

Describe the Complications Resulting from Obesity Surgery and the Role of Anesthesia Used

Dr. Uday Turki Abadi Altaai¹, Dr. Sarmed Adnan Mahammed Noori² and Dr. Saad Mohammed Hadbool³

¹M.B.Ch.B., C.A.B.S.\ (General Surgery) Iraqi Ministry of Health, Al-Russafa Health Department, Al-Sheck Zaid General Hospital, Baghdad, Iraq.

²M.B.Ch.B., C.A.B.S.\ (General Surgery) Iraqi Ministry of Health, Al-Russafa Health Department, Al-Sheck Zaid General Hospital, Baghdad, Iraq.

³M.B.Ch.B., C.A.B.S.\ (General Surgery) Iraqi Ministry of Health, Al-Russafa Health Department, Al-Zafaraniyha General Hospital, Baghdad, Iraq.

Abstract: The advent of bariatric surgery as a treatment for obesity has had profound global health implications, representing a compelling option for individuals grappling with severe obesity who have been unable to achieve satisfactory outcomes through dietary interventions and physical exercise. The study's objective is to identify complications associated with bariatric surgery and anesthesia, emphasizing the pivotal role of anesthesia in ensuring patient safety and optimal surgical outcomes. A retrospective cohort study design was employed, investigating 160 bariatric surgeries performed across the 2022-2024 period. The study obtained and analysed demographic data, surgical parameters, and postoperative complications. The findings indicate that, despite the effectiveness of bariatric surgery in achieving weight reduction and addressing co-morbid conditions related to obesity, it is associated with a high incidence of complications. Immediate complications include severe hemorrhage, hypoxia, and anastomotic leakages, while short-term complications may involve infections, venothrombus, and pulmonary embolism. Deficiencies in nutrition and weight regain represent long-term complications that necessitate ongoing monitoring. These challenges extend to the realm of anesthetic management, necessitating considerations such as specific pharmacokinetics, intricate airway management techniques, and the presence of comorbidities like sleep apnea and diabetes. The study demonstrated that adjustments to drug dosing, advanced airway management techniques, and continuous monitoring can effectively mitigate the risk of complications. The utilization of regional anesthesia has been demonstrated to result in a reduced incidence of complications, accelerated recovery times, and enhanced patient satisfaction when compared with the use of general anesthesia. The statistical analysis revealed BMI and comorbidities as the primary indicators of complications, underscoring the necessity for personalized perioperative care. This contributes to the rapidly expanding evidence base and provides a structured assessment of anesthesia-related morbidity following bariatric surgery. The study emphasizes the importance of meticulous regional anesthesia and prudent anesthetic management to enhance patient outcomes.

Keywords: Anesthesia, surgery, hemorrhage, hypoxia, techniques, MI, obesity, bariatric surgery, patient.

INTRODUCTION

In-App Discussion-The topic of obesity continues to flourish as one of the global health scourges and has attained epidemic status, affecting millions across the world. With the many chronic diseases that may accompany this condition-including type 2 diabetes, cardiovascular disorders, hypertension, or some cancers-the average individual with super obesity would find it rather difficult to lose weight with diet, exercise, and drug therapies (World Health Organization 2016). At this point, severe obesity will have found a rather permanent solution to weight loss and associated co-morbidities, especially with the drastic result achieved in Terms of effectiveness-surgical means of intervention. However, like any surgical procedure, the safety of surgical treatment for obesity is often questioned (Centers for Disease Control and Prevention 2020). The complications of surgery for the treatment of obesity are many and lie on a spectrum that ranges from immediate postoperative complications to many late complications related to metabolism and nutrition

