Research Square

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Comparison of Ease of Endotracheal Intubation Between Left Head Rotation and Sniffing Position: A Randomised Controlled Trial

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Abstract

Background:

Optimising head–neck position improves laryngeal exposure and intubation conditions. Sniffing position is widely adopted, but its superiority is inconsistent. Left head rotation is a simple, non-invasive manoeuvre that may improve intubation conditions. The objective is to compare the ease of endotracheal intubation between left head rotation and the sniffing position during direct laryngoscopy.

Methods:

This prospective, randomised clinical trial included 54 adults undergoing elective surgery under general anaesthesia. Participants were randomly assigned to Group A (left head rotation, n = 27) or Group B (sniffing position, n = 27). In Group A, the head was rotated 45° to the left, while in Group B, the head was placed in sniffing position. Endotracheal intubation ease was assessed using the modified Cormack–Lehane classification and Intubation Difficulty Scale.

Results:

There was no significant difference in modified Cormack–Lehane grades between groups, with Cormack–Lehane Grade 1 occurring in 66.7% of Group A and 74.1% of Group B (P = 0.354). Individual components of Intubation Difficulty Scale were similar, except that the external laryngeal pressure requirement was significantly higher in the left head rotation group, 0.15 (0.36) versus 0.00 in the sniffing position, with P = 0.039. “Easy” intubation occurred in 33.3% versus 22.2%, “slightly difficult” in 66.7% versus 74.1%, and “moderate–major difficulty” in 0% versus 3.7%, in groups A and B, respectively

Conclusion:

Left head rotation provided glottic views and intubation conditions comparable to those in the sniffing position, except for a higher requirement for external laryngeal manipulation.

Trial registration:

Clinical Trials Registry–India (CTRI/2023/10/059355), prospectively registered on 31/10/2023.

Introduction

Successful tracheal intubation during direct laryngoscopy depends foremost on obtaining an adequate view of the glottis. Among modifiable factors, optimising head–neck position enhances laryngeal

exposure, reducing the attempts and time required for tracheal intubation. The sniffing position is the conventional and most commonly used head–neck alignment among anaesthesiologists; in this position, flexion of the lower cervical spine combined with extension at the atlanto-occipital joint, which aligns the oral, pharyngeal, and laryngeal axes, thereby improving laryngeal visualisation.[1]

Although the sniffing position is widely adopted, it cannot be assumed to be superior for every patient. This variability makes tracheal intubation challenging, especially in settings where devices like videolaryngoscopes or fibreoptic bronchoscopes are unavailable. Studies have reported inconsistent or less favourable outcomes with the sniffing position, showing no clear advantage in glottic visualisation, first-pass success, or intubation time.[2–4] Consequently, simple manoeuvres used as adjuncts or alternatives to sniffing position, including head elevation/ramping, jaw thrust, simple head extension, and external laryngeal manipulation, are used to optimise the laryngeal view and intubation conditions during direct laryngoscopy. [2,5–8]

Left head rotation is a simple, non-invasive manoeuvre that may enhance glottic visualisation before resorting to advanced airway devices. By laterally displacing the tongue and epiglottis, it can enlarge the oropharyngeal space and reduce posterior pharyngeal crowding along the operator's line of sight. In 2019, Yezid and colleagues first described the use of left head rotation during tracheal intubation in non-trauma patients.[9] Subsequently, few studies have evaluated the impact of this manoeuvre on intubation conditions using both direct and indirect laryngoscopes. [10–12] Supporting its potential to improve intubation conditions. However, the available evidence remains limited and relatively unknown.

Hence, a randomised, parallel-group clinical trial was undertaken to compare intubation conditions during direct laryngoscopy in adults undergoing elective surgery, using left head rotation and the sniffing position. The primary aim was to evaluate whether left head rotation enhances the laryngeal view and reduces intubation difficulty, measured by the modified Cormack–Lehane (CL) classification and the Intubation Difficulty Scale (IDS).[8,13,14] The secondary outcome was time to intubation. We hypothesised that left head rotation would be comparable to the sniffing position with respect to laryngeal view and intubation difficulty.

