e-ISSN: 0976-822X, p-ISSN:2961-6042

Available online on http://www.ijcpr.com/

International Journal of Current Pharmaceutical Review and Research 2026; 18(9); 506-512

Original Research Article

Comparative Evaluation of Ramp versus Sniffing Position for Videolaryngoscopy-Guided Tracheal Intubation in Obese Patients: A Prospective Randomized Comparative Study

Mahejbin Pathan[1], Ankita Joshi[2], Meenakshi Paratey-Nimje[3], Noorjahan Manikindi[4], Srushti M. Nimje[5], Vishwas Sathe[6]

[1]Assistant Professor, Department of Anaesthesiology, Mahatma Gandhi Mission (MGM) Medical College & Hospital, Navi Mumbai, Maharashtra, India

[2]Associate Professor, Department of Anaesthesiology, Mahatma Gandhi Mission (MGM) Medical College & Hospital, Navi Mumbai, Maharashtra, India

[3]Assistant Professor, Department of Anaesthesiology, Mahatma Gandhi Mission (MGM) Medical College & Hospital, Navi Mumbai, Maharashtra, India

[4]Senior Resident, Department of Anaesthesiology, Mahatma Gandhi Mission (MGM) Medical College & Hospital, Navi Mumbai, Maharashtra, India

[6]Professor & HOD, Department of Anaesthesiology, Mahatma Gandhi Mission (MGM) Medical College & Hospital, Navi Mumbai, Maharashtra, India

Received: 01-06-2026 / Revised: 15-07-2026 / Accepted: 21-08-2026
Corresponding author: Dr. Mahejbin Pathan
Conflict of interest: Nil

Abstract

Background: Tracheal intubation in obese patients presents substantial challenges due to altered upper airway geometry and diminished functional residual capacity. While the ramped position improves glottic exposure during direct laryngoscopy, its clinical utility alongside videolaryngoscopy (VL) remains debated. This prospective randomized comparative study evaluated whether the ramped position provides superior intubation dynamics compared with the conventional sniffing position during VL-guided intubation in obese adults.

Methods: Eighty adult patients aged 18–65 years with Body Mass Index (BMI) ≥ 30 kg/m^2 and ASA physical status II–III scheduled for elective surgery under general anesthesia were enrolled and allocated into two equal groups of 40: Group R (ramped position aligning external auditory meatus horizontally with sternal notch) and Group S (sniffing position with a 7-cm firm occipital pillow). Both groups underwent standardized induction followed by videolaryngoscopy. The primary outcome was Time to Intubation (TTI). Secondary outcomes included Percentage of Glottic Opening (POGO) score, Cormack–Lehane (CL) grade, Intubation Difficulty Score (IDS), first-pass success rate, hemodynamic trends, and peri-intubation desaturation (SpO_2 < 92%).

Results: Baseline demographic and airway parameters were comparable between groups, with equal gender distribution (20 females [50.0%] and 20 males [50.0%] per group, p=1.000). Mean TTI was significantly shorter in Group R than in Group S (25.3 ± 5.8 s vs. 47.7 ± 9.7 s, p<0.001). Glottic visualization was superior in Group R (median POGO score 100% [IQR: 90–100%] vs. 50% [IQR: 47.5–60%], p<0.001). First-pass success was significantly higher in Group R (95.0% vs. 72.5%, p=0.013). Fewer patients required external laryngeal manipulation in Group R (20.0% vs. 82.5%, p<0.001). Peri-intubation desaturation occurred in 2 patients (5.0%) in Group R compared to 11 patients (27.5%) in Group S (p=0.013).

Conclusion: The ramped position significantly reduces intubation duration, improves glottic visualization, increases first-pass success, and lowers the risk of peri-intubation desaturation compared to the standard sniffing position during videolaryngoscopy in obese patients. Biomechanical airway alignment remains an essential safety intervention despite indirect optical visualization.

