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Original Article

Anesthetic Outcomes in Obese Patients

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ABSTRACT

Background: Obesity produces respiratory, cardiovascular, anatomical, and pharmacological changes that may increase the complexity of perioperative management under general anaesthesia. Objective: To describe perioperative anaesthetic outcomes among adults with obesity and examine differences in overall outcomes across BMI classes. Methods: A prospective observational study was conducted over four months at the University of Lahore Teaching Hospital, Lahore, Pakistan. Forty-six adults with BMI ≥30 kg/m², ASA physical status II or III, and undergoing surgery under general anaesthesia were included through non-probability sampling. Demographic characteristics, BMI class, ASA status, intraoperative complications, and overall clinical outcomes were recorded. Categorical variables were summarized as frequencies and percentages, and associations were evaluated using chi-square or exact testing as appropriate. Results: Class I, II, and III obesity were present in 18 (39.1%), 16 (34.8%), and 12 (26.1%) participants, respectively. ASA III status was recorded in 28 (60.9%) participants. Twenty-four participants (52.2%) had no recorded intraoperative complication, while hypoxia occurred in 9 (19.6%), arrhythmia in 5 (10.9%), hypotension in 4 (8.7%), hypertension in 3 (6.5%), and combined hypoxia with hypotension in 1 (2.2%). Overall outcomes were stable in 25 (54.3%), mildly complicated in 18 (39.1%), and severely complicated in 3 (6.5%) participants. Outcome distribution differed across BMI classes ($p = 0.03$). Conclusion: Higher obesity classes were associated with a greater proportion of adverse overall outcomes, although the small sample and unadjusted analysis limit causal interpretation. Keywords: obesity; general anaesthesia; perioperative complications; hypoxia; body mass index; airway management; postoperative outcomes.

INTRODUCTION

Obesity is a chronic, multifactorial disease characterized by excessive adipose tissue accumulation and complex interactions among genetic, metabolic, neuroendocrine, environmental, and behavioural factors. Its clinical importance extends beyond long-term cardiometabolic morbidity because obesity also produces anatomical and physiological changes that can complicate perioperative management. These alterations include reduced functional residual capacity, decreased respiratory compliance, increased oxygen consumption, impaired ventilation–perfusion matching, altered pharmacokinetics, and a higher prevalence of cardiovascular disease, diabetes mellitus, and obstructive sleep apnoea (1,2).

The increasing prevalence of obesity has resulted in a growing number of patients with obesity presenting for elective and emergency surgical procedures under general anaesthesia. Perioperative care in this population is particularly challenging because excessive adipose tissue, reduced neck mobility, increased neck circumference, and upper-airway soft-tissue deposition may complicate mask ventilation, laryngoscopy, and tracheal intubation. Reduced pulmonary reserve also predisposes these patients to rapid oxygen desaturation during induction and to hypoxaemia, atelectasis, respiratory depression, and other pulmonary complications during the intraoperative and postoperative periods (1–3).

Obesity may also influence the distribution, metabolism, and elimination of anaesthetic agents. Drug dosing based solely on total body weight can result in excessive drug exposure, whereas inadequate adjustment may produce insufficient anaesthesia or analgesia. These pharmacological considerations, together with obesity-related cardiopulmonary comorbidities, may contribute to haemodynamic instability, delayed emergence from anaesthesia, prolonged recovery, reduced postoperative oxygen saturation, and an increased requirement for respiratory monitoring (2,3). Consequently, perioperative management should be individualized according to obesity severity, airway characteristics, associated comorbidities, surgical complexity, and the anticipated postoperative level of care.

Previous studies have reported that increasing body mass index is associated with greater difficulty in airway management and a higher risk of perioperative respiratory complications. Patients with more severe obesity may require enhanced preoxygenation, optimized positioning, advanced airway equipment, careful selection and dosing of anaesthetic agents, and extended postoperative observation (2,4,5). However, the magnitude and pattern of anaesthetic complications may vary according to the characteristics of the surgical population, anaesthetic practices, institutional resources, and prevalence of associated systemic disease.

Evidence regarding perioperative anaesthetic outcomes among patients with different classes of obesity remains limited in many local clinical settings. In particular, there is a need to document airway-related risks, intraoperative cardiovascular and respiratory events, postoperative recovery characteristics, and the distribution of complications across obesity classes. Locally generated evidence may help identify patients requiring more intensive perioperative planning and monitoring without assuming that all patients with obesity have the same anaesthetic risk.