Methods

The study was conducted at a Tertiary Care teaching medical institute in India between July 2024 and December 2024. The study received approval from the Ethics Committee (Approval No. IEC/AIIMS/BTI/408, dated 05 September 2023) and was prospectively registered with the Clinical Trials Registry–India (CTRI/2023/10/059355) on 31/10/2023. All procedures were carried out in accordance with the ethical principles outlined in the Declaration of Helsinki (2013).

Sample size was calculated using G*Power software version 3.1.9.7 (Heinrich-Heine-Universität Düsseldorf, Germany) for a two-group comparative parallel-arm design employing a z-test for the difference between two independent proportions. Based on prior literature, the success proportion for

the control group (sniffing position) was estimated at 0.65, consistent with previously reported rates of favourable glottic visualisation and intubation conditions during direct laryngoscopy.[2,8] Previous airway-positioning studies have demonstrated approximately 25–30% improvement in glottic visualisation with modified positioning manoeuvres.[5,11] Accordingly, the anticipated success proportion for the intervention group (left head rotation) was estimated at 0.95. With a significance level of 0.05 (two-tailed) and a desired power of 0.80, the minimum required sample size was calculated to be 27 participants per group, yielding a total sample size of 54. After accounting for a 10% attrition rate, a target enrolment of 60 patients was planned.

Adults aged 18–65 years, belonging to American Society of Anaesthesiologists (ASA) physical status I–II, with Mallampati class I–III and a body mass index (BMI) between 18.5 and 35 kg/m², scheduled to undergo elective surgery under general anaesthesia, were recruited after providing written informed consent obtained from the patient (or next of kin, if applicable). Exclusion criteria included Mallampati class IV, restricted neck extension or head rotation, mouth opening less than three fingerbreadths of the patient, facial or neck trauma, anterior neck mass, BMI greater than 35 kg/m², known gastroesophageal reflux disease, facial fractures obstructing the airway, thyromental distance less than 6 cm or sternomental distance less than 12 cm.

Enrolled participants meeting the inclusion criteria were randomised by drawing opaque slips into two groups: Group A (left head rotation) and Group B (sniffing position), prepared by a staff member not involved in data collection or laryngoscopy. The slips were shuffled and placed in sequentially numbered opaque envelopes to ensure equal allocation to each group. Each patient drew one slip immediately before induction. Standard ASA monitors (pulse oximetry, electrocardiography, temperature monitoring, and non-invasive blood pressure) were applied, and intravenous access was secured. Patients were pre-oxygenated with 100% oxygen for three minutes, followed by induction with fentanyl 2 µg/kg and propofol 1.5–2.0 mg/kg, titrated until loss of verbal response, after which mask ventilation was confirmed. Neuromuscular blockade and other medications were administered in accordance with institutional guidelines and practices. During the apnoeic period, patients were ventilated as required with oxygen and 1% isoflurane until laryngoscopy.

To minimise inter-operator variability and ensure standardisation, all intubations were initially attempted by a single senior anaesthesiologist with more than 10 years of experience, however, in cases where intubation could not be successfully completed by primary operator, assistance from another experienced anaesthesiologist with more than 10 years of experience was permitted and documented.

In the left head rotation group (Group A), with the patient supine, the head was gently rotated approximately 45° to the left while maintaining neutral neck flexion.

In the sniffing position group (Group B), the occiput was supported on an incompressible head ring to bring the external auditory meatus and the sternal notch on a similar horizontal plane, thereby achieving lower cervical flexion with atlanto-occipital extension. Direct laryngoscopy was done using a Macintosh

blade of appropriate size according to the patient's build, and the endotracheal tube was selected as per standard institutional practice. External laryngeal manipulation was applied if clinically indicated and was documented. The best glottic view at the first laryngoscopy attempt findings were recorded for the modified Cormack–Lehane (CL) classification. All seven components of the Intubation Difficulty Scale (IDS) were recorded separately, and the total IDS score was calculated to classify the degree of difficulty. Intubation time was measured from insertion of the laryngoscope blade into the mouth until the sixth continuous capnography waveform, with ventilation maintained at 12 breaths per minute in all patients. Measurements were performed using a digital timer by an independent observer. Due to the obvious differences in head position, blinding of the laryngoscopist was not feasible

If intubation was unsuccessful in the assigned position, rescue techniques were employed, including changing the blade of the laryngoscope, using a stylet, performing nasotracheal intubation, applying cricoid pressure, utilizing fibreoptic-guided intubation, or inserting an intubating laryngeal mask airway.