Keywords: Airway Management; Intubation, Intratracheal; Laryngoscopy; Obesity; Patient Positioning; Videolaryngoscopy.

DOI: 10.25258/ijcpr.18.9.72

Introduction

Airway management in obese patients presents significant challenges for anesthesiologists. Pathophysiological changes associated with increasing adiposity—including excessive pre-tracheal fat deposition, increased neck circumference, redundant palatopharyngeal soft tissues, limited atlanto-occipital extension, and a prominent anterior chest wall—frequently impede upper airway visualization and device maneuverability [1,2,19]. Concurrently, obesity alters respiratory mechanics: total thoracic compliance is compromised, and the cranial shift of the diaphragm precipitates an exponential decline in functional residual capacity (FRC) [14,15]. Coupled with accelerated metabolic oxygen consumption, these alterations induce rapid arterial desaturation during induction of anesthesia, severely curtailing the duration of safe nonhypoxic apnea [11,12].

The classic "sniffing" position (flexion of the lower cervical spine with extension at the atlanto-occipital joint) has long served as the conventional standard to bring the oral, pharyngeal, and laryngeal axes into alignment [1,2]. In obese individuals, however, substantial posterior cervical fat pads and thoracic bulk place the head into an exaggerated relative extension when supine, preventing true three-axis alignment [2,5]. To overcome this anatomical impediment, the "ramped" position (Head-Elevated Laryngoscopy Position [HELP])—achieved by elevating the patient's head, neck, and upper torso until the external auditory meatus lies horizontally planar with the suprasternal notch—was introduced and validated as superior for direct laryngoscopy (DL) [1,2,5]. With the introduction and widespread clinical adoption of videolaryngoscopes (VL), which project a wide-angle view of the laryngeal inlet without requiring a line-of-sight visual axis, the absolute necessity of routine upper-body ramping has been debated [3,6,10].

Many practitioners have reverted to the simpler sniffing posture under the assumption that high-resolution digital optics negate the requirement for bodily axis alignment [3,4]. However, videolaryngoscopy introduces distinct mechanical challenges [6,9]: securing an optimal camera view of the vocal cords does not guarantee unobstructed passage of the endotracheal tube across an adipose, crowded pharynx [7,8]. Furthermore, ramping recruits resting lung volumes, optimizes chest wall mechanics during positive-pressure bag-mask ventilation, and prolongs safe apnea reserve [12,13,15].

Current international airway guidelines emphasize that optimal patient preparation and positioning are critical determinants of first-pass success in anticipated difficult airways [20-22]. Nevertheless, literature remains divided on whether the ramped posture confers tangible clinical advantages over the sniffing position during videolaryngoscopy in obese cohorts [3,4,10]. Therefore, this prospective randomized comparative study was designed to evaluate the impact of the ramped position versus the conventional sniffing position on intubation time, glottic view, first-pass success, and peri-intubation oxygenation in obese patients undergoing VL-guided tracheal intubation.

Materials and Methods

Study Design and Ethical Considerations: This prospective, randomized, comparative clinical study was conducted in the Department of Anesthesiology at MGM Hospital & Research Centre, CBD Belapur, Navi Mumbai, under MGM Medical College, Nerul. The study protocol received institutional clearance from the Institutional Ethics Committee (IEC) Approval no MGMMCN/IEC/2026/02/01-05. Written informed consent was secured from all participants prior to study inclusion. The trial conformed to the Declaration of Helsinki and adhered to the reporting principles of the Consolidated Standards of Reporting Trials (CONSORT) guidelines.

Patient Selection: Adult patients aged 18 to 65 years with American Society of Anesthesiologists (ASA) physical status II or III, body mass index (BMI) ≥ 30 kg/m^2, scheduled for elective surgical procedures under general endotracheal anesthesia, were assessed preoperatively [19,23].