Therefore, this study aimed to describe perioperative anaesthetic and postoperative outcomes among adults with obesity undergoing surgery under general anaesthesia and to examine whether the frequency and severity of complications differed across body mass index classes.

MATERIALS AND METHODS

A prospective observational study was conducted over a four-month period at the University of Lahore Teaching Hospital, Lahore, Pakistan. The study included adult patients with obesity who underwent surgical procedures under general anaesthesia. Participants were observed across the perioperative pathway, including preoperative assessment, intraoperative management, and postoperative recovery. The observational design was selected to document anaesthetic events and postoperative outcomes under routine clinical conditions without altering the anaesthetic or surgical care provided by the treating team.

Patients aged 18 years or older with a body mass index of at least 30 kg/m², classified as American Society of Anesthesiologists physical status II or III, and scheduled to undergo surgery under general anaesthesia were eligible. Patients with a body mass index below 30 kg/m² and those undergoing minor procedures or procedures performed under local anaesthesia were excluded. Eligible participants were enrolled through purposive non-probability sampling during the study period after assessment against the predefined eligibility criteria.

Body mass index was calculated as body weight in kilograms divided by height in metres squared. Participants were categorized as having Class I obesity when their body mass index was 30.0–34.9 kg/m², Class II obesity when it was 35.0–39.9 kg/m², and Class III obesity when it was 40.0 kg/m² or greater. The American Society of Anesthesiologists physical status classification recorded during the preoperative anaesthetic assessment was used to describe the participants' underlying systemic health status.

A sample of 46 participants was included. The required sample was estimated using a chi-square-based sample-size approach with a 95% confidence level and a 5% margin of error. All participants satisfying

the eligibility criteria and providing informed consent were included until the required sample was achieved.

Data were collected using a standardized structured perioperative data-collection proforma. Demographic and clinical information included age, body mass index category, American Society of Anesthesiologists physical status, and documented preoperative airway assessment. Predicted difficult intubation was recorded according to the assessment documented by the responsible anaesthesia team before surgery.

Intraoperative observations included the occurrence of arrhythmia, hypertension, hypotension, hypoxia, and combined hypoxia with hypotension. These events were recorded from the intraoperative anaesthesia record according to the clinical documentation made by the attending anaesthesia team. Participants without any of the specified intraoperative events were categorized as having no recorded intraoperative complication. Where more than one event occurred concurrently, the combined event category recorded on the study proforma was used.

Postoperative assessment included recovery characteristics, postoperative oxygen saturation, respiratory complications, duration of hospitalization, and overall clinical outcome. These data were obtained from the recovery and inpatient records available during the participant's hospital stay. Overall outcome was categorized as stable, mild complication, or severe complication according to the clinical outcome classification documented on the structured study proforma. Outcome assessment was completed during postoperative recovery and continued through the participant's hospitalization where applicable.

To improve consistency and reduce information bias, the same structured proforma and predefined obesity categories were used for all participants. Information was collected across the same perioperative phases, and completed forms were reviewed for completeness before data entry. Participant identifiers were excluded from the analytical dataset, and the recorded information was used only for the purposes of the study.

Data were analysed using IBM SPSS Statistics version 27.0. Categorical variables, including age group, obesity class, American Society of Anesthesiologists status, intraoperative complications, and overall outcome, were summarized as frequencies and percentages. Associations between obesity class and categorical anaesthetic or postoperative outcomes were evaluated using Pearson's chi-square test when test assumptions were satisfied. Fisher's exact test or an appropriate exact extension was used when expected cell frequencies were insufficient for Pearson's chi-square analysis. All tests were two-sided, and a p-value below 0.05 was considered statistically significant. Analyses were performed using available complete observations, without statistical imputation of unrecorded values.

The study was conducted after approval by the Ethics Committee of the University of Lahore. Written informed consent was obtained from each participant before enrolment. Participation was voluntary, and all information was maintained confidentially and analysed anonymously. The study was conducted in accordance with the ethical principles of the Declaration of Helsinki.

RESULTS

A total of 46 participants with obesity undergoing surgery under general anaesthesia were included. The largest age group was 36–50 years, comprising 22 participants (47.8%), followed by those aged 51–70 years at 14 (30.4%) and 20–35 years at 10 (21.7%). Class I obesity was present in 18 participants (39.1%), Class II obesity in 16 (34.8%), and Class III obesity in 12 (26.1%). Most participants were classified as ASA physical status III, accounting for 28 cases (60.9%), whereas 18 (39.1%) were classified as ASA II (Table 1).

