



Original Research Article

Feasibility and Preliminary Outcomes of Anaesthetic Management Strategies in Bariatric Surgery: A Pilot Observational Study

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Abstract: Background: Anaesthetic management in bariatric surgery is complex due to physiological and anatomical challenges associated with obesity. While Enhanced Recovery After Surgery (ERAS) protocols have improved outcomes globally, there is limited prospective data from low- and middle-income countries evaluating feasibility and early anaesthesia-related outcomes. **Objective:** To assess the feasibility of prospective perioperative anaesthesia data collection and to describe preliminary anaesthetic management patterns and outcomes in patients undergoing bariatric surgery. **Methods:** This prospective observational pilot study was conducted at a tertiary care hospital in Pakistan over three months. Fifty adult patients undergoing elective bariatric procedures were enrolled consecutively. A structured proforma was used to collect preoperative, intraoperative, and postoperative data. Feasibility outcomes included recruitment rate, completeness of data, and integration into clinical workflow. Descriptive analyses were performed, with exploratory subgroup comparisons interpreted cautiously. **Results:** The study achieved complete recruitment (n=50) with high data completeness across core variables (>95%). The mean age was 38.9 ± 10.1 years, and mean BMI was 45.2 ± 8.3 kg/m². Difficult mask ventilation occurred in 22.9% of patients, while difficult laryngoscopy (grade ≥ 3) was observed in 18.4%. Postoperative non-invasive ventilation (CPAP/BiPAP) was required in 20% of patients, particularly among those with higher BMI and ASA III status. Major complications were infrequent (6%), and 90% of patients were discharged in stable condition. Missing documentation of STOP-BANG scores highlighted a gap in preoperative risk stratification. **Conclusion:** Prospective perioperative anaesthesia data collection in bariatric surgery is feasible in a resource-constrained tertiary care setting. Preliminary findings demonstrate acceptable safety profiles and highlight key areas for optimisation, including airway management and postoperative respiratory support. These results provide a foundation for larger, multicentre studies and the development of context-specific anaesthesia protocols.

Keywords: Bariatric surgery, anaesthetic management, obesity, ERAS, perioperative care, airway management, difficult intubation, non-invasive ventilation, LMICs, postoperative outcomes.

INTRODUCTION

Bariatric surgery is widely recognised as the most effective long-term intervention for morbid obesity, with more than one million procedures performed annually worldwide and consistent evidence demonstrating sustained weight loss and remission of obesity-related comorbidities, including type 2 diabetes mellitus, obstructive sleep apnea, and

cardiovascular disease [1–3]. Despite advances in surgical techniques, anaesthetic management remains a critical determinant of perioperative safety and recovery in this population. Obese patients present unique anaesthetic challenges due to altered respiratory mechanics, difficult airway anatomy, changes in pharmacokinetics and pharmacodynamics, and a higher burden of

cardiometabolic disease, all of which contribute to increased perioperative risk [4,5].

In response to these challenges, Enhanced Recovery After Surgery (ERAS) guidelines tailored to bariatric surgery have been developed and increasingly adopted internationally. These protocols emphasise multimodal, opioid-sparing anaesthesia, standardised airway and ventilation strategies, and early postoperative recovery goals, and have been associated with reduced opioid consumption, shorter hospital stays, improved patient satisfaction, and lower complication rates [6,7]. Nevertheless, despite broad consensus on recommended principles, substantial variability persists globally in anaesthetic techniques, airway management approaches, intraoperative monitoring, and postoperative support strategies for bariatric patients [8,9]. Such heterogeneity reflects differences in institutional resources, patient characteristics, and local clinical workflows, underscoring the need for context-specific evaluation of anaesthetic practices.