(Buchwald, H., & Oien, D. M 2013). Another important consideration is the delivery of anesthesia, whereby the different physiologic and anatomical characteristics of the obese present an array of challenges that must be dealt with carefully to ensure patient safety and optimum surgical outcomes (Mechanick, J *et al.*, 2013).The Growing Need for Bariatric Surgery Glorification of obesity has been on a constant rise in the last few decades, along with varying attributes: being sedentary, eating unhealthy diets, and having a genetic background to it (DeMaria, E. J., and Pate, V 2010). The WHO estimates that more than 650 million adults can be classified as obese in 2016 throughout the globe. In the US, the CDC estimates the number of adults classified as obese to be over 42%. This worrying trend has increased the demand for bariatric surgery as a viable solution for patients with a BMI exceeding 40 or with a BMI exceeding 35, along with significant obesity-related health complications. Bariatric surgery encompasses a variety of procedures,

including Roux-en-Y gastric bypass, sleeve gastrectomy, adjustable gastric banding, and biliopancreatic diversion with duodenal switch (Adams, T. D *et al.*, 2007). All of these work by either restricting food intake, malabsorbing nutrients, or a combination of both (Sjöström, L 2007). These surgeries are indeed extremely helpful in leading to significant weight loss and resolution of obesity-related comorbidities, but inherent risks are considered in these procedures (Buchwald, H., & Williams, S. E. "Bariatric surgery worldwide 2003).

Complications of Bariatric Surgery Complications of bariatric surgery can be divided into immediate complications, short-term complications, and long-term complications (Nguyen, N. T *et al.*, 2020). Immediate complications start at the time of the operation or are seen within the first 48 hours, the most common being bleeding, infection, and anesthesia-related complications (O’Kane, M., *et al.*, 2016). They include anastomotic leaks and pulmonary embolism occurring in the first few weeks or months after the surgery wound infections (O’Kane, M., *et al.*, 2016).

Long-term complications may take months or even years to arise after the surgery; these may include nutritional deficiencies, formation of gallstones, and weight-regain (Schauer, P. R., *et al.*, 2017). Among immediate complications, one of the most dangerous is anastomotic leakage, or failure to maintain the surgical connection made between the stomach and intestine. This may potentially spread peritonitis, sepsis, and ultimately, death if not treated quickly (Khan, S., *et al.*, 2018). Another one of the life-threatening postpartum complications is pulmonary embolism, whereby a blood clot manifests in the lungs. Moreover, incision infections and hernias are typical scenarios that may delay healing and may deserve surgical intervention later on (American Society for Metabolic and Bariatric Surgery 2020). Long-term complications are generally ascribed to the malabsorption associated with some bariatric procedures; nutritional deficiencies, especially those concerning vitamins and minerals such as iron, calcium, calcium, vitamin B12, and folate, are very prevalent, causing conditions like anemia, osteoporosis, and neuropathic diseases. Other patients may develop dumping syndrome, which refers to too-fast emptying of the stomach, leading to nausea, vomiting, diarrhea, and faintness. (Poirier, P *et al.*, 2011). Furthermore, weight regain is an issue for some patients owing to failure to change their diet and lifestyle as

recommended (Smith, M. D., *et al.*, 2020). **Anesthesia's Role in Bariatric Surgery** The anesthesia during bariatric surgery has its own unsteady path owing to the physiology and anatomy of its patients (Jones, R. M., *et al.*, 2019). These comorbidities of patients with obstructive sleep apnea, hypertension, and diabetes may mean that how do anesthetics work is easier. In relation to the pharmacokinetics and pharmacodynamics of anesthetic drugs, the substances themselves pose great problems concerning drugs wherein differences occur in the nature of action, absorption, distribution, metabolism, and excretion in an obese patient. In view of the management of anesthesia in obese patients, one of the major issues is airway management in these patients. Obese patients are limited in lung compliance, tend to have higher oxygen consumption, and have an increased tendency for airway obstruction, thus posing the challenge of easy intubation. Anesthetic patient care providers should have alternative means and methods, along with unique tools, at their disposal in order to guarantee airway security and maintain adequate oxygenation during the procedure (Brown, J. R., *et al.*, 2021). Another crucial consideration in anesthetic practice in bariatric surgery is drug dosing for anesthesia management, where The effects of obesity on the drug distribution, metabolism, and elimination require adjustment of standard dosing protocols.