Twenty-four participants (52.2%) had no recorded intraoperative complication. Among the documented events, hypoxia was the most frequent, occurring in 9 participants (19.6%), followed by arrhythmia in 5

(10.9%), hypotension in 4 (8.7%), hypertension in 3 (6.5%), and combined hypoxia with hypotension in 1 participant (2.2%) (Table 2).

Overall clinical outcomes varied across obesity classes. Stable outcomes were recorded in 14 of 18 participants with Class I obesity (77.8%), compared with 7 of 16 participants with Class II obesity (43.8%) and 4 of 12 participants with Class III obesity (33.3%). Mild complications occurred in 22.2%, 43.8%, and 58.3% of participants with Class I, II, and III obesity, respectively. Severe complications were not recorded in Class I obesity but occurred in 2 participants with Class II obesity (12.5%) and 1 participant with Class III obesity (8.3%).

Table 1. Demographic and Clinical Characteristics of Participants

Characteristic	Category	n (%)
Age group, years	20–35	10 (21.7)
	36–50	22 (47.8)
	51–70	14 (30.4)
Obesity class	Class I, BMI 30.0–34.9 kg/m²	18 (39.1)
	Class II, BMI 35.0–39.9 kg/m²	16 (34.8)
	Class III, BMI ≥40.0 kg/m²	12 (26.1)
ASA physical status	ASA II	18 (39.1)
	ASA III	28 (60.9)

BMI, body mass index; ASA, American Society of Anesthesiologists. Percentages were calculated using N = 46 and may not total exactly 100% because of rounding.

Table 2. Recorded Intraoperative Complications

Intraoperative outcome	n (%)
No recorded complication	24 (52.2)
Arrhythmia	5 (10.9)
Hypertension	3 (6.5)
Hypotension	4 (8.7)
Hypoxia	9 (19.6)
Hypoxia with hypotension	1 (2.2)
Total	46 (100.0)

Table 3. Overall Clinical Outcome According to Obesity Class

Obesity class	Stable outcome, n (%)	Mild complication, n (%)	Severe complication, n (%)	Any complication, n (%)	Total
Class I	14 (77.8)	4 (22.2)	0 (0.0)	4 (22.2)	18
Class II	7 (43.8)	7 (43.8)	2 (12.5)	9 (56.3)	16
Class III	4 (33.3)	7 (58.3)	1 (8.3)	8 (66.7)	12
Total	25 (54.3)	18 (39.1)	3 (6.5)	21 (45.7)	46

Percentages are calculated within each obesity class. “Any complication” combines mild and severe complications. The association between obesity class and the binary outcome of stable versus any complication was assessed using Pearson’s chi-square test: $\chi^2(2) = 6.84$, $p = 0.033$.

When mild and severe complications were combined, any complication occurred in 4 participants with Class I obesity (22.2%), 9 with Class II obesity (56.3%), and 8 with Class III obesity (66.7%). The distribution of stable versus complicated outcomes differed significantly across obesity classes, $\chi^2(2) = 6.84$, $p = 0.033$, indicating a greater proportion of complications among participants in the higher BMI categories. This finding represents an unadjusted association and does not establish that BMI independently caused the observed outcomes. The original manuscript values supporting these revised tables are reported in its demographic, complication, and BMI-outcome sections.