Pakistan is currently experiencing a rapid rise in obesity prevalence, with a parallel increase in demand for bariatric surgery, particularly within urban tertiary care centres [10]. The local bariatric population is characterised by a high prevalence of diabetes mellitus and obstructive sleep apnea, factors that further complicate perioperative anaesthetic management [10,11]. Although anaesthesia teams in Pakistan generally attempt to align their practice with international guidelines, there is a notable absence of prospective, systematically collected local data evaluating anaesthesia-specific outcomes in bariatric surgery. As a result, institutional practices are often extrapolated from international literature without a formal assessment of their applicability, effectiveness, or feasibility in the local setting. In addition, the role of regional anaesthesia techniques and structured opioid-sparing strategies has not been adequately studied in this population [12].

At Shalamar Hospital, Lahore, bariatric procedures such as laparoscopic sleeve gastrectomy and gastric bypass are performed on a regular basis. Anaesthetic care is broadly informed by international ERAS frameworks; however, practical adaptations are frequently required due to local resource constraints and workflow considerations. While the department benefits from modern anaesthetic equipment and experienced personnel, there is currently no formal institutional audit or prospective analysis focusing on anaesthesia-specific outcomes, including extubation timing, postoperative nausea and vomiting, post-anaesthesia care unit (PACU) stay, or early recovery milestones. Consequently, anaesthesia practice remains largely experience-driven rather than data-driven.

Although ERAS-based anaesthetic strategies for

bariatric surgery are well established in high-income settings, their direct transferability to low- and middle-income countries such as Pakistan remains uncertain. To date, no local pilot data exist to inform the feasibility of prospective perioperative data collection, to characterise prevailing anaesthetic practices, or to identify early outcome trends in bariatric patients. This lack of foundational data represents a major barrier to the design and implementation of larger, adequately powered studies aimed at optimising perioperative care.

The present pilot observational study is therefore designed with two complementary objectives. First, it aims to assess the feasibility of conducting prospective perioperative anaesthesia data collection for bariatric surgery patients at a tertiary care hospital. Feasibility will be evaluated through indicators such as patient recruitment rates, completeness of data capture, ease of integration of data collection into routine clinical workflow, and the extent of missing or unusable data. Second, the study seeks to generate preliminary descriptive outcome data, including patterns of anaesthetic techniques, airway management strategies, perioperative complications, recovery parameters (such as extubation time, PACU stay, and postoperative nausea and vomiting), and postoperative respiratory support requirements, including the use of CPAP or BiPAP.

By generating early empirical evidence from a Pakistani tertiary care setting, this study aims to address a critical gap in the national literature. The findings will highlight practical and logistical challenges inherent to anaesthesia research in bariatric surgery, inform refinement of a standardised data collection tool, and provide initial insights into local anaesthetic practice and outcomes. Collectively, these data will lay the groundwork for future larger-scale studies and support the development of context-specific, evidence-based anaesthesia protocols tailored to the local bariatric population. Ultimately, this work seeks to contribute to improved perioperative safety, enhanced recovery, and the long-term advancement of bariatric anaesthesia practice in Pakistan.

Objectives

The objectives of our study were:

1. To estimate the frequency of perioperative anaesthetic complications (e.g., hypotension, difficult airway, desaturation) in patients undergoing bariatric surgery.
2. To determine the feasibility of using a standardised perioperative anaesthesia data collection tool in the local bariatric surgical population.
3. To describe preliminary trends in intraoperative management strategies (e.g., anaesthesia technique, airway approach)

and their association with immediate postoperative outcomes (e.g., extubation status, PACU stay, PONV incidence).

Methods

Study Design and Setting

This prospective observational pilot study was conducted at the Shalamar Institute of Health Sciences (SIHS), Lahore, a tertiary care teaching hospital with a dedicated bariatric surgery program after obtaining ethical approval from the Institutional Review Board. The study aimed to evaluate the feasibility of prospective perioperative anaesthesia data collection and to describe preliminary anaesthesia-related outcomes in patients undergoing elective bariatric surgery. No interventions or randomisation were performed, and all patients received routine perioperative care in accordance with institutional protocols.