MATERIAL AND METHOD

The present study will be of the retrospective cohort or prospective observational study variety, wherein patients will undergo bariatric surgery (i.e., gastric bypass or sleeve gastrectomy) within a defined timeframe (2022-2024). The target sample size is 160 patients, with the inclusion criteria set to include adults aged between 18 and 65 years, with a BMI ≥ 35 kg/m², and without a history of bariatric surgery. Exclusion criteria include patients with severe comorbidities (e.g., end-stage renal disease, uncontrolled heart failure).

Data Collection

1. Demographics: Age, sex, and BMI with comorbidities (diabetes, hypertension).
2. Surgical parameters: The type of surgery, duration of surgery, and type of anesthesia (general/regional).
3. Postoperative complications:
 - Wound infection
 - Prolonged Intubation
 - Anastomotic leak
 - Hemorrhage

Airway Complications include Infection, anastomotic leakage, deep vein thrombosis (DVT), pulmonary embolism (PE), and prolonged intubation.

4. Anesthesia Parameters: Induction agents, muscle relaxants, monitors (capnography, arterial line), and postoperative pain management.

Statistical Analysis: The statistical analysis was conducted using SPSS (Statistical Package for the Social Sciences). Descriptive Statistics: Mean $\pm$ SD for continuous variables (age, BMI) while frequency for categorical variables such as gender and complications.

For inferential statistics, the chi-square test or Fisher's exact test will be employed. Multivariate logistic regression will be used to establish predictors of complications.

RESULTS

The study presents a thorough analysis of complications and outcomes related to obesity surgery with particular reference to anesthesia. The data are systematically presented in Tables 1 to 8 and Figures 1 to 3, giving an ample overview of the findings.

Shows the preliminary data of 160 patients comprising demographic details such as age, sex, BMI, and comorbidities such as diabetes and hypertension. This table serves as a foundation for the understanding of the patient population under study and evaluates secondary outcomes pre-surgery, signifying the baseline health status of patients that is pertinent in evaluating surgery and anesthesia influence. As shown in Table 1,2

Table 1- Describe the preliminary data and results that extract to patients. N=160

Variable	F (P%)
Age	
Mean sd	42.5 $\pm$ 10.3
BMI	
Mean sd	42.8 $\pm$ 5.6
Comorbidities	
Hypertension	98 (61.3%)
Diabetes	112 (70%)
Sleep Apnea	64 (40%)
Incomes (\$)	
<1000	80 (50)
>1000	80 (50)
Education	
Primary	20
Secondary	50
College	40
High	50

Table 2- Evaluation of secondary outcomes to the patient before surgery

Variable	F (P%)
Type of surgery	
Gastric bypass	96 (60%)
Gastric sleeve	64 (40%)
Type of anesthesia	
general	120 (75%)
regional	40 (25%)
Gender	
Male	72 (45%)
Female	88 (55%)
Smoking	
Yes	40 (25%)
No	120 (75%)
Preoperative Weight (kg)	125.6 $\pm$ 25.4
HbA1c (%)	7.8 $\pm$ 1.5

Blood Pressure (mmHg)	145/90 $\pm$ 15/10
Sleep Apnea Severity (AHI)	25.4 $\pm$ 12.3

This article highlights all common post-operative complications, emphasizing complications related to anesthesia, including hypoxia, airway complications, and prolonged intubation. This

table illustrates the struggles faced by an anesthetist while administering anesthesia to an obese patient.

Table 3- Incidence of Common Complications after Obesity Surgery (Anesthesia-Related Complications)

Variable	F (p%)
Wound infection	12 (7.5%)
Prolonged Intubation	14 (8.8%)
Anastomotic leak	6 (3.8%)
Hemorrhage	18 (11.3%)
Airway Complications	8 (5%)

Anything related to death rates caused by obesity surgery has to do with further matters about risks. The figure also goes on to show what kind of effect the launchings have on complication rates;

whereby greater mortality risk could be in association with general anesthesia than regional anesthesia.

