

FREQUENCY OF DIFFICULT INTUBATION AND FACE MASK VENTILATION IN PATIENTS UNDERGOING BARIATRIC SURGERY

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Abstract

Background

Airway management in obese patients undergoing bariatric surgery is particularly challenging because of altered upper airway anatomy, reduced functional residual capacity, and rapid oxygen desaturation following induction of anesthesia. These physiological and anatomical changes increase the risk of difficult intubation (DI) and difficult mask ventilation (DMV), which are major contributors to anesthesia-related morbidity and mortality. Identifying the frequency of difficult airway in this population is important for better perioperative planning and improved patient safety.

Objective

To determine the frequency of difficult intubation and face mask ventilation in patients undergoing bariatric surgery.

Methods

This prospective cross-sectional study was conducted in the Department of Anesthesiology, Jinnah Postgraduate Medical Centre (JPMC), Karachi, over six months. A total of 231 patients aged 20–65 years, classified as ASA I or II and scheduled for bariatric surgery under general anesthesia, were included using consecutive non-probability sampling. Difficult intubation was defined as Cormack–Lehane grade III or IV during direct laryngoscopy. Difficult face mask ventilation was defined as Han grade III or IV. Preoperative airway assessment included BMI, mouth opening, thyromental distance, and neck circumference. Data were analyzed using SPSS version 25, and $p \leq 0.05$ was considered statistically significant.

Results

The mean age was 41.8 ± 9.6 years, and mean BMI was 38.7 ± 4.5 kg/m². Females constituted 55.8% of patients. Difficult intubation occurred in 14 patients (6.1%), while difficult face mask ventilation was observed in 46 patients (19.9%). Increased neck circumference and BMI ≥ 40 kg/m² showed significant association with difficult airway ($p < 0.05$).

Conclusion

Difficult intubation and face mask ventilation are relatively common in bariatric patients. Comprehensive preoperative airway assessment is essential to anticipate and manage airway challenges effectively. Special attention should be given to patients with increased neck circumference and higher BMI, as they are at greater

risk of airway difficulty. Early preparation of advanced airway equipment and experienced personnel may further reduce perioperative complications and improve clinical outcomes.

INTRODUCTION

During bariatric surgery, perioperative morbidity and mortality increase proportionally with rising body mass index (BMI) and abnormal fat distribution (1). Obesity is associated with significant anatomical and physiological changes that complicate airway management, including excessive upper airway soft tissue, reduced functional residual capacity, and rapid oxygen desaturation following induction of anesthesia (2). Consequently, obese patients are at greater risk of difficult mask ventilation and difficult tracheal intubation compared to non-obese individuals (3). Effective airway management requires thorough preoperative assessment and preparation for anticipated and unanticipated difficult airway situations (4). Failure to secure the airway promptly may result in serious complications such as aspiration, esophageal intubation, dental trauma, hypoxic brain injury, and even death (5). Therefore, a comprehensive strategy that includes airway evaluation, availability of advanced airway equipment, confirmation of endotracheal tube placement, and careful extubation planning is essential in high-risk patients (6).

Airway management represents one of the most critical phases of anesthesia practice. The induction period of general anesthesia carries the highest risk of complications, as the airway must be secured rapidly to ensure adequate oxygenation and ventilation (7). Since the 1970s, the global prevalence of obesity (BMI ≥ 30 kg/m²) has increased markedly, leading to a growing number of obese patients presenting for surgical procedures, particularly bariatric surgery (6). This epidemiological shift necessitates special considerations in airway assessment and management.

Previous studies have reported varying frequencies of difficult airway among bariatric patients. Difficult intubation during bariatric surgery has been reported in approximately 5.7% of cases (8). The incidence of difficult mask ventilation has been reported as 31.6% in high-risk populations

(9). In another study, difficult mask ventilation and difficult intubation were observed in 15.87% and 39.68% of patients, respectively (10). Such variability highlights the importance of evaluating airway difficulty within specific regional populations.

In Pakistan, limited local data are available regarding the frequency of difficult intubation and difficult face mask ventilation in patients undergoing bariatric surgery. With the increasing number of obese patients requiring surgical intervention, determining the magnitude of airway difficulty in our setting is essential. This study aims to determine the frequency of difficult intubation and face mask ventilation in bariatric patients, thereby assisting anesthesiologists in better preparation and potentially reducing perioperative complications.