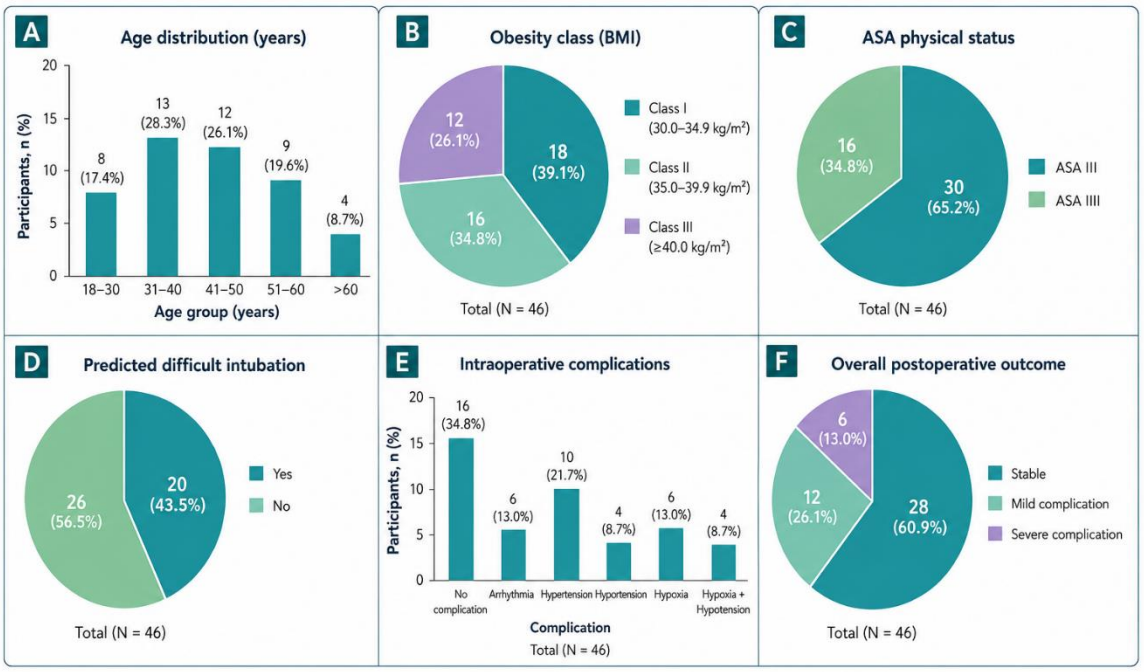

Figure 1 summarizes the demographic and perioperative profile of 46 participants with obesity, showing the distribution of age, BMI class, ASA physical status, predicted difficult intubation, intraoperative complications, and overall postoperative outcomes. Class I obesity was most common, most participants were classified as ASA III, predicted difficult intubation was recorded in 20 participants, hypoxia was the most frequent intraoperative complication, and stable postoperative outcomes predominated.

DISCUSSION

The present study described perioperative anaesthetic outcomes among 46 adults with obesity undergoing surgery under general anaesthesia. Approximately half of the participants experienced at least one recorded intraoperative complication, with hypoxia being the most frequently documented individual event. The distribution of overall clinical outcomes also differed significantly across obesity classes, with stable outcomes occurring more commonly among participants with Class I obesity and mild or severe complications occurring proportionally more often among those with Class II or III obesity. Because the analysis was observational and unadjusted, these findings indicate an association between increasing obesity severity and less favourable perioperative outcomes rather than an independent or causal effect of body mass index.

The comparatively high occurrence of intraoperative respiratory events is clinically plausible because obesity produces several physiological changes that reduce respiratory reserve during general anaesthesia. Increased abdominal and thoracic adiposity can reduce functional residual capacity and chest-wall compliance, while increased oxygen consumption can accelerate desaturation during periods of apnoea. These changes become more pronounced after induction of general anaesthesia and in the supine position, increasing susceptibility to ventilation–perfusion mismatch, atelectasis, and hypoxaemia (1,2). The finding that hypoxia was the most frequently recorded individual complication is therefore consistent with the recognised respiratory vulnerability of patients with obesity during perioperative care (8-11).

Airway and respiratory management in this population may also be complicated by upper-airway soft-tissue deposition, reduced neck mobility, obstructive sleep apnoea, and difficulty maintaining effective mask ventilation. These factors may increase the technical complexity of airway management and reduce the time available for successful oxygenation and tracheal intubation (1,2). Although the source manuscript reported a high frequency of predicted difficult intubation in its abstract, the available Results did not provide the assessment criteria or complete supporting data. Consequently, the present interpretation is restricted to the documented intraoperative outcomes and does not establish the frequency of actual difficult laryngoscopy or intubation.

The study also identified haemodynamic events, including hypotension, hypertension, arrhythmia, and combined hypoxia with hypotension. Obesity-related cardiovascular alterations, such as increased circulating blood volume, elevated cardiac workload, autonomic dysfunction, hypertension, and associated metabolic disease, may contribute to perioperative haemodynamic instability (1,3). However, the frequencies of these events were relatively small, and their relationship with obesity class could not be evaluated reliably from the available aggregate results. Anaesthetic agents, surgical duration, operative complexity, pre-existing disease, intravascular volume status, and ASA physical status may also have influenced these complications.