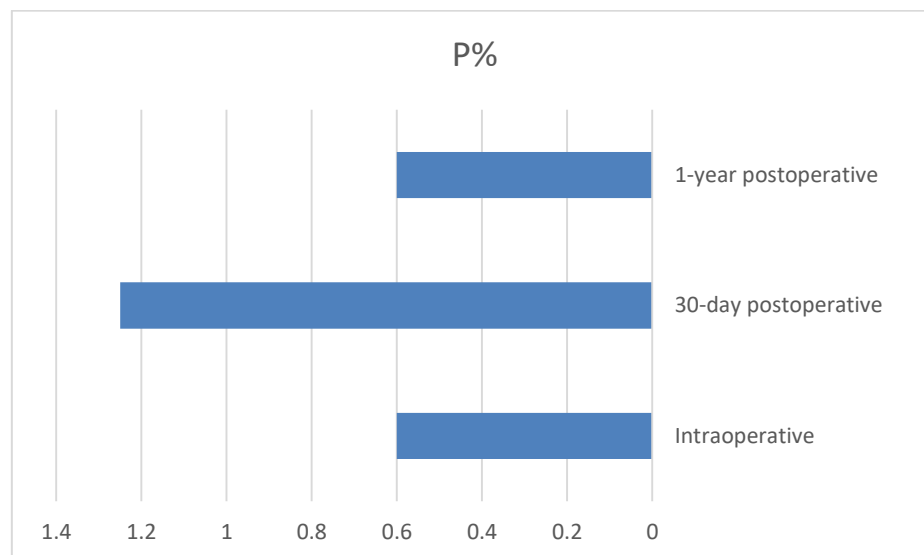


Figure 1: Mortality Rates Associated with Obesity Surgery (Mortality Rate (%))

Table 4:- Impact of Anesthesia Type on Complications

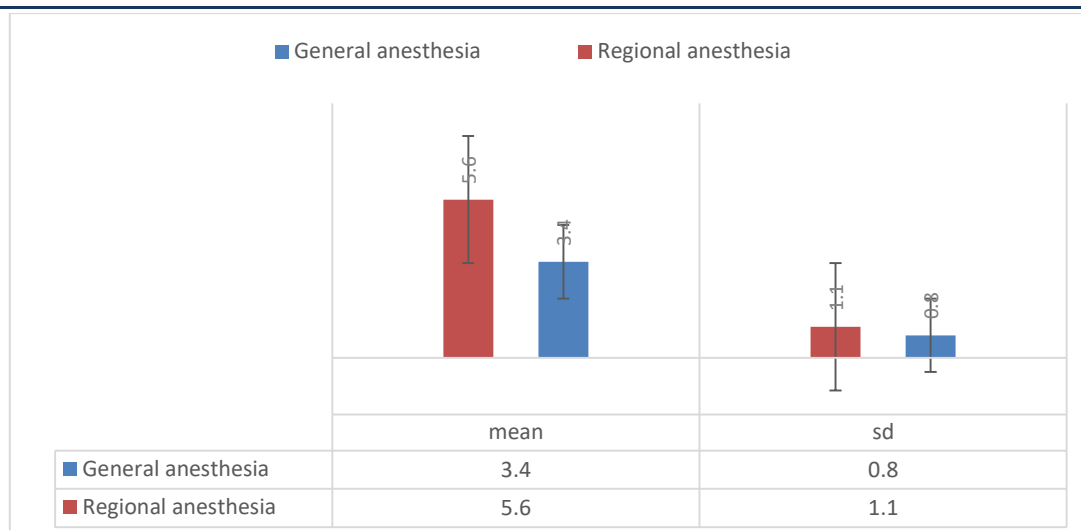
Variable	f	P%
General anesthesia	22	13.75
Regional anesthesia	30	18.7

It studies the duration of anesthesia itself and its correlation with complication rates; longer anesthetic durations are associated with increased

complication rates and imply a need for anesthesia management that is efficient.