Exclusion criteria comprised:

1. Anticipated difficult airway on screening (inter-incisor gap < 3 cm, modified Mallampati class IV, thyromental distance < 6 cm, or severely restricted cervical mobility) [20,21].
2. Clinical requirement for rapid sequence induction or emergent operations.
3. Documented history of prior difficult intubation or prior extensive upper airway/pharyngeal surgery [20,22].
4. Active pregnancy.
5. Severe cardiopulmonary compromise or hemodynamically unstable systemic disease.
6. Refusal to participate.

Sample Size Calculation: Based on the study by Korean J Anesthesiol (Mean TTI diff ~18s), sample size is calculated as 40 patients per group (Total N=80) (Power 80%, $\alpha = 0.05$).

Randomization and Patient Positioning: Participants were allocated in a 1:1 ratio into two parallel groups using computer-generated random numbers enclosed in serially numbered, sealed opaque envelopes opened by an operating theatre assistant:

Group R (Ramped Position, n= 40): Patients were positioned on firm ramping pillows and contoured elevation pads placed beneath the upper torso, shoulders, neck, and head until the external auditory meatus was aligned horizontally with the suprasternal notch [1,2].

Group S (Sniffing Position, $n = 40$**):** Patients were positioned supine with a standard 7-cm firm pillow placed beneath the occiput [1,3].

Due to the apparent visual nature of patient posture, blinding of the intubating anesthesiologist was unfeasible. However, data recording of all procedural times, glottic scores, hemodynamics, and complications was conducted by an independent trained observer unaware of the specific study hypotheses.

Anesthetic Protocol: All patients fasted according to standard clinical fasting protocols (6 hours for solids, 2 hours for clear fluids). Standard institutional monitors were attached: continuous electrocardiography (ECG), non-invasive blood pressure (NIBP), pulse oximetry (SpO_2), and end-tidal capnography ($EtCO_2$). Baseline vital parameters were documented. Pre-oxygenation was performed for 3–5 minutes with 100% oxygen using an airtight face mask in the allocated posture [11,13]. General anesthesia was induced intravenously with fentanyl (2 µg/kg) and propofol ($2.0 - 2.5$ mg/kg). Following confirmation of effective bag-mask ventilation, neuromuscular blockade was achieved with intravenous rocuronium ($0.9 - 1.0$ mg/kg). Tracheal intubation commenced 90 seconds post-relaxant administration following confirmed complete muscle relaxation.

Tracheal intubation was performed with a C-MAC videolaryngoscope using a standard Macintosh-type blade (Mac 3 for females, Mac 4 for males) [6,8]. Cuffed endotracheal tubes (internal diameter: 7.0–7.5 mm for females; 8.0–8.5 mm for males) mounted over a preformed rigid stylet were utilized. All intubations were carried out by experienced anesthesiologists proficient in videolaryngoscopy.

Outcome Measurements

Primary Outcome:

- **Time to Intubation (TTI):** Defined as the duration in seconds from the passage of the videolaryngoscope blade beyond the patient's incisors until confirmation of the first continuous square waveform on the $EtCO_2$ monitor [3].

Secondary Outcomes:

- **Glottic Visualization:** Quantified via the Cormack–Lehane (CL) grading system [18] and the Percentage of Glottic Opening (POGO) score (0–100%) [17].
- **Intubation Characteristics:** Intubation Difficulty Score (IDS) [16], first-attempt success rate, total number of attempts, and the requirement for adjunct airway maneuvers (external laryngeal manipulation [BURP] or bougie/stylet adjustment).
- **Hemodynamic Parameters:** Heart rate (HR), systolic blood pressure (SBP), diastolic blood pressure (DBP), and mean arterial pressure (MAP) recorded at baseline, post-induction, and 1, 3, and 5 minutes post-intubation.
- **Complications:** Peri-intubation hypoxemia ($SpO_2 < 92\%$), dental or lip injury, airway mucosal bleeding, and accidental esophageal intubation [7,20].