Study Duration and Population

The study was carried out over a three-month period from July 1 to September 30, 2025. Adult patients aged 18–65 years undergoing elective bariatric surgery were recruited consecutively. Eligible procedures included laparoscopic sleeve gastrectomy, Roux-en-Y gastric bypass, and mini-gastric bypass.

Inclusion criteria comprised a body mass index (BMI) ≥ 35 kg/m² and American Society of Anesthesiologists (ASA) physical status II–IV. Patients undergoing emergency surgery, those with severe or unstable comorbid conditions (including advanced heart failure, severe pulmonary hypertension, end-stage renal disease, Child-Pugh class C liver disease, or poorly controlled diabetes), prior bariatric surgery, pregnancy, or inability to provide informed consent were excluded.

Sample Size Considerations

As a pilot study, the primary objective was feasibility assessment rather than hypothesis testing. Therefore, no formal sample size calculation or power analysis was performed. Based on methodological recommendations for pilot observational studies, a target sample size of 30–50 patients was deemed sufficient to evaluate recruitment feasibility, data completeness, and variability in key perioperative outcomes, and to inform sample size estimation for a future definitive study.

Data Collection

A structured, pre-designed anaesthetic data-collection proforma was used to capture perioperative data across the preoperative, intraoperative, and postoperative phases. Data were

collected in real time by trained anaesthesia personnel, under the supervision of the principal investigator. Each participant was assigned a unique study identification number to ensure anonymity.

Preoperative variables included demographic data, BMI, comorbidities, ASA status, STOP-BANG score, and relevant cardiac investigations. Intraoperative data encompassed anaesthetic technique (total intravenous anaesthesia or balanced anaesthesia), airway management approach, laryngoscopy grade, intraoperative desaturation events, hemodynamic parameters, and duration of anaesthesia and surgery. Postoperative outcomes included pain scores using a numerical rating scale, postoperative nausea and vomiting, extubation time, duration of post-anaesthesia care unit (PACU) stay, need for non-invasive ventilation (CPAP/BiPAP), intensive care unit admission, and early postoperative complications.

The data collection proforma was developed by experienced anesthesiologists and pilot-tested prior to study initiation to ensure clarity and usability, with minor revisions incorporated before formal data collection commenced.

Feasibility Outcomes

Feasibility was assessed using predefined indicators, including the patient recruitment rate, completeness of data collection, the proportion of missing data, and the average time required to complete the data collection form. These metrics were used to evaluate the practicality of integrating prospective data collection into the routine clinical workflow.

Statistical Analysis

Data were entered into Microsoft Excel for initial cleaning and subsequently analysed using IBM SPSS Statistics (version 25 or higher). Descriptive statistics were used to summarise patient characteristics and perioperative outcomes. Categorical variables were reported as frequencies and percentages, while continuous variables were presented as mean $\pm$ standard deviation or median with interquartile range, depending on data distribution.

Exploratory subgroup analyses were performed using descriptive comparisons. Although inferential statistical tests (chi-square test, independent t-test, or Mann–Whitney U test) were applied where appropriate, the results were interpreted cautiously given the pilot nature of the study and limited sample size. No formal hypothesis-driven conclusions were drawn.

RESULTS

A total of 50 adult patients undergoing elective bariatric surgery were enrolled during the study period, meeting the predefined target sample size for this pilot study. No patients were excluded after enrollment. Overall data

completeness was high across core perioperative variables, supporting the feasibility of prospective anaesthesia data collection in routine clinical practice.

The mean age of the study population was 38.9 ± 10.1 years (range 21–59), with a female predominance (58%). Female predominance is consistent with regional bariatric surgery cohorts. The mean body weight was 127.2 ± 27.8 kg (range 83–192 kg). Body mass index (BMI) data were available for 44 patients, with a mean BMI of 45.2 ± 8.3 kg/m² (median 44.6; range 33.0–66.4), indicating a predominantly morbidly obese population. Most patients were classified as ASA physical status II or III, with a smaller proportion having ASA status missing.