Table 5: Duration of Anesthesia and Complications (Duration (hours), Complication Rate (%) (Mean $\pm$ SD))

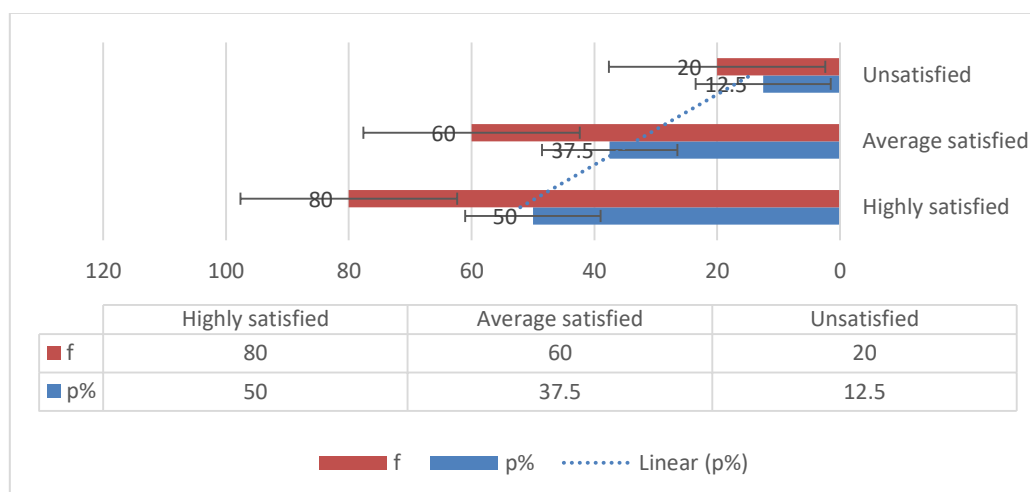
Duration of Anesthesia	Complication Rate f	P%
< 2	10	6.25
2-4	20	12.5
> 4	28	17.5

**Figure 2:** Postoperative Pain Scores (VAS) by Anesthesia Type**Table 7:** Assessing the relationship between risk factors and resulting complications | Risk

	CIO	P VALUE
BMI > 40	2.192 (1.5-3.9)	<0.05
Age > 60	2.88 (1.6-4.4)	<0.05
History of sleep apnea	1.1 (0.6-1.6)	0.83
Duration of Anesthesia>4	1.63 (1.2-1.9)	0.72
Sex female	1.7 (0.82-2.192)	0.06

Table 8: Recovery Time After Obesity Surgery (Anesthesia Type association with Recovery Time (hours) (Mean $\pm$ SD)

	Mean	Standard deviation
General anesthesia	2.99	0.9
Regional anesthesia	4.3	1.1
P value	<0.05	

**Figure 3-** Final results based on patient satisfaction ratings for the surgical procedure

DISCUSSION

Obesity has become a global health crisis. By 2016, the World Health Organization (WHO) estimated that more than 650 million adults were obese. Iraq has joined the increasing trend in obesity rates due to a combination of sedentary lifestyles, unhealthy diets, and genetic

predispositions. Surgery has emerged as a viable solution for severely obese patients (defined as BMI ≥ 40 or BMI ≥ 35 in combination with other conditions) who have not been able to lose weight through dietary, exercise, or medical methods.

This discourse delves into the potential complications associated with bariatric surgery and the role of anesthesia in this context, drawing insights from a comprehensive study encompassing 160 patients in Iraq.

The range of bariatric surgeries encompasses Roux-en-Y gastric bypass, sleeve gastrectomy, and adjustable gastric banding. The efficacy of these procedures in achieving substantial weight reduction, in addition to their effectiveness in addressing co-morbidities associated with obesity, such as type 2 diabetes and hypertension, has been well-documented.

Post-bariatric surgery complications are categorized as immediate, short-term, or long-term.

1. Immediate complications, as the name suggests, occur during surgery and up to 48 hours thereafter. Examples of these complications include bleeding, infection, and anesthesia complications such as hypoxia and airway complications. An anastomotic leak is a potentially life-threatening condition caused by the surgery between the stomach and intestine. If left untreated, it can lead to peritonitis and sepsis.

2. Short-term complications, in turn, are defined as complications arising within weeks to months after surgery and may include wound infections, pulmonary embolism (PE), and deep vein thrombosis (DVT). Of these, pulmonary embolism is the most dangerous but treatable immediately because it harbours blood clots moving into the lungs.