An intubation attempt was categorized as failed if TTI exceeded 120 seconds or if SpO_2 declined below 92%, triggering immediate blade withdrawal, bag-mask re-oxygenation, and escalation of difficult airway algorithms [20,21].

Statistical Analysis: Continuous parametric data (age, weight, height, BMI, TTI, hemodynamics) are presented as mean $\pm$ standard deviation (SD) and compared between groups using the independent Student's t-test. Non-parametric continuous or ordinal variables (POGO score, IDS score) are expressed as median (interquartile range [IQR]) and analyzed using the Mann–Whitney U test. Categorical and nominal variables (sex, ASA classification, CL grade, first-attempt success, complication rates) are reported as frequencies and percentages (n [%]) and evaluated using the Chi-square test or Fisher's exact test. Two-tailed p-values < 0.05 were considered statistically significant.

Results

A total of 80 patients were enrolled, allocated, and completed the study protocol (40 in Group R and 40 in Group S).

Baseline Demographic and Preoperative Airway Data: Baseline demographic and preoperative airway characteristics were comparable between Group R and Group S, confirming adequate allocation balance across all variables, including a balanced sex distribution (20 males [50.0%] and 20 females [50.0%] in each group; p=1.000; all baseline p>0.05) [Table 1].

Primary and Secondary Intubation Outcomes: The primary endpoint, Time to Intubation (TTI), was significantly shorter in Group R compared with Group S (25.3 ± 5.8 s vs. 47.7 ± 9.7 s; mean difference of 22.5 s, 95% CI: 18.9 to 26.0 s, p<0.001) [Table 2].

Group R demonstrated superior glottic visualization. POGO scores were significantly higher in Group R (median 100% [IQR: 90–100%] vs. median 50% [IQR: 47.5–60%], p<0.001). A Cormack–Lehane Grade I view was achieved in 32 patients (80.0%) in

Group R versus 2 patients (5.0%) in Group S (p<0.001), while Grade III views occurred exclusively in Group S (10 patients [25.0%] vs. 0 patients [0.0%]).

First-attempt intubation success was achieved in 38 patients (95.0%) in Group R compared to 29 patients (72.5%) in Group S (p=0.013). Eleven patients (27.5%) in Group S required a second attempt compared to 2 patients (5.0%) in Group R. The requirement for external laryngeal manipulation was markedly lower in Group R (20.0% vs. 82.5%, p<0.001), as was the need for stylet or bougie adjustments (7.5% vs. 90.0%, p<0.001).

Table 1: Baseline Demographic and Preoperative Airway Characteristics

Parameter	Group R (Ramped, n=40)	Group S (Sniffing, n=40)	p-value
Age (years)	46.7 ± 9.8	47.5 ± 8.9	0.720
Sex (Female / Male)	20 (50.0%) / 20 (50.0%)	20 (50.0%) / 20 (50.0%)	1.000
Weight (kg)	93.7 ± 8.3	93.8 ± 7.8	0.950
Height (cm)	163.4 ± 6.5	163.5 ± 6.1	0.929
BMI (kg/m²)	35.1 ± 1.1	35.1 ± 1.2	0.995
ASA Grade (II / III)	24 (60.0%) / 16 (40.0%)	22 (55.0%) / 18 (45.0%)	0.821
Neck Circumference (cm)	43.1 ± 2.5	43.1 ± 2.4	0.982
Mallampati Class (I / II / III)	6 (15.0%) / 18 (45.0%) / 16 (40.0%)	5 (12.5%) / 17 (42.5%) / 18 (45.0%)	0.888
Thyromental Distance (cm)	6.4 ± 0.4	6.4 ± 0.4	0.855
Sternomental Distance (cm)	13.2 ± 0.7	13.2 ± 0.7	0.874
Interincisor Gap (cm)	3.9 ± 0.3	3.9 ± 0.3	1.000
Features/History of OSA (n, %)	14 (35.0%)	14 (35.0%)	1.000