Mini-gastric bypass was the most frequently performed procedure, followed by laparoscopic sleeve gastrectomy and Roux-en-Y gastric bypass. Balanced general anaesthesia was used in the majority of cases. Difficult mask ventilation was documented in 22.9% of patients, while laryngoscopy grade ≥ 2 was observed in a minority.

Postoperatively, most patients experienced mild to moderate pain, and postoperative nausea and vomiting occurred in a small proportion. Ten patients (20%) required postoperative non-invasive ventilatory support (CPAP or BiPAP). Major postoperative complications were uncommon (6%), and 90% of patients were discharged home in a stable condition, the remaining 10% had prolonged hospital stay.

Table 1: Baseline Demographics of the study population.

Variable	Value
Age (years)	38.9 ± 10.1 years
Gender	42% males, 58% females
Weight (kg), mean $\pm$ SD	127.2 ± 27.8
BMI (kg/m ²), mean $\pm$ SD	45.2 ± 8.3 (n = 44)
BMI ≥ 50 kg/m ²	12 (24%)
ASA II	15 (30%)
ASA III	26 (52%)
Any comorbidity present	34 (69.4%)

Table 2: Anaesthesia outcomes of the patients.

Outcome	n (%)
Difficult mask ventilation	11/48 (22.9%)
Laryngoscopy grade ≥ 3	9/49 (18.4%)
CPAP/BiPAP requirement	10 (20%)
Major postoperative complications	3 (6%)
Discharged home stable	45 (90%)

Exploratory Subgroup Analyses

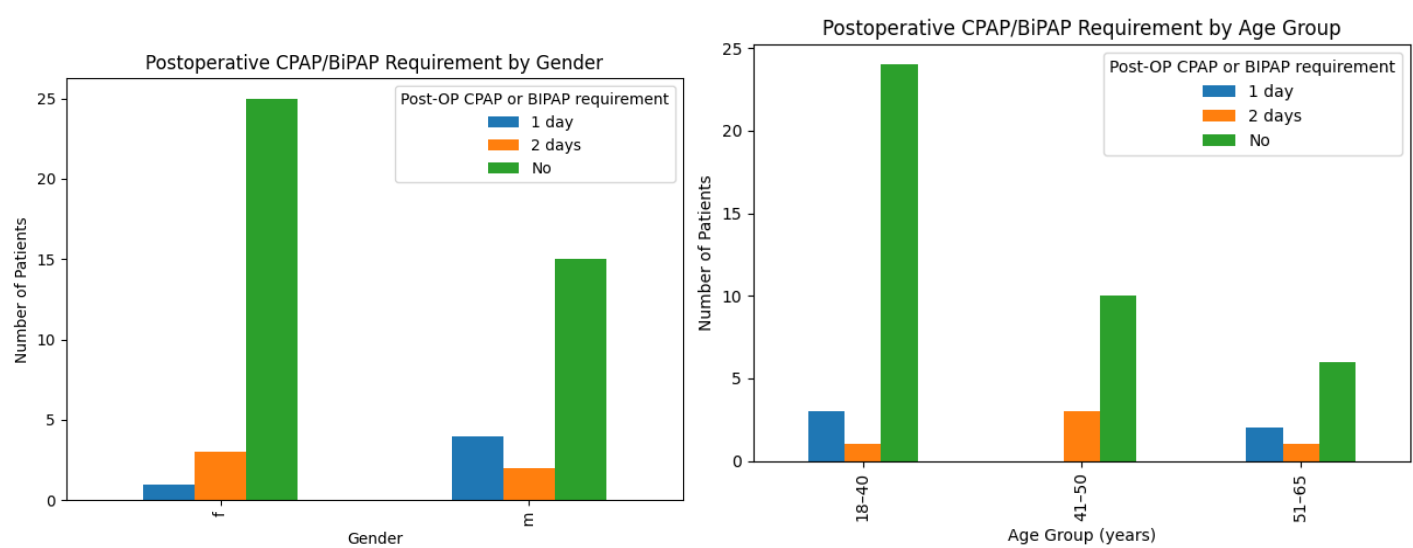
Exploratory analyses demonstrated clinically meaningful trends. Increasing BMI was associated with a higher frequency of difficult mask ventilation, particularly among patients with BMI ≥ 50 kg/m². Patients with difficult mask ventilation had a higher mean BMI compared to those without airway difficulty and were more likely to require postoperative CPAP or BiPAP support.