Data were collected prospectively using case record forms. Categorical variables, such as IDS categories, Cormack–Lehane grades, use of adjunct manoeuvres, sex distribution, and Mallampati class, were analysed using the Chi-square test. Continuous demographic variables (age, weight, height, BMI) and intubation time were assessed for normality using the Shapiro–Wilk test. Normally distributed continuous variables were compared between groups using the unpaired t-test. Individual components of the Intubation Difficulty Scale (IDS), total IDS scores, and intubation time were compared between groups using the Mann–Whitney U test because these variables were ordinal or not normally distributed. These variables are presented as mean ± standard deviation for descriptive purposes. Effect sizes with 95% confidence intervals were calculated for primary and secondary outcomes. A two-sided $P < 0.05$ was considered statistically significant. IBM SPSS Statistics, version 29.0 (IBM Corp., Armonk, NY, USA) was used for statistical analysis. This randomised controlled trial was conducted and reported in accordance with the Consolidated Standards of Reporting Trials (CONSORT) 2010 Statement.

Results

A total of 60 patients were assessed for eligibility; 6 were excluded: 2 with Mallampati Class IV and 4 with limited cervical mobility. A total of 54 participants were randomly allocated into two groups: Group A, which involved left head rotation, and Group B, which involved the sniffing position (n = 27 in each group). All participants completed the study and were analysed (Fig. 1). The two groups were similar in demographic and airway variables (Table 1). There were no significant differences in age (41.78 (17.13) vs 38.59 (12.56) years; P = 0.489), weight (64.85 (16.05) vs 68.07 (13.16) kg; P = 0.423), height (157.22 (12.86) vs 162.52 (10.61) cm; P = 0.105), or BMI (26.13 (5.15) vs 25.80 (4.63) kg/m²; P = 0.809).

Table 1
Baseline characteristics of patients

Variable	Left head rotation (n = 27)	Sniffing position (n = 27)	P value
Age (years)	41.78 (17.13)	38.59 (12.56)	0.489
Weight (kg)	64.85 (16.05)	68.07 (13.16)	0.423
Height (cm)	157.22 (12.86)	162.52 (10.61)	0.105
BMI (kg/m²)	26.13 (5.15)	25.80 (4.63)	0.809
Female sex, n (%)	14 (51.9)	11 (40.7)	0.413
Mallampati I/II/III, n (%)	8/10/9	10/9/8	0.846
Continuous variables analysed using unpaired t-test or Mann–Whitney U test depending on data distribution; categorical variables analysed using Chi-square test or Fisher's exact test as appropriate			
BMI = Body Mass Index			

The laryngoscopic view, assessed using the modified CL classification, was similar in both groups (Table 2). Cormack–Lehane Grade 1 was observed in 66.7% of Group A and 74.1% of Group B, with other grades occurring less frequently and without significant groupwise differences (P = 0.354). The frequency of individual IDS components did not differ significantly, except for external laryngeal manipulation (Table 3); the detailed distribution of these components is shown in Table 4. Most patients were successfully intubated on the first attempt (66.7% vs 59.3%; P = 0.573). The proportion requiring more than one operator was similar (14.8% vs 11.1%; P = 0.999). Use of alternative techniques (11.1% vs 22.2%; P = 0.159) and additional lifting force (3.7% in both; P = 0.999) did not differ. External laryngeal manipulation was applied more often in the left head rotation group (14.8% vs 0%; P = 0.039). The mean (SD) total IDS scores did not differ (1.22 (1.12) vs 1.07 (1.04); P = 0.646). Vocal mobility was normal in all participants (100% in both groups).