Table 2: Comparison of Primary and Secondary Intubation Parameters

Parameter	Group R (n=40)	Group S (n=40)	Test Value	p-value
Time to Intubation (s) (mean ± SD)	25.3 ± 5.8	47.7 ± 9.7	t = -12.56	<0.001
POGO Score (%) (median [IQR])	100 [90 – 100]	50 [47.5 – 60]	U = 1567.0	<0.001
Cormack–Lehane Grade (I / II / III)	32 (80.0%) / 8 (20.0%) / 0 (0.0%)	2 (5.0%) / 28 (70.0%) / 10 (25.0%)	χ^2 = 47.58	<0.001
Intubation Difficulty Score (IDS)	0 [0 – 0]	2 [1 – 3]	U = 119.0	<0.001
First-Attempt Success (n, %)	38 (95.0%)	29 (72.5%)	Fisher's exact	0.013
Number of Attempts (1 / 2)	38 (95.0%) / 2 (5.0%)	29 (72.5%) / 11 (27.5%)	Fisher's exact	0.013
External Laryngeal Manipulation (n, %)	8 (20.0%)	33 (82.5%)	χ^2 = 28.82	<0.001
Stylet / Bougie Adjustment (n, %)	3 (7.5%)	36 (90.0%)	χ^2 = 51.23	<0.001

Hemodynamic Profile and Complications: Hemodynamic parameters did not differ significantly at baseline (HR: 81.2 ± 5.9 bpm vs. 81.2 ± 5.8 bpm, p=0.954; MAP: 103.3 ± 7.5 mmHg vs. 103.2 ± 7.7 mmHg, p=0.977) or immediately post-induction [Table 3]. However, at 1 minute post-intubation, Group S displayed significantly higher mean arterial pressures (115.8 ± 6.3 mmHg vs. 100.0 ± 4.6 mmHg, p<0.001) and heart rates (94.7 ± 6.0 bpm vs. 80.2 ± 4.5 bpm, p<0.001). This exaggerated sympathetic response persisted at 3 minutes and 5 minutes post-intubation (p<0.001).

Episodes of peri-intubation arterial desaturation (SpO_2 < 92%) occurred in 11 patients (27.5%) in Group S compared with 2 patients (5.0%) in Group R (p=0.013). Minor airway mucosal trauma/bleeding was observed in 7 patients (17.5%) in Group S versus 1 patient (2.5%) in Group R (p=0.057). No esophageal intubations, dental injuries, or severe bradycardia occurred in either group.

Table 3: Hemodynamic Measurements and Procedural Complications

Parameter	Group R (n=40)	Group S (n=40)	p-value

Baseline Heart Rate (bpm)	81.2 ± 5.9	81.2 ± 5.8	0.954
Baseline MAP (mmHg)	103.3 ± 7.5	103.2 ± 7.7	0.977
1-min Post-Intubation MAP (mmHg)	100.0 ± 4.6	115.8 ± 6.3	<0.001
3-min Post-Intubation MAP (mmHg)	91.3 ± 3.1	105.2 ± 4.8	<0.001
5-min Post-Intubation MAP (mmHg)	87.7 ± 2.7	98.2 ± 3.9	<0.001
Peri-induction Desaturation (SpO_2 < 92%)	2 (5.0%)	11 (27.5%)	0.013
Airway Mucosal Bleeding (n, %)	1 (2.5%)	7 (17.5%)	0.057
Dental / Lip Injury (n, %)	0 (0.0%)	0 (0.0%)	1.000
Accidental Esophageal Intubation	0 (0.0%)	0 (0.0%)	1.000

Discussion

Airway management in the obese surgical patient demands both optical exposure and mechanical access [1,19]. While videolaryngoscopy minimizes the need for direct line-of-sight alignment by using micro-video cameras, our findings demonstrate that indirect digital optics cannot substitute for anatomical positioning [6,9,10]. In this prospective comparative study of 80 obese patients with balanced gender distribution (50% male, 50% female in each cohort), the ramped position significantly reduced intubation duration, improved glottic visibility, raised first-pass success rates, and attenuated peri-intubation hemodynamic surges and hypoxemia compared with the sniffing position.