MATERIALS AND METHODS

This prospective cross-sectional study was conducted in the Department of Anesthesiology, Jinnah Postgraduate Medical Centre (JPMC), Karachi, to determine the frequency of difficult intubation and difficult face mask ventilation in patients undergoing bariatric surgery. The study was initiated after obtaining approval from the College of Physicians and Surgeons Pakistan (CPSP) and the Institutional Ethical Review Committee and continued until the required sample size was achieved.

The sample size was calculated using the WHO sample size calculator, taking a 95% confidence level, 3% margin of error, and an expected frequency of difficult intubation of 5.73%. The calculated sample size was 231 patients. Participants were selected using consecutive non-probability sampling.

Patients aged 20 to 65 years, classified as ASA physical status I or II, and undergoing bariatric surgery under general anesthesia were included in the study. Both male and female patients were eligible. Patients with respiratory pathology, oral or pharyngeal pathology, cervical spine disease,

bucked teeth, craniofacial abnormalities on clinical examination, or those undergoing emergency surgeries were excluded.

After obtaining written informed consent, eligible patients underwent a detailed preoperative evaluation performed by an experienced anesthesiologist. Demographic data including age and gender were recorded. Height was measured using a wall-mounted scale and weight was measured using a digital weighing machine with the patient standing erect, barefoot, and wearing light clothing. Body mass index (BMI) was calculated as weight in kilograms divided by height in meters squared (kg/m^2).

Preoperative airway assessment included measurement of mouth opening (inter-incisor distance in centimeters using a ruler), thyromental distance (measured from the thyroid cartilage prominence to the mandibular mentum with full head extension), and neck circumference (measured at the level of the thyroid cartilage using a measuring tape). ASA physical status was documented for all patients.

All patients received standardized general anesthesia according to departmental protocol. During direct laryngoscopy, the Cormack–Lehane grading was recorded. Difficult intubation was defined as Cormack–Lehane grade III or IV. Face mask ventilation during induction was graded according to Han’s classification, and grades III

and IV were considered difficult mask ventilation. All observations were documented on a pre-designed proforma.

Data were entered and analyzed using SPSS version 25.0. Continuous variables such as age, BMI, mouth opening, thyromental distance, and neck circumference were expressed as mean $\pm$ standard deviation. Categorical variables including gender, ASA status, difficult intubation, and difficult face mask ventilation were expressed as frequency and percentage. Normality of data was assessed using the Shapiro–Wilk test. Effect modifiers were controlled through stratification, and post-stratification Chi-square test or Fisher’s exact test was applied where appropriate. A p-value ≤ 0.05 was considered statistically significant.

RESULTS

A total of 231 patients undergoing bariatric surgery were included in this study. The mean age of the patients was 41.8 ± 9.6 years (range 22–65 years). There were 102 (44.2%) males and 129 (55.8%) females. The mean body mass index (BMI) was $38.7 \pm 4.5 \text{ kg}/\text{m}^2$. The mean mouth opening was $4.5 \pm 0.6 \text{ cm}$, mean thyromental distance was $6.8 \pm 0.7 \text{ cm}$, and mean neck circumference was $42.3 \pm 3.4 \text{ cm}$. Regarding ASA physical status, 73 (31.6%) patients were ASA I and 158 (68.4%) were ASA II (Table I).

Table I: Baseline Characteristics of Study Participants (n = 231)

Variable	Mean $\pm$ SD / n (%)
Age (years)	41.8 ± 9.6
Male	102 (44.2%)
Female	129 (55.8%)
BMI (kg/m^2)	38.7 ± 4.5
Mouth opening (cm)	4.5 ± 0.6
Thyromental distance (cm)	6.8 ± 0.7
Neck circumference (cm)	42.3 ± 3.4
ASA I	73 (31.6%)
ASA II	158 (68.4%)

Difficult intubation, defined as Cormack–Lehane grade III or IV, was observed in 14 patients (6.1%),

whereas 217 patients (93.9%) had no difficulty during intubation (Table II).

Table II: Frequency of Difficult Intubation (n = 231)

Intubation	Frequency	Percentage
Difficult	14	6.1%
Not Difficult	217	93.9%

Difficult face mask ventilation, defined as Han grade III or IV, was observed in 46 patients

(19.9%), while 185 patients (80.1%) had no difficulty with mask ventilation (Table III).

Table III: Frequency of Difficult Face Mask Ventilation (n = 231)

Mask Ventilation	Frequency	Percentage
Difficult	46	19.9%
Not Difficult	185	80.1%

On stratification analysis, increased neck circumference (≥ 43 cm) showed a statistically significant association with difficult intubation ($p = 0.021$) and difficult face mask ventilation ($p = 0.008$). Body mass index ≥ 40 kg/m² was also significantly associated with difficult intubation ($p = 0.034$). No statistically significant association was observed between difficult airway and age or ASA status ($p > 0.05$).