Table 2
Comparison of Laryngeal view using modified Cormack–Lehane classification

Cormack–Lehane grade, n (%)	Left head rotation (n = 27)	Sniffing position (n = 27)	P value
Grade 1	18 (66.7%)	20 (74.1%)	0.354
Grade 2a	1 (3.7%)	3 (11.1%)	
Grade 2b	4 (14.8%)	3 (11.1%)	
Grade 3	2 (7.4%)	0 (0%)	
Grade 4	2 (7.4%)	1 (3.7%)	
Comparison performed using Chi-square test/Fisher's exact test			

Table 3
Comparison of individual IDS components and total IDS score

IDS Component	Left head rotation (mean (SD))	Sniffing position (mean (SD))	P value
N1 > 1 attempt	0.33 (0.48)	0.41 (0.50)	0.577
N2 > 1 operator	0.15 (0.36)	0.11 (0.32)	0.688
N3 alternative technique	0.15 (0.46)	0.22 (0.42)	0.316
N4 Cormack grade	0.41 (0.64)	0.30 (0.54)	0.523
N5 lifting force	0.04 (0.19)	0.04 (0.19)	0.999
N6 external laryngeal manipulation	0.15 (0.36)	0.00 (0.00)	0.039
N7 vocal-cord mobility	0.00 (0.00)	0.00 (0.00)	0.999
Total IDS score	1.22 (1.12)	1.07 (1.04)	0.646
IDS component values and total IDS scores are presented as mean (SD) for descriptive purposes and compared using the Mann–Whitney U test			
IDS = Intubation Difficulty Scale			
N = Component number of the Intubation Difficulty Scale			
SD = Standard Deviation			

Table 4
Number of Patients in both Groups based on IDS Components

IDS Component (N-value)	Clinical Description	Left head rotation	Sniffing position
Number of intubation attempts (N1)	1 attempt	18 (66.7%)	16 (59.3%)
	> 1 attempt	9 (33.3%)	11 (40.7%)
Number of operators (N2)	1 operator	23 (85.2%)	24 (88.9%)
	> 1 operator	4 (14.8%)	3 (11.1%)
Alternative intubation techniques (N3)	Standard technique	24 (88.9%)	21 (77.8%)
	Use of alternative technique	2 (7.4%)	6 (22.2%)
	Multiple alternative techniques	1 (3.7%)	0 (0.0%)
Glottic view Cormack–Lehane Grade (N4)	Grade 1	18 (66.7%)	20 (74.1%)
	Grade 2	7 (25.9%)	6 (22.2%)
	Grade 3	2 (7.4%)	1 (3.7%)
Lifting force required (N5)	Normal lifting force	26 (96.3%)	26 (96.3%)
	Increased lifting force	1 (3.7%)	1 (3.7%)
Laryngeal manipulation required (N6)	None	23 (85.2%)	27 (100.0%)
	External laryngeal manipulation	4 (14.8%)	0 (0.0%)
Vocal cord position and mobility (N7)	Normal mobility (Abducted)	27 (100.0%)	27 (100.0%)
	Impaired mobility (Adducted)	0 (0.0%)	0 (0.0%)
Categorical data values represented as numbers (percentages)			
IDS = Intubation Difficulty Scale			
N = Component number of the Intubation Difficulty Scale			

The majority of patients showed low IDS scores (0–1) in both groups (Fig. 2). The degree of difficulty based on the total score of the IDS did not differ significantly, with Easy: 9 (33.3%) vs 6 (22.2%), Slight difficulty: 18 (66.7%) vs 20 (74.1%), Moderate–major difficulty 0 (0%) vs 1 (3.7%) were found in group A

and B respectively; The difference was not statistically significant (P = 0.351). The time to intubation was similar between groups (70.26 (12.52) vs. 66.48 (11.70) seconds; P = 0.253) (Table 5).