The primary outcome, Time to Intubation (TTI), was reduced by a clinically meaningful mean difference of 22.5 seconds in the ramped cohort (25.3 ± 5.8 s vs. 47.7 ± 9.7 s, p<0.001). In the conventional sniffing position, prominent anterior chest adipose tissue restricts the caudal excursion of the laryngoscope handle, steepening the blade angle during insertion [1,2]. Concurrently, posterior pharyngeal redundant soft tissues collapse dorsally under general anesthesia and muscle relaxation, substantially constricting hypopharyngeal volume [2,19]. Although videolaryngoscopy often captures an image of the vocal cords despite this spatial crowding, maneuvering and railroading the endotracheal tube past the base of the tongue into the glottic aperture frequently encounters acute mechanical impingement [7,8]. Aligning the external auditory meatus horizontally with the suprasternal notch via upper torso elevation recruits gravitational displacement of anterior chest wall and breast tissues away from the submandibular space, restoring operational working room for tracheal tube passage [1,2,5].

These findings align with prior clinical literature. A prospective study in the *Korean Journal of Anesthesiology* demonstrated that the ramped position significantly decreased intubation time and lowered Intubation Difficulty Scale (IDS) values during videolaryngoscopy in morbidly obese cohorts [3]. Similarly, recent systematic reviews and meta-analyses conclude that ramped positioning optimizes tracheal tube delivery and manual ventilation mechanics across elevated BMI populations [2,10].

Our secondary endpoints further substantiate these mechanical benefits. Glottic visualization—quantified by POGO score and Cormack–Lehane classification—strongly favored the ramped configuration [17,18]. Median POGO scores reached 100% in Group R versus only 50% in Group S (p<0.001), and 80.0% of ramped patients demonstrated Cormack–Lehane Grade I views compared to 5.0% in the sniffing cohort. Although acceptable visualization was ultimately achieved in most sniffing-position patients, 82.5% required external laryngeal manipulation (BURP) and 90.0% necessitated repeated stylet or bougie re-angulation to guide the tube into the trachea. By comparison, 80.0% of ramped patients were successfully intubated without any external manipulation. This reduced manual resistance translated directly into superior first-attempt success (95.0% in Group R vs. 72.5% in Group S, p=0.013) and reduced mucosal trauma (2.5% vs. 17.5%). The prolonged instrumentation, repeated blade manipulations, and tactile difficulty in the sniffing cohort elicited marked sympathoadrenal stimulation, evidenced by significantly higher heart rates and mean arterial pressures at 1, 3, and 5 minutes post-intubation (p<0.001).

Critically, balancing gender distribution equally across both cohorts (20 males and 20 females in each arm) eliminated potential confounding attributable to sexual dimorphism in adipose tissue topography and airway dimensions. Men characteristically display android (central/cervical) fat distribution with larger neck circumferences and pharyngeal collapsibility, often requiring larger laryngoscope blades (Mac 4), whereas women more commonly demonstrate gynoid adiposity with voluminous anterior thoracic tissue and breast tissue that directly impinge on blade handle insertion [1,2,19]. Subgroup analysis within our balanced cohort confirmed that the time savings conferred by ramping was robust and consistent across both sexes (females: 25.9 ± 6.5 s vs. 47.6 ± 9.6 s; males: 24.7 ± 5.1 s vs. 47.9 ± 10.1 s), underscoring that the mechanical relief offered by torso elevation benefits both android-type pre-tracheal narrowing and gynoid-type anterior chest interference.

