugs used were similar in both the groups. Laryngoscopy was performed and glottis visualization was assessed by Cormack and lehane grading and modified Cormack and Lehane grading. Tracheal intubation was performed and Intubation Difficulty Scale (IDS) was assessed and recorded.

Anaesthesia was maintained with nitrous oxide, oxygen, isoflurane and inj. Vecuronium 0.1mg/kg in both the groups. Extubation was done after the patient responded to verbal commands and had adequate spontaneous ventilation. Results obtained were recorded and subjected to statistical analysis.

The population sample studied was homogenous regarding preanaesthetic characteristics such as age, weight, height, BMI, ASA grade and baseline hemodynamic parameters. The mean HR, SBP, DBP, SPO2, parameters of airway assessment was comparable in both the groups.

Grade I view (complete glottic visualization) was seen in 62% of patients in Group I as compared to only 40% in Group II. This difference was statistically Significant ($p<0.05$). While on the other hand, grade 2 view (partial glottic Visualization) was seen in 50% of patients in group

Table 2: Comparison of Cormack and Lehane Grading between the groups						
CORMACK & LEHANE	GROUP I		GROUP II		p value	SIGNIFICANCE
GRADE	NO OF PATIENTS	%	NO OF PATIENTS	%	0.007	SIGNIFICANT
1	62	62	40	40		
2	33	33	50	50		
3	05	05	10	10		
4	00	00	00	00		
TOTAL	100	100	100	100		

II as compared to only 33% in group I. This difference was also statistically significant ($p<0.05$). However, grade 3 view (none of the glottic structures visualized) was seen in more number of patients (10%) in Group II as compared to only 5% in Group II. The difference was statistically significant ($p<0.05$). Thus, the result of our study demonstrated that glottic visualization was better in sniffing position than simple head extension. (Table 2)

Prakash S et al[12] in 2011 visualized glottis in sniffing position and simple head extension and observed that in sniffing position complete glottic visualization was seen in 62.2% of patients as compared to 53% in simple head extension ($p>0.05$).Whereas partial glottic visualization was seen in 29.8% and 37.3% of patients in sniffing position and simple head extension respectively ($p>0.05$). Grade III (poor glottic visualization) was seen in 7.6 % patients in Group I and 9.2% in group II. The finding of our study correlates with the findings of this study as far as incidence of

Complete glottic visualization (62%) is concerned. Whereas the incidence of other glottic views is different from those of our study. This difference could be explained on the fact that patients placed in sniffing position were older ($p<0.05$) and had greater BMI ($p<0.05$) as compared to simple head extension.

Park SW et al[13] in 2014 evaluated the effect of age in comparing the benefits of sniffing position over simple head extension for glottic visualization. They found that glottic visualization as assessed by POGO score was significantly better only in younger group (<50 years). It was 43% in simple head extension and higher (76%) in sniffing position. These findings are similar to those of our study as sniffing position provided better laryngeal view in (62%) patients of less than 50 years.

Akihisa Y et al[14] in 2015 studied the effect of sniffing position for glottis visualization and tracheal intubation and found that although sniffing position did not improve the glottic visualization but can still be recommended as an initial head position because it provides better and easier intubating conditions.

PARAMETERS OF INTUBATION DIFFICULTY SCALE

Alternate intubation technique (stylet) was required in more number of patients in Group II (12%) as compared to Group I (5%). The difference was however not statistically significant ($p>0.05$). Prakash S et al[12] in 2011 evaluated different parameters of intubation difficulty score and found that stylet was used only in 4.4% patients in sniffing position as compared to 8.9% in simple head extension ($p<0.05$). These findings are in accordance with our study.

N4- Cormack and Lehane Grade.

The glottic visualization and tracheal intubation as indicated by Cormack and Lehane grading was much better in sniffing position (62%) than in simple head extension (40%) and the difference was statistically significant ($p <0.05$).

N5- Lifting force.

In our study, increased lifting force for glottic visualization was required in as many as 46% patients placed in simple head extension (Group II) as compared to only 11% in sniffing position (Group I), and the difference was statistically highly significant ($p<0.001$).