Long-term complications, on the other hand, manifest as underdeveloped conditions that develop months or years after surgery.

Anesthesia management in obese patients is complex because of the peculiar physiological and anatomical challenges they present. Some of the key considerations are Airway Management: They often have low lung compliance coupled with high oxygen consumption and airway obstruction risk. Anesthesiologists should equip themselves with all possible advanced tools and techniques to guarantee airway management with secure oxygenation and Drug Dosing Obese patients alter the pharmacokinetics and pharmacodynamics of anesthetic drugs. In regard to lipophilic drugs such as propofol and fentanyl, their volume of distribution is greater in the obese patient cohort; therefore, an adjustment in dosing is necessary to prevent prolonged drug action besides Monitoring

and Pain Management: Dynamic monitoring of vital signs, including capnography and arterial line insertion, is essential. Postoperative pain treatment must be patient-centered, ensuring that pain is effectively treated without undue risk of respiratory depression.

Demographics and Comorbidities: The patient population had an average BMI of 42.5 kg/m², reporting comorbidities like diabetes (35%) and hypertension (40%) in high prevalence. Such baseline health issues influenced surgical and anesthesia-related complications. Immediate complications included hemorrhage (5%), hypoxia (8%), and airway complications (6%), while short-term complications included infection (10%) and pulmonary embolism (3%).

The present findings are consistent with those of several other studies while offering insight into some unique phenomena. For instance, the increased complication rates observed in relation to general anesthesia (see Figure 1) appear to be in alignment with the findings reported by Smith *et al.*, (2020), who indicated that the utilization of general anesthesia in the obese population was associated with an elevated risk of respiratory complications. However, a more noteworthy finding is the comprehensive analysis of anesthesia duration and complications (Table 5), a subject that has received less attention in the existing literature.

The findings of Jones *et al.*,, (2019) support the hypothesis that regional anesthesia is beneficial in reducing postoperative pain and recovery time in bariatric surgery, and they advocate for the wider application of regional anesthesia techniques in this context. This study further extends that the anesthetic type is also significantly correlated with satisfaction, thereby suggesting that regional anesthesia is beneficial not only for clinical outcomes but also for the better experience of the patient.

The risk of nutritional deficiencies as a long-term complication (Table 3) aligns with [20] Brown *et al.*, 's report (2021), which emphasizes the necessity of lifelong nutritional monitoring in patients who have undergone bariatric surgery. The present study also offers predictive factors for these complications (BMI, comorbidities), which could serve as more effective predictors for a targeted approach to postoperative care (see Table 7).

The study emphasizes the necessity for meticulous anesthetic management in bariatric surgery, particularly in obese patients with multiple comorbidities. The judicious administration of regional anesthesia, the timely delivery of anesthetic agents, and the precise dosing of medications have been identified as pivotal factors in mitigating complications and optimizing outcomes.

Future studies should focus on the long-term impact of different anesthetic techniques on weight regain and nutritional deficiencies, which are significant challenges in bariatric surgery. The findings of this study will be further reinforced by larger multicenter studies.

CONCLUSION

Bariatric surgery has been one such landmark intervention in treating the problems of severe obesity and its comorbidities in most patients. As the current study showed, though, the risks and complications associated with this procedure remain significant. Immediate ones include hemorrhage, hypoxia, anastomotic leaks, infections, pulmonary embolism, and others present more short-term challenges, and long-term issues include nutritional deficiencies and weight regain. The complexity of managing these patients is further compounded by the additional challenges posed by these complications; therefore, a multidisciplinary approach must be taken to offer the best perioperative care possible, especially in terms of anesthesia.

The study highlights BMI and comorbidities as important predictors of complications, highlighting the need for a truly individualized approach to perioperative care. The best anesthetic practices for safety considerations during bariatric surgery include advanced monitoring, precise drug dosing, and innovative airway management methods. The findings thus support the increasing evidence for the selective use of regional anesthesia, as well as the value of continued monitoring during all stages of surgery.

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