From a safety perspective, preserving arterial oxygen reserve during induction is paramount in obese patients [11,12]. Functional residual capacity declines exponentially with increasing BMI in the flat supine and standard sniffing postures as abdominal contents push the paralyzed diaphragm cranially, producing progressive basal atelectasis and ventilation-perfusion mismatch [14,15]. Ramping elevates the torso and head, relieving intra-abdominal cephalad pressure on the diaphragm, restoring functional resting lung volume, and enhancing pulmonary oxygen stores during pre-oxygenation [11-13,15]. In our study, peri-intubation desaturation ($SpO_2 < 92\%$) was over five-fold higher in the sniffing cohort (27.5% vs. 5.0%, p=0.013). The combination of longer intubation times and compromised baseline FRC in the sniffing group created a precarious safety margin, reinforcing clinical guidelines that advocate routine head-and-torso elevation as a foundational safety maneuver in obese airway management [20-23].

Limitations

1. Blinding the primary intubator to patient posture was structurally unachievable, introducing potential operator bias. This was mitigated by utilizing objective primary endpoints (time to capnographic confirmation) and independent data collectors.
2. The study evaluated elective surgical patients with a mean BMI of ~ 35 kg/m^2; results may not fully extrapolate to super-obese cohorts (BMI > 50 kg/m^2) or rapid-sequence crash inductions.
3. Ramping was achieved using standardized hospital ramping pillows and folded blankets rather than dedicated commercial positioners, though alignment of the external auditory meatus with the sternal notch was confirmed for all patients in Group R.

Conclusion

The ramped position provides clear advantages over the standard sniffing position during videolaryngoscopy-guided tracheal intubation in obese patients. Ramping shortens intubation time, enhances glottic visualization, increases first-pass success, and lowers the incidence of oxygen desaturation. Videolaryngoscope optics do not replace anatomical axis optimization. Routine adoption of the ramped position is recommended as the primary airway positioning standard for obese patients undergoing general anesthesia.

Declarations

Ethical Approval: Approved by the Institutional Ethics Committee (IEC), MGM Medical College Nerul, Navi Mumbai.

Informed Consent: Written informed consent was obtained from all individual participants prior to enrollment.

Data Availability: De-identified clinical datasets generated during this study are available from the corresponding author upon reasonable academic request.

References:

1. Rao SL, Kunselman AR, Schuler HG, DesHarnais S. Laryngoscopy and tracheal intubation in the head-elevated position in obese patients: a randomized, controlled, equivalence trial. Anesth Analg. 2008;107(6):1912–1918.
2. Collins JS, Lemmens HJ, Brodsky JB, Brock-Utne JG, Levitan RM. Laryngoscopy and morbid obesity: a comparison of the "sniff" and "ramped" positions. Obes Surg. 2004;14(9):1171–1175.
3. Lee JH, Jung JY, Kang SY, Baek SH, Lim SH. Ramped versus sniffing position in the videolaryngoscopy-guided tracheal intubation of morbidly obese patients: a prospective randomized study. Korean J Anesthesiol. 2022;75(4):320–327.
4. Semler MW, Janz DR, Russell DW, Casey JD, Lentz RJ, Zouk AN, et al. A multicenter, randomized trial of ramped position vs sniffing position during endotracheal intubation of critically ill adults. Chest. 2017;152(5):988–995.
5. Cattano D, Melnikov V, Khalil Y, Sridhar S, Hagberg CA. Positioning morbidly obese patients for anesthesia induction: a randomized trial. Minerva Anestesiol. 2010;76(12):1007–1012.
6. Aziz MF, Dillman D, Fu R, Brambrink AM. Comparative effectiveness of the C-MAC video laryngoscope versus direct laryngoscopy in the setting of the predicted difficult airway. Anesthesiology. 2012;116(3):629–636.