Table 5
Comparison of IDS-based difficulty and time to intubation. Values are n (%) or mean (SD)

IDS category, n (%)	**Left head rotation (n = 27)**	**Sniffing position (n = 27)**	**P value**
Easy	**9 (33.3%)**	**6 (22.2%)**	**0.351**
Slight difficulty	**18 (66.7%)**	**20 (74.1%)**	
Moderate–major difficulty	**0 (0%)**	**1 (3.7%)**	
Time to intubation (s)	70.3 (12.5)	66.5 (11.7)	0.253
IDS categories compared using Chi-square test; intubation time compared using Mann-Whitney U test			
IDS = Intubation Difficulty Scale			

In summary, except for a greater need for external laryngeal manipulation in Group A, both groups showed comparable outcomes in terms of laryngeal view, IDS-based intubation difficulty, number of attempts, operator involvement, use of alternative techniques, and intubation time. No airway-related complications or adverse events were observed in either group

Discussion

In this prospective, randomised clinical trial, we compared the ease of intubation in left head rotation with the sniffing position for direct laryngoscopy in adults undergoing elective surgery. Left head rotation provided glottic views and intubation conditions comparable to the sniffing position. The total IDS scores were low in both groups, indicating generally favourable intubation conditions. Except for a higher frequency of external laryngeal manipulation in the left head rotation group, no other parameters differed significantly between the two groups.

Adequate glottic visualisation is important for the successful endotracheal intubation using direct laryngoscopy. The optimal positioning of the patient's head during laryngoscopy can significantly influence the ease of intubation and the overall outcome. The left head rotation manoeuvre laterally displaces the tongue and epiglottis, enlarges the oropharyngeal space, and reduces posterior pharyngeal crowding, thereby improving alignment of the visual axis.

Yezid and colleagues first described this technique in non-trauma patients, highlighting its simplicity and clinical utility.[9] Later, Rajan and colleagues demonstrated improved Percentage of Glottic Opening (POGO) scores with left head rotation compared with the sniffing position when assessed using a C-MAC videolaryngoscope.[11] In contrast, our study did not demonstrate a statistically significant improvement in the CL grade with left head rotation. A CL Grade 1 view was obtained in 66.7% of

patients in the left head rotation group and 74.1% in the sniffing group (P = 0.354). Chan and colleagues also observed that left head rotation and sniffing produced comparable laryngeal exposure and ease of intubation during direct laryngoscopy.[10] However, there are differences in the devices used (direct vs. indirect laryngoscopy) and grading scales for glottic assessment in these studies.

Several investigators have evaluated modifications in head position that can influence laryngeal exposure during intubation. Ueda and colleagues showed that combining ramp position with left head rotation improved laryngeal visualisation.[15] Adnet and colleagues found no significant improvement of glottic view on direct laryngoscopy in the sniffing position over simple head extension.[8] Similarly, Akhtar and colleagues observed that the sniffing position did not significantly enhance the Cormack–Lehane grade compared with head extension alone. [2] Lee and colleagues studied the glottic view using a videolaryngoscope in non-obese adults, where the POGO score improved significantly from 42.2% (27.4%) to 66.8% (27.6%) in the supine and 25° back-up position, respectively.[5] 45° head rotation compared to the neutral position in adults undergoing general anaesthesia significantly improved the expiratory tidal volume during mask ventilation, by increasing the upper airway cross-sectional area and reducing posterior pharyngeal wall collapse. [16,17] However, glottic exposure alone does not fully reflect the complexity of tracheal intubation. Therefore, in this study, we used the IDS to provide a more comprehensive assessment of intubating conditions.