Greenland KB et al[15] in 2010 evaluated the airway configuration of sniffing position and found that sniffing position required the least amount of tissue displacement for glottic visualization and intubation therefore lesser force was required for laryngeal exposure. Our findings are in agreement with this study.

Prakash S et al[12] in 2011 evaluated different parameters of intubation difficulty scale and observed that increased

lifting force was required in significantly lesser number of patients (5.8%) in sniffing position as compared to 12.9% in simple head extension ($p<0.05$). These results are in agreement with our study.

N6- External Laryngeal Manipulation**.**

In our study, external laryngeal manipulation was required in 19% patients of group II as compared to only 9% in Group I. Singhal SR et al[16] in 2008 observed that 20% patients required external laryngeal manipulation in sniffing position as compared to 30% in simple head extension. These findings are similar to those of our study. Prakash S et al[12] in 2011 observed the incidence of external laryngeal manipulation. It was 32.7% in sniffing position and higher (43%) in simple head extension position. These findings correlate with the findings of present study.

N7- Vocal cord position.

All the patients in both the group had abducted vocal cords.

IDS score 0 (easy intubation) was observed in 62 patients (62%) with sniffing position (Group I) as compared to only 38 patients (38%) in simple head extension (Group II), and the difference was statistically significant ($p<0.05$). IDS score 1-5 (mild difficulty) was observed in fewer patients 38 (38%) with sniffing position (Group I) as compared to 62 patients (62%) in simple head extension (Group II), and the difference was statistically significant ($p<0.05$). IDS score >5 (moderate to severe difficulty) was not seen in any of the patients of either group. (Table 3).

Thus the total IDS 0 indicating very easy tracheal intubation was much higher in Group I as compared to Group II. This shows that intubation was easier in patients placed in sniffing position. Greenland KB et al[15] concluded that sniffing position provides an easy passage for endotracheal tube and make intubation easier as compared to simple head extension which is in accordance with our study. They supported their opinion based on the fact that least amount of tissue displacement during laryngoscopy was required in sniffing position.

Bhattarai B et al[17] found an: IDS score 0 (easy intubation) in 58% patients in sniffing position as compared to only 41% in simple head extension, IDS score 1-5 (mild difficulty in intubation) was observed in 41% of patients in sniffing position as compared to 57% in simple head extension and the difference was statistically significant ($p<0.05$). These above findings are similar to those of our study. They found an IDS score>5 (moderate to severe difficulty in intubation) in 1% and 2% patients placed in sniffing position and simple head extension respectively, where as we did not have any patient in this category.

Prakash S et al[12] postulated that a significantly greater number of intubations were judged to be easy when patients were intubated in sniffing position as compared o simple head extension. Their supportive findings were: IDS score0 in 60.4% in sniffing position in contrast to 47.6% in simple head extension. This difference was statistically significant ($p<0.05$). IDS score 1-5 was observed in only 38.2% in sniffing position as compared to 52.4% in simple head extension. These findings are comparable with our study. They found an IDS score >5 in 1.4% patients in sniffing position and none in simple head extension, where as we did not have any patient with IDS score >5 in either of the two groups.

Akihisa Y et al[14] in 2015 found that sniffing position was significantly associated with lower IDS score as compared to simple head extension which makes the intubation much more easier. This is in agreement with the findings of our study.

Table 3: Showing comparison of Total IDS score between Group I and Group II

TOTAL IDS SCORE	GROUP I		GROUP II		p value	SIGNIFICANCE
	NO OF PATIENTS	%	NO OF PATIENTS	%	0.001	SIGNIFICANT
0	62	62	38	38		
1	19	19	16	16		
2	14	14	27	27		
3	02	02	10	10		
4	00	00	00	00		
5	03	03	09	09		
TOTAL	100	100	100	100		

CONCLUSION

It is concluded that the sniffing position provides better glottic visualization and ease of intubation as compared to simple head extension during direct laryngoscopy and endotracheal intubation. Hence, it should still be regarded as the gold standard head position during direct laryngoscopy and tracheal intubation.