7. Cooper RM. Complications associated with the use of the GlideScope videolaryngoscope. Can J Anaesth. 2007;54(1):54–57.
8. Cavus E, Kieckhaefer J, Doerges V, Moeller T, Thee C, Bein B. The C-MAC videolaryngoscope: first experiences with a new device for videolaryngoscopy-guided intubation in patients with difficult airways. Anesth Analg. 2010;110(2):473–477.
9. Kelly FE, Cook TM. Seeing is believing. Getting the best out of videolaryngoscopy. Br J Anaesth. 2016;117(Suppl 1):i9–i13.
10. Hansel J, Rogers AM, Lewis SR, Cook TM, Smith AF. Videolaryngoscopy versus direct laryngoscopy for adult patients requiring tracheal intubation: a Cochrane Systematic Review. Br J Anaesth. 2022;129(4):612–623.
11. Dixon BJ, Dixon JB, Carden JR, Burn AJ, Schachter LM, Playfair JM, et al. Preoxygenation is more effective in the 25° head-up position than in the supine position in severely obese patients: a randomized controlled study. Chest. 2005;128(3):1716–1720.
12. Boyce JR, Ness T, Gleysteen P. A ramped position increases the duration of nonhypoxic apnea in morbidly obese patients undergoing general anesthesia. Anesth Analg. 2003;97(3):901–904.
13. Altermatt FR, Muñoz HR, Delfino AE, Cortínez LI. Pre-oxygenation in the obese patient: effects of position on tolerance to apnea. Br J Anaesth. 2005;95(5):706–709.
14. Pelosi P, Croci M, Ravagnan I, Tredici S, Pedoto A, Lissoni A, et al. The effects of body mass index on lung volumes, respiratory mechanics, and gas exchange during general anesthesia. Anesth Analg. 1998;87(3):654–660.
15. Valenza F, Vagginelli F, Tiby A, Francesconi S, Ronzoni G, Guglielmi M, et al. Effects of the ramp position on respiratory mechanics and gas exchange in obese patients during general anesthesia. Anesth Analg. 2007;104(4):869–875.
16. Adnet F, Borron SW, Racine SX, Clemessy JL, Fournier JL, Plaisance P, et al. The Intubation Difficulty Scale (IDS): proposal and evaluation of a new score characterizing the difficulty of endotracheal intubation. Anesthesiology. 1997;87(6):1290–1297.
17. Levitan RM, Ochroch EA, Kush S, Shofer FS, Hollander JE. Assessment of airway visualization: validation of the percentage of glottic opening (POGO) score. Acad Emerg Med. 1998;5(9):919–923.
18. Cormack RS, Lehane J. Difficult tracheal intubation in obstetrics. Anaesthesia. 1984;39(11):1105–1111.
19. Brodsky JB, Lemmens HJ, Brock-Utne JG, Vierra M, Saidman LJ. Morbid obesity and tracheal intubation. Anesth Analg. 2002;94(3):732–736.
20. Ahmad I, El-Boghdadly K, Bhagrath R, Hodzovic I, McNarry AF, Mir F, et al. Difficult Airway Society guidelines for the management of the anticipated difficult airway in adults. Anaesthesia. 2024;79(6):615–640.
21. Apfelbaum JL, Hagberg CA, Connis RT, Abdelmalak BB, Agarkar M, Dutton RP, et al. 2022 American Society of Anesthesiologists practice guidelines for management of the difficult airway. Anesthesiology. 2022;136(1): 31–81.
22. Law JA, Broemling N, Cooper RM, Drolet P, Duggan LV, Griesdale DE, et al. The difficult airway with recommendations for management – Part 2 – The anticipated difficult airway. Can J Anaesth. 2013;60(11):1119–1138.
23. Nightingale CE, Margarson MP, Shearer E, Redman JW, Lucas DN, Cousins JM, et al. Peri-operative management of the obese surgical patient 2015: Association of Anaesthetists of Great Britain and Ireland Society for Obesity and Bariatric Anaesthesia. Anaesthesia. 2015;70(7):859–876.