In our study, individual components of the IDS did not differ significantly between groups, except for the application of external laryngeal manipulation. More patients required external laryngeal manipulation in the left head rotation group (14.8%) compared to the sniffing position group (0%), and this difference was statistically significant (P = 0.039). This difference may be attributed to variations in airway geometry and operator familiarity. Greenland and colleagues used magnetic resonance imaging to demonstrate that the area between the line of sight and the airway curve is smaller in the sniffing position, making it optimal for direct laryngoscopy.[18] This alignment brings the oral, pharyngeal, and laryngeal axes closer together, requiring minimal adjustment by the laryngoscope blade to obtain an optimal view. However, left head rotation has not been studied to know the alignment, which may be slightly less optimal, occasionally necessitating external laryngeal pressure. Furthermore, operators are more accustomed to performing laryngoscopy in the sniffing position; relative unfamiliarity with left head rotation may have contributed to more frequent external manipulation. Akhtar and colleagues observed that patients intubated in the sniffing position required less frequent external laryngeal manipulation, the use of alternative techniques, and a lesser lifting force compared to simple head extension.[2] More manipulations are required in other positions compared to sniffing, due to airway geometry or familiarity with the position.

Chan and colleagues also reported no statistically significant differences in total IDS scores between patients intubated in the left head rotation or sniffing positions, indicating similar ease of intubation.[10] In our study, “easy” intubation was observed in 33.3% of patients in the left head rotation group, compared to 22.2% in the sniffing group. In comparison, 66.7% and 74.1% respectively were categorised as “slightly

difficult", a difference that was not statistically significant. The time required for intubation was also similar (70.3 (12.5) vs 66.5 (11.7) seconds). Although intubation time was numerically shorter with left head rotation, this was not clinically meaningful. However, in a study by Lee and colleagues, i-gel insertion was performed using the head rotation technique, which significantly reduced insertion time compared with the neutral position. The mean (SD) time for successful placement was 13.4 (3.7) seconds with head rotation versus 16.3 (7.8) seconds in the neutral position (P = 0.030).[19]

Limitations

This study has certain limitations. First, the anaesthesiologist performing the laryngoscopy could not be blinded to the intervention, introducing a potential bias. As a randomised, open-label trial, blinding was impractical due to visible differences in head position. Second, airway management success is operator-dependent. All anaesthesiologists in our study were experienced with the sniffing position but relatively less familiar with left head rotation, which might have influenced performance and outcomes. Third, we included only patients with anticipated normal airways, limiting extrapolation to those with predicted difficult airways or cervical spine restrictions. Finally, this new head position may also require minor adjustments in laryngoscopy technique, as the tongue tends to fall slightly to the left, suggesting that blade insertion along the midline and specific direction of external manipulation might optimise visualisation. Future studies could explore these nuances and assess the utility of left head rotation in patients with anticipated difficult airways or under simulated emergency conditions.

Conclusion

In adults undergoing elective surgery under general anaesthesia, left head rotation provided intubation conditions and glottic views comparable to those in the conventional sniffing position, with a higher need for external laryngeal manipulation. Given its simplicity, safety, and zero cost, left head rotation is a practical and effective alternative to the sniffing position during direct laryngoscopy.

Declarations

Ethics approval and consent to participate

The study was approved by the Institutional Ethics Committee, All India Institute of Medical Sciences (AIIMS), Bathinda, Punjab, India (Approval No. IEC/AIIMS/BTI/408; dated 05 September 2023). Written informed consent was obtained from all participants prior to enrolment.

Consent for publication

Not applicable.

Competing interests

The authors declare that they have no competing interests.

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Author Contribution

JS contributed to conceptualization, methodology, and drafting of the manuscript. HS contributed to formal analysis and manuscript review. SP contributed to methodology and statistical analysis. NS, GP, and AG contributed to study conceptualization and manuscript review. All authors read and approved the final manuscript.

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Data Availability

The datasets generated and/or analysed during the current study are available from the corresponding author on reasonable request.