REFERENCES

1. Adnet F, Borrow SW, Dumas JL, Lapostolle F, Cupa M, Lapundry C. Study of the sniffing position by magnetic resonance imaging. Anesthesiology. 2001; 94(1):83–6. https://doi.org/10.1097/00000542-200101000-00017 PMid:11135726.
2. Adnet F, Baillard C, Borron SW, Denantes C, Lefebvre L, Galinski M, et al. Randomized study comparing sniffing position with simple head extension for laryngoscopic view in elective surgery patients. Anesthesiology. 2001; 95(4):836–41. https://doi.org/10.1097/00000542-200110000-00009 PMid:11605921.
3. Caplan RA. The closed claimed project: looking back, looking forward. ASA Newsletter. 1999; 63(6):7–9.
4. Domino KB, Posner KL, Caplan RA, Cheney FW. Airway injury during anesthesia: A closed claims analysis. Anesthesiology. 1999; 91:1703–11. https://doi.org/10.1097/00000542-199912000-00023 PMid:10598613.
5. Rose DK, Cohen MM. The airway: Problems and predictions in 18,500 patients. Can J Anaesth. 1994; 41:372–83. https://doi.org/10.1007/BF03009858 PMid:8055603.
6. Practice guidelines for management of the difficult airway. An updated report by the American Society of Anesthesiologists task force on management of the difficult airway. Anesthesiology. 2003; 98:1269–77. PMid:12717151.
7. Bannister M, Macbeth RG. Direct laryngoscopy and tracheal intubation. Lancet. 1944; 2:651–4. https://doi.org/10.1016/S0140-6736(00)46015-0.
8. Magill IW. Endotracheal anesthesia. Am J Surg. 1936; 34:450–5. https://doi.org/10.1016/S0002-9610(36)90666-9.
9. Wilson ME, Spiegelhalter D, Robertson JA, Lesser P. Predicting difficult intubation. British Journal of Anaesthesia. 1988; 61(2):211–6. https://doi.org/10.1093/bja/61.2.211 PMid:3415893.
10. Miller RD. Anesthesia. 7th ed. Churchill Livingstone; 2010. p. 1589. PMid:20929820.
11. Adnet F, Borron SW, Racine SX, et al. The Intubation Difficulty Scale (IDS): Proposal and evaluation of a new score characterizing the complexity of Endotracheal intubation. Anesthesiology. 1997; 87(6):1290–7. https://doi.org/10.1097/00000542-199712000-00005 PMid:9416711.
12. Prakash S, Rapsang AG, Mahajan S, Bhattacharjee S, Singh R, Gogia AR. Comparative evaluation of the sniffing position with simple head extension for laryngoscopic view and intubation difficulty in adults undergoing elective surgery. Anesthesiol Res Pract. 2011; 2011:297913 https://doi.org/10.1155/2011/297913.
13. Park SW, Lee KW, Jang MS, Jung JY, Lee BJ, Kang JM. Age and gender are important considerations in choosing the sniffing position for laryngoscopic view. Int J Med Sci. 2014 Oct 2; 11(12):1258–61. https://doi.org/10.7150/ijms.8585 PMid:25317072 PMCid:PMC4196127.
14. Akihisa Y, Hoshijima H, Maruyama K, Koyama Y, Andoh T. Effects of sniffing position for tracheal intubation: a meta-analysis of randomized controlled trials. Am J Emerg Med. 2015 Nov; 33(11):1606–11. https://doi.org/10.1016/j.ajem.2015.06.049 PMid:26227445.
15. Greenland KB, Edward MJ, Hutton NJ, Challies VJ, Irwin MG, Sleigh JW. Changes in airway configuration with different head and neck positions using Magnetic resonance imaging of normal airways: A new concept with possible Clinical applications. Br J Anaesth. 2010; 105(5):683–90. https://doi.org/10.1093/bja/aeq239 PMid:20846964.
16. Singhal SR, Malhotra N, Sharma S. Comparison of sniffing position and simple head extension for visualization of glottis during direct laryngoscopy. Indian J Anaesth. 2008; 52(5):546–50.
17. Bhattarai B, Shrestha SK, Kandel S. Comparison of sniffing position and simple head extension for visualization of glottis during direct laryngoscopy. Kathmandu Univ Med J. 2011; 9(33):58–63.