Male patients required postoperative CPAP or BiPAP support more frequently than females (28.6% vs 13.8%) and experienced a higher proportion of postoperative complications, though absolute numbers were small. Increasing age was associated with greater postoperative respiratory support requirements, with CPAP/BiPAP use rising from 14.3% in patients aged 18–40 years to 33.3% in those aged 51–65 years. Major complications also demonstrated an age-related increase. Despite these trends, discharge home in stable condition exceeded 85% across all age and gender subgroups.

Table 3: Anesthesia outcomes among different age groups.

Age Group	n	CPAP/BiPAP	Major Post-OP comp.
18-40 years	28	4 (14.3%)	1 (3.6%)
41-50 years	13	3 (23.1%)	1 (7.7%)
51-65 years	9	3 (33.3%)	1 (11.1%)

Figure 1: Anesthesia outcomes in different groups



ASA physical status also showed a clear relationship with outcomes. Patients classified as ASA III were more likely to require postoperative non-invasive ventilation and experience complications compared to ASA II patients, who demonstrated uniformly favourable outcomes. Procedure-specific comparisons were limited by small subgroup sizes; however, postoperative respiratory support was observed across all procedure types.

Figure 2: Difficult bag mask ventilation based on patient BMI.

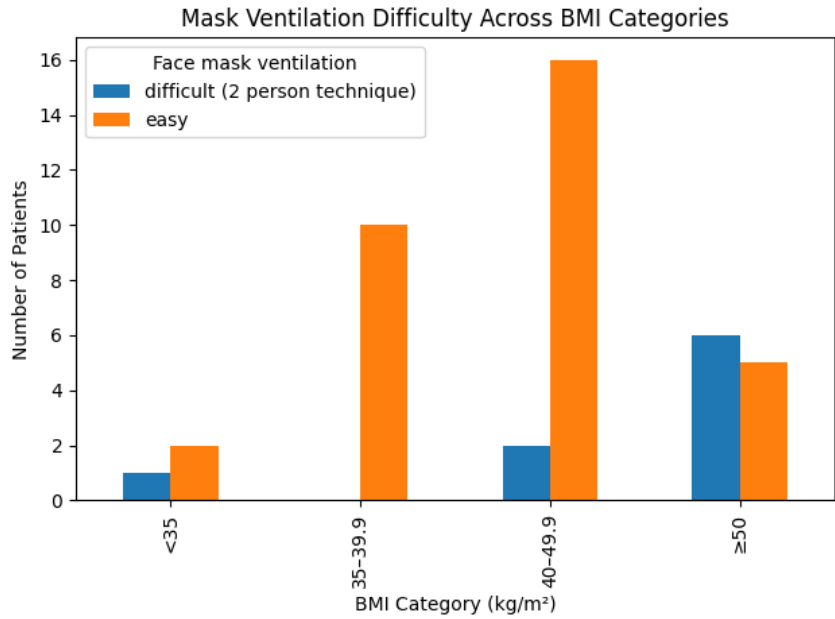
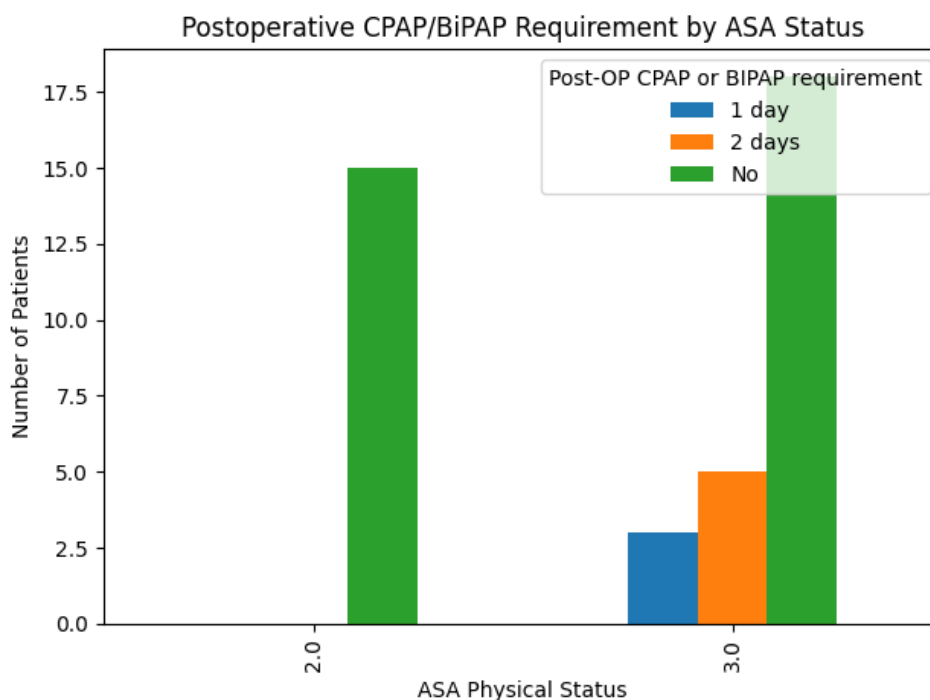