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Figures

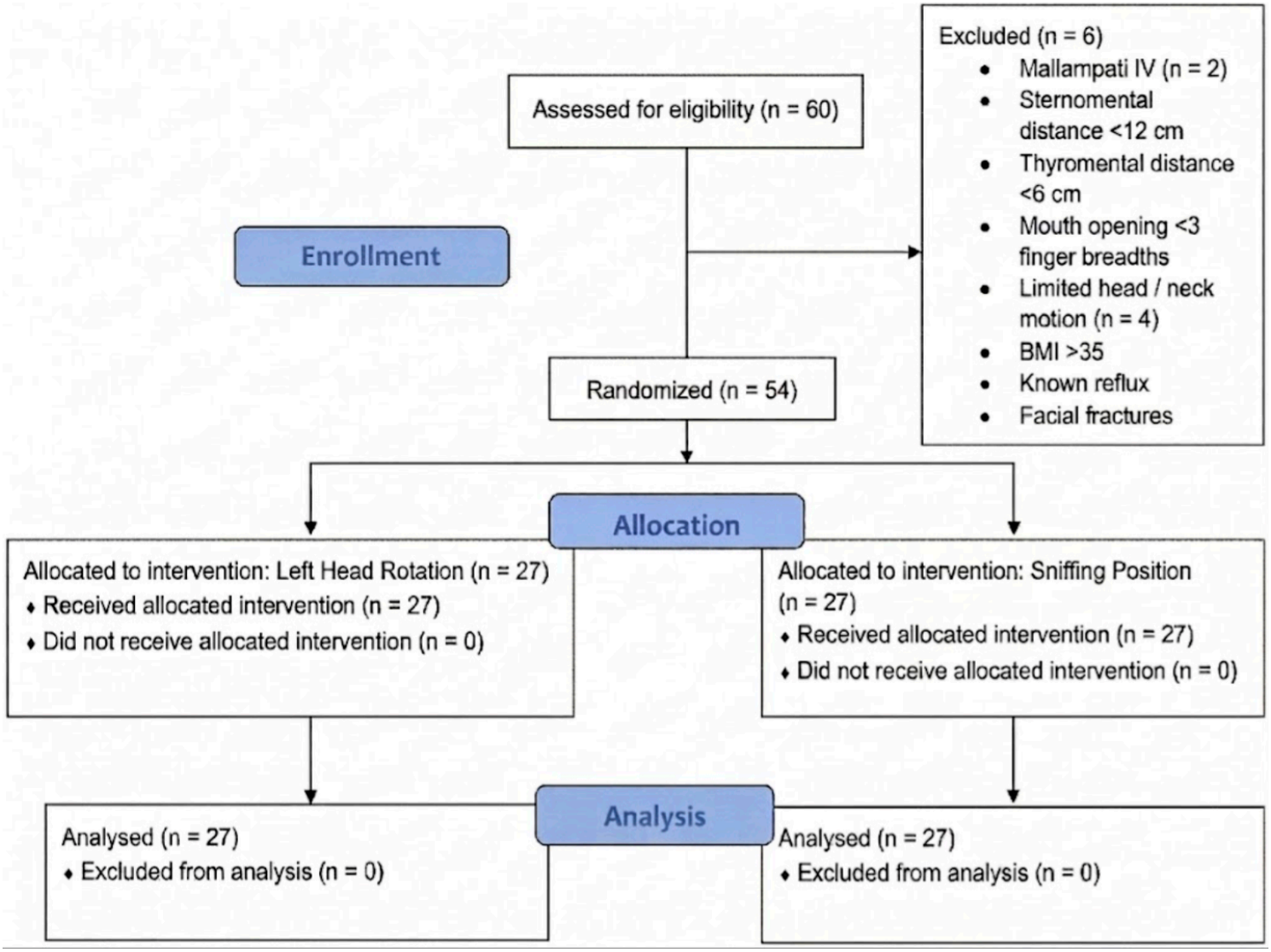


Figure 1

CONSORT flow diagram showing patient enrolment, exclusions, randomisation, allocation, follow-up, and analysis.