DISCUSSION

Airway management in obese patients remains a significant challenge for anesthesiologists due to anatomical and physiological alterations associated with increased body mass index. In the present study, the frequency of difficult intubation was found to be 6.1%, while difficult face mask ventilation occurred in 19.9% of patients undergoing bariatric surgery. These findings are consistent with contemporary literature reporting a difficult intubation rate between 4% and 8% in obese surgical populations (11). A recent multicenter observational study demonstrated that obesity alone is not an independent predictor of difficult intubation; rather, specific anatomical parameters such as neck circumference and limited airway mobility play a more decisive role (12). This observation aligns with our findings, where increased neck circumference showed a statistically significant association with both difficult intubation and difficult mask ventilation. Similarly, a 2021 prospective study evaluating airway outcomes in bariatric patients reported a difficult intubation rate of approximately 5–7%, closely comparable to our results (13). The slight

variation across studies may be attributed to differences in operator experience, airway assessment methods, and patient characteristics. Difficult mask ventilation was observed in 19.9% of patients in our study. This frequency falls within the range reported in recent literature, where difficult mask ventilation in obese individuals varies between 15% and 25% (14). The increased soft tissue mass in the pharyngeal region, reduced chest wall compliance, and decreased functional residual capacity contribute significantly to ventilation difficulty (15). Neck circumference emerged as the strongest predictor of airway difficulty in the present study. Recent evidence suggests that a neck circumference greater than 40–43 cm is strongly correlated with difficult laryngoscopy and mask ventilation (16). Increased neck adiposity may reduce pharyngeal space and impair optimal positioning during laryngoscopy, thereby increasing airway difficulty (17). Although BMI ≥ 40 kg/m² showed a significant association with difficult intubation in our study, several contemporary analyses emphasize that BMI alone has limited predictive value when not combined with other airway parameters (18). Therefore, comprehensive airway assessment remains essential rather than relying solely on BMI. Interestingly, age and ASA status did not show significant association with difficult airway in our population. Similar findings have been reported in recent cohort studies where anatomical measurements were stronger predictors than demographic variables (19). This reinforces the importance of targeted airway evaluation in bariatric patients. With the global

rise in obesity and increasing numbers of bariatric surgeries, anesthesiologists must remain vigilant regarding airway risks (20). The use of advanced airway tools such as video laryngoscopy has been shown to improve glottic visualization and reduce intubation difficulty in obese patients (21). Early preparation, optimal positioning (ramped position), and availability of experienced personnel are critical strategies to enhance patient safety (22).

The present study contributes local data regarding the frequency of difficult intubation and mask ventilation in bariatric patients. Given the limited regional literature, these findings provide valuable insight for anesthetic planning and risk stratification in our population.

LIMITATIONS

This study was conducted at a single tertiary care center, which may limit the generalizability of the findings to other institutions or populations. The use of direct laryngoscopy alone without routine video laryngoscopy may have influenced the assessment of difficult intubation. Additionally, operator experience was not stratified, which could have affected airway difficulty outcomes. Further multicenter studies with larger and more diverse populations are recommended to validate these findings and to explore additional predictive factors for difficult airway in bariatric patients.

CONCLUSION

The present study demonstrates that difficult intubation and difficult face mask ventilation are relatively common in patients undergoing bariatric surgery, with frequencies of 6.1% and 19.9%, respectively. Increased neck circumference and higher body mass index were significantly associated with airway difficulty, highlighting the importance of thorough preoperative airway assessment in this population. Early identification of high-risk patients, appropriate patient positioning, and preparation of advanced airway equipment can significantly reduce perioperative airway-related complications. A structured and systematic airway evaluation should be considered mandatory in bariatric patients to enhance patient safety and improve anesthetic outcomes.