Table 4: Observations among different subgroups

Subgroup	Key Observation
BMI ≥50 kg/m²	Higher rate of difficult mask ventilation (50%)
Difficult mask ventilation	CPAP/BiPAP required in 45.5%
ASA III vs ASA II	CPAP/BiPAP: 30.8% vs 0%
ASA III	All major complications occurred in this group

Figure 3: Relation between post-operative CPAP/BiPAP requirement and ASA status.

These findings are exploratory and intended to generate hypotheses for future adequately powered studies.



Feasibility Outcomes

The study successfully recruited 50 patients within a 3-month period, meeting the predefined pilot target. Core perioperative variables demonstrated high completion rates: Age and Gender were recorded in 100% of the cases. BMI was recorded in 88% of patients, airway variables in more than 95%, and postoperative outcomes in 100%. Missing data were non-systematic and primarily involved secondary variables. STOPBANG score was not documented for any of the participants, while obesity class and OSA were documented for only a few patients. The absence of STOP-BANG documentation highlights a critical gap in structured preoperative risk stratification. Data collection was smoothly integrated into the routine clinical workflow without disruption to patient care, confirming the feasibility of conducting a larger prospective anaesthesia outcomes study in this setting.

DISCUSSION

This pilot observational study demonstrates the feasibility of conducting prospective perioperative anaesthesia research in bariatric surgery within a tertiary care hospital in Pakistan. Over a three-month period, robust recruitment and high data completeness were achieved without disrupting routine clinical workflows, confirming the practicality of systematic perioperative data collection in a resource-constrained setting. The study cohort predominantly comprised morbidly obese patients (mean BMI ~ 45 kg/m²), reflecting the severity of obesity in the local bariatric population and supporting the external validity of the findings.