CONSORT = Consolidated Standards of Reporting Trials

BMI = Body Mass Index

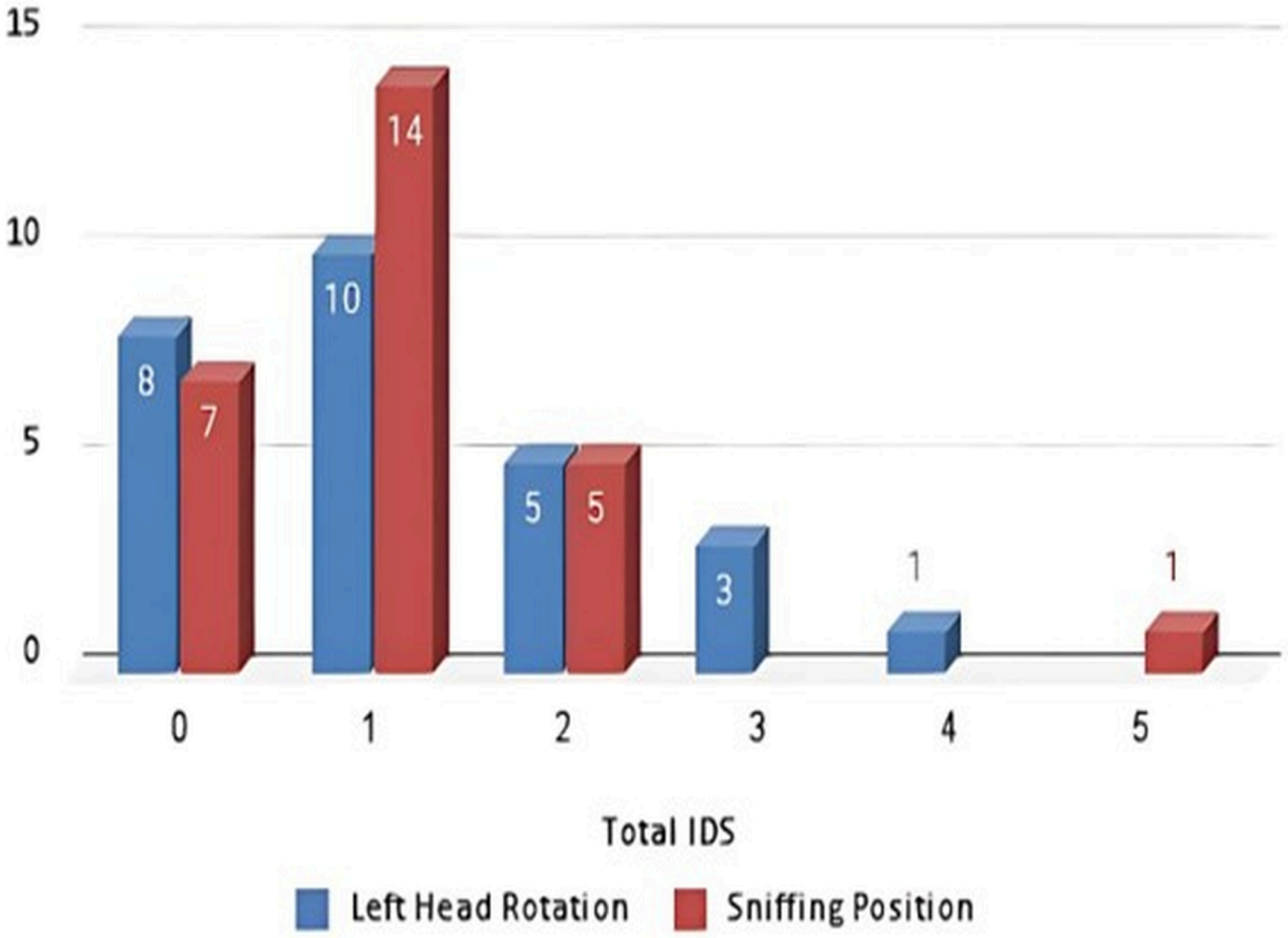


Figure 2

Distribution of Intubation Difficulty Scale (IDS) scores in both groups.

Data presented as number of patients in each IDS category. Comparison performed using Chi-square test. Group A: left head rotation (n=27); Group B: sniffing position (n=27).

IDS = Intubation Difficulty Scale

Supplementary Files

This is a list of supplementary files associated with this preprint. Click to download.

- CONSORT2010Checklist.doc