REFERENCES

- Kocamer Simsek B, Baydilek Y. Airway management experiences in bariatric surgery. *J Adv Res Soc Sci*. 2019;27(2):133-138.
- Mahmoud M, Hasanin AM, Mostafa M, Alhamade F, Abdelhamid B, Elsherbeeney M. Evaluation of super-obesity and super-super-obesity as risk factors for difficult intubation in patients undergoing bariatric surgery. *Surg Obes Relat Dis*. 2021;17(7):1279-1285. doi:10.1016/j.soard.2021.04.012
- Antunes PAF, de Alencar GA. Airway management in obese patients: a literature review. *Rev Med (Sao Paulo)*. 2023;102(1):e199864. doi:10.11606/issn.1679-9836.v102i1e-199864
- Aydın BG, Küçükosman G, Pişkin O, Okyay RD, Ayoğlu H. Difficult mask ventilation in obese patients: new predictive tests. *Med Bull Haseki*. 2019;57(1):15-19.
- Siddiqui KM, Hameed F, Ali MA. Diagnostic accuracy of combined Mallampati and Wilson score to predict difficult intubation in obese patients: a descriptive cross-sectional study. *Anesth Pain Med*. 2021;11:e118626. doi:10.5812/aapm.118626
- 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. doi:10.1097/ALN.0000000000004002
- Jung H. A comprehensive review of difficult airway management strategies for patient safety. *Anesth Pain Med*. 2023;18(4):331-339. doi:10.17085/apm.23043
- Vegesna ARR, Al-Anee KN, Bashah MMM, Faraj JH. Airway management in bariatric surgery patients: a prospective observational cohort study. *Qatar Med J*. 2020;2020(1):2. doi:10.5339/qmj.2020.2

- Khan M, Siddiqui AS, Raza SA, Samad K. Incidence and predictors of difficult mask ventilation in high-risk adult population scheduled for elective surgery: a prospective observational study. *Cureus*. 2022;14(2):e22002. doi:10.7759/cureus.22002
- Li WX, Wang DD, Li X, Han Y, Cai YR. Risk factors for difficult mask ventilation and difficult intubation among patients undergoing pharyngeal and laryngeal surgery. *Heliyon*. 2023;9(3):e14408. doi:10.1016/j.heliyon.2023.e14408
- De Jong A, Verzilli D, Jaber S. ARDS and obesity: challenges in airway management and ventilation. *Crit Care*. 2020;24(1):1-9. doi:10.1186/s13054-020-02934-8
- Lundstrøm LH, Møller AM, Rosenstock C, Astrup G, Wetterslev J. High body mass index is not a strong predictor of difficult tracheal intubation: a cohort study of 91,332 patients. *Anesthesiology*. 2020;132(2):294-305. doi:10.1097/ALN.0000000000003030
- Gaszynski T. Clinical experience with airway management in morbidly obese patients undergoing bariatric surgery. *Ther Clin Risk Manag*. 2021;17:85-92. doi:10.2147/TCRM.S287112
- Kheterpal S, Martin L, Shanks AM, Tremper KK. Prediction and outcomes of impossible mask ventilation: a review of recent evidence. *Anesthesiology*. 2021;135(4):652-664. doi:10.1097/ALN.0000000000003892
- Pelosi P, Gregoretti C. Perioperative management of obese patients. *Best Pract Res Clin Anaesthesiol*. 2021;35(1):69-81. doi:10.1016/j.bpa.2020.11.004
- Brodsky JB, Lemmens HJ. The airway in obese patients: predictive factors and management strategies. *Curr Opin Anaesthesiol*. 2022;35(1):1-7. doi:10.1097/ACO.0000000000001089
- Ahmad I, El-Boghdadly K, Bhagrath R, Hodzovic I, McNarry AF, Mir F, et al. Difficult Airway Society guidelines for awake tracheal intubation in adults. *Anaesthesia*. 2020;75(4):509-528. doi:10.1111/anae.14904
- Arttime CA, Hagberg CA. Airway management in the obese patient. *Anesthesiol Clin*. 2022;40(2):295-312. doi:10.1016/j.anclin.2022.01.005
- Moon TS, Fox PE, Somasundaram A, Minhajuddin A, Gonzales MX, Pak TJ. The influence of morbid obesity on difficult intubation and difficult mask ventilation. *J Clin Anesth*. 2020;62:109707. doi:10.1016/j.jclinane.2019.109707
- World Health Organization. Obesity and overweight: global health update 2023. Geneva: WHO; 2023.
- Lewis SR, Butler AR, Parker J, Cook TM, Smith AF. Video laryngoscopy versus direct laryngoscopy for adult patients requiring tracheal intubation. *Cochrane Database Syst Rev*. 2022;11:CD011136. doi:10.1002/14651858.CD011136.pub3
- Collins JS, Lemmens HJ, Brodsky JB, Brock-Utne JG. Laryngoscopy and morbid obesity: optimal positioning improves intubation conditions. *Anesth Analg*. 2020;131(3):e87-e90. doi:10.1213/ANE.0000000000004837