Airway management emerged as a key perioperative consideration. A moderate incidence of difficult mask ventilation and a smaller proportion of difficult laryngoscopy were observed, consistent with the international literature, which describes obesity as a strong predictor of difficult mask ventilation but a less reliable predictor of difficult intubation [13]. Large studies have found that the frequency of

problematic direct laryngoscopy in morbidly obese patients can be on the order of 12–20%, compared to 1–4% in lean patients [14]. The higher BMI observed among patients with difficulty with mask ventilation further supports this association. These findings emphasise the importance of meticulous preoperative airway assessment, ramped positioning, and readiness with alternative airway devices, in line with current airway management recommendations for obese patients [13]. The relatively low incidence of severe airway complications suggests that, when appropriately prepared, bariatric patients can be managed safely even in non-high-income settings.

Balanced general anaesthesia was the predominant anaesthetic technique used, aligning with global practice patterns [15]. Recent systematic reviews indicate no major differences in recovery outcomes between total intravenous and inhalational anaesthesia in obese patients, aside from a modest reduction in postoperative nausea and vomiting with propofol-based techniques [16]. The anaesthetic practices observed in this study are therefore consistent with current evidence. While opioid-based

balanced anaesthesia remains common in this setting, emerging regional data suggest growing interest in opioid-sparing approaches for bariatric surgery [17], highlighting an area for future investigation.

Postoperative respiratory support was required in 20% of patients, predominantly among those with higher ASA status or extreme obesity. This finding aligns with the high prevalence of obstructive sleep apnea in bariatric populations and reinforces international recommendations advocating proactive use of CPAP or BiPAP in high-risk patients following extubation [13, 18]. Importantly, none of the patients requiring noninvasive ventilation experienced respiratory deterioration or required reintubation, underscoring the effectiveness of targeted postoperative respiratory support. These findings support integrating structured respiratory care pathways into perioperative protocols for bariatric surgery.

Overall postoperative outcomes were favourable, with major complications being uncommon and 90% of patients were discharged home in stable condition with the remaining having prolonged hospital stay. These results compare favourably with international bariatric surgery outcomes, where perioperative mortality and major morbidity are generally low when procedures are performed within structured care pathways [19]. Although direct comparisons are limited by the pilot design and sample size, the observed safety profile suggests that quality anaesthetic care can be delivered effectively in a low- and middle-income country context [20].

From an enhanced recovery perspective, the study provides early evidence that key ERAS principles—such as early extubation, adequate analgesia, and selective postoperative respiratory support—are achievable in this setting. Global evidence consistently demonstrates that ERAS pathways in bariatric surgery reduce length of stay and complications without compromising safety [19]. While full ERAS implementation may be limited by local resource constraints, selective adoption of high-impact, low-cost components appears feasible and may yield meaningful benefits.

Limitations

This study has several limitations inherent to its pilot design. The modest sample size precludes formal hypothesis testing and limits the ability to detect rare complications or perform multivariable analyses. Additionally, the single-centre design may limit generalizability to institutions with different resource profiles. Nevertheless, the primary objective was feasibility assessment, which was successfully achieved. BMI data were missing for a subset of patients, potentially influencing subgroup analyses.

Future Recommendations

The findings provide a strong foundation for future work. Larger multicenter prospective studies are needed to validate these observations, identify predictors of adverse outcomes, and evaluate the effectiveness of specific anaesthetic and recovery strategies. The data also highlight the need for locally tailored guidelines and training focused on bariatric anaesthesia, airway management, and postoperative respiratory care. Given the rising burden of obesity in Pakistan and South Asia [20], generating regional evidence is essential to ensure that international best practices are appropriately adapted to local healthcare realities.

Conclusion

This pilot study confirms that prospective evaluation of anaesthetic management in bariatric surgery is feasible in a Pakistani tertiary care setting and yields clinically meaningful preliminary outcomes. The observed trends in airway difficulty, postoperative respiratory support, and recovery align with global literature and support the safe application of evidence-based perioperative strategies. These findings lay the groundwork for larger studies and contribute to the development of context-specific protocols to improve perioperative outcomes for bariatric surgery patients in low- and middle-income countries.

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