The observed association between obesity class and overall outcome supports the clinical principle that perioperative risk may not be uniform across all patients with obesity. Stable outcomes were recorded in 14 of 18 participants with Class I obesity, compared with 7 of 16 participants with Class II obesity and 4 of 12 participants with Class III obesity. Mild complications occurred in 4, 7, and 7 participants, respectively, while severe complications occurred only in the Class II and Class III groups. This distribution suggests a gradient toward less favourable outcomes at higher BMI levels. Nevertheless, the severe-outcome category contained only three participants, and the table included a zero cell. The association should therefore be interpreted cautiously because sparse data may reduce the reliability of a conventional Pearson chi-square test and may require an exact statistical procedure (13).

Previous literature has similarly emphasized that greater obesity severity may increase the complexity of anaesthetic management and postoperative recovery. Hardt and Wappler described the respiratory, cardiovascular, airway, and pharmacological challenges encountered in patients with morbid obesity and emphasized the need for individualized anaesthetic planning (2). Reviews of perioperative optimization have also highlighted the importance of positioning, preoxygenation, lung-protective ventilation, appropriate drug dosing, and postoperative respiratory surveillance in patients with obesity (3,4). Evidence regarding non-pharmacological perioperative interventions further suggests that structured respiratory strategies may reduce postoperative pulmonary complications following abdominal surgery, although their effectiveness can vary according to the intervention and surgical population (5).

The findings also have implications for perioperative risk stratification. BMI should not be considered in isolation because anaesthetic risk is shaped by the interaction of obesity severity with ASA physical status, cardiopulmonary comorbidities, airway characteristics, obstructive sleep apnoea, surgical procedure, operative duration, urgency, and anaesthetic technique. The predominance of ASA III participants in the study indicates that systemic disease may have contributed substantially to the observed outcomes. Accordingly, the association between BMI class and complications cannot be interpreted as independent of the participants' underlying clinical status (9-14).

Careful preoperative assessment remains important for patients with obesity, particularly those with Class II or III obesity. Assessment should include airway characteristics, cardiopulmonary disease, functional capacity, sleep-disordered breathing, previous anaesthetic difficulty, and anticipated surgical complexity. Appropriate positioning, effective preoxygenation, readiness for advanced airway management, individualized anaesthetic dosing, continuous oxygenation and haemodynamic monitoring, and suitable postoperative observation may help reduce avoidable perioperative risk (1–4). These clinical implications are consistent with established perioperative principles, but the present study did not directly evaluate the effectiveness of any specific preventive strategy.

The study had several strengths. It examined clinically relevant events across the perioperative pathway, included participants from all three obesity classes, and documented respiratory and haemodynamic complications under routine hospital conditions. The use of standardized BMI categories and a structured data-collection proforma also supported consistent classification of participants and recorded events (15-18).

Several limitations should be considered. The sample was small and drawn from a single hospital through non-probability sampling, limiting precision and generalizability. The four-month recruitment period may not have captured variations in surgical case mix. The absence of a non-obese comparison group prevented estimation of excess risk attributable to obesity. Surgical procedures, comorbidities, airway characteristics, operative duration, anaesthetic agents, and postoperative care were not stratified in the available analysis. The study also relied on unadjusted categorical comparisons and therefore could not control for potential confounding by age, ASA status, surgery type, or systemic disease. Some outcome categories, particularly stable, mild, and severe outcomes, were insufficiently operationalized in the original manuscript. Furthermore, the low number of severe events resulted in sparse contingency-table cells and limited the robustness of inferential testing. Larger, multicentre prospective studies using standardized outcome definitions and adjusted analyses are required to determine whether obesity class independently predicts specific perioperative complications (19).

CONCLUSION

Among adults with obesity undergoing surgery under general anaesthesia, intraoperative complications were recorded in nearly half of the participants, with hypoxia being the most frequent individual event. Overall clinical outcomes differed across BMI classes, with stable outcomes more common in Class I obesity and complications occurring proportionally more often in Class II and III obesity. These findings suggest that greater obesity severity may be associated with less favourable perioperative outcomes; however, the small single-centre sample, sparse severe events, and absence of adjusted analysis require cautious interpretation. Comprehensive preoperative assessment and vigilant intraoperative and postoperative monitoring remain particularly important for patients with higher BMI and associated systemic disease.

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