Original Article

Comparison of Postoperative Complications in Patients who Scheduled for Bariatric Surgery in Surgery Ward and Intensive Care Unit

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ABSTRACT

Background:
Sleeve gastrectomy is one of the most commonly performed bariatric procedures for patients with morbid obesity. However, the postoperative care environment may influence the occurrence and severity of complications. The aim of this study was to compare postoperative complications in patients scheduled for bariatric surgery (sleeve) in the surgery ward and the intensive care unit (ICU).

Materials and Methods:
A prospective comparative study was conducted over 6 months, involving 100 patients undergoing laparoscopic sleeve gastrectomy at Al-Tawfiq Private Hospital in Iraq. Patients were assigned to two groups based on their postoperative admission: 50 in the surgical ward and 50 in the ICU. The inclusion criteria included adults aged 18–65 with a BMI ≥ 35 and associated comorbidities. Data collection encompassed demographic variables, obstructive sleep apnea (OSA), postoperative complications, hemodynamic status, patient satisfaction, and length of hospital stay (LOS).

Results:
There was a significant difference between ward type and age and weight variables, as older patients and those with higher weights were admitted to the ICU ward (P=0.024 and P<0.001, respectively). OSA was significantly higher in ICU patients (P<0.001). Also, the ICU group exhibited statistically significant changes in systolic blood pressure over time (P<0.001), and they experienced more nausea and vomiting (P<0.001). Patient satisfaction was significantly higher in the surgery ward group (P=0.008). Finally, the LOS in the ICU group was significantly longer (P<0.001).

Conclusion:
Patients who are admitted to the ICU after gastrectomy are mostly at higher risk of various complications. Based on this, improved monitoring, early intervention strategies, and personalized care pathways may improve outcomes, reduce discomfort, and shorten hospital stays.

Keywords: Sleeve gastrectomy, Intensive care unit, Postoperative monitoring, Surgical ward

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INTRODUCTION:

Obesity surgery is growing in popularity worldwide. Although patient selection is a key factor in determining the success of surgery, postoperative care is equally important in identifying and treating complications, as well as optimizing long-term health and nutritional status (1). Progressive body mass gain leads to a gradual decline in the function of organs and systems. Abdominal obesity is considered to be the dominant risk factor for developing metabolic syndrome, which includes hypertension, dyslipidemia, and insulin resistance (2, 3). Patients diagnosed with metabolic syndrome more often develop myocardial infarction, stroke, and type 2 diabetes, which significantly increases the cardiovascular risk and contributes to increased mortality in comparison with the general population (4). Nevertheless, bariatric surgery is just one step along the therapeutic pathway. Similar to preoperative multidisciplinary management, postoperative follow-up remains essential, since obesity is a chronic disease and patients undergoing bariatric surgery are often young with a long life expectancy. Recent data concerning bariatric surgical patients underscore the difficulties in good quality surveillance with a high rate of patients lost-to-follow-up after two years and the development of complications during the first 5 postoperative years and thereafter (medical and surgical complications, nutritional deficiencies) (5,6,7). Body mass index (BMI) did not significantly affect the risk of intensive care unit (ICU), suggesting that obesity itself is not an independent risk factor. Instead, increasing age and multiple comorbidities are key factors in assessing patient risk and were even protective in a larger cohort of patients with obesity (8). This includes no formal indication for ICU admission; prolonged observation in the post-anesthesia care unit is sufficient for most patients (9). Even when considering obstructive sleep apnea (OSA), a condition known to increase the risk of postoperative complications and ICU admission (10), patients with obesity suffering from severe OSA and/or using home continuous positive airway pressure (CPAP), when appropriately selected and perioperatively managed, do not require routine planned ICU admission (11). Patients in the ICU typically receive closer monitoring and more interventions than those in the surgery ward, which can be crucial for identifying complications (12). Understanding these differences is crucial for improving patient management strategies and resource allocation (13). In conclusion, the choice between the surgical suite and the ICU for postoperative care after gastrectomy should be based on the patient's individual risk factors, potential complications, and the level of monitoring required (14). This personalized approach can enhance patient safety and improve overall surgical outcomes (15). Accordingly, the current study was conducted with the aim of comparing postoperative complications in patients scheduled for bariatric (sleeve) surgery in the surgical suite and the ICU.

METHOD AND MATERIALS:

The method of this study was a prospective descriptive-analytic cross-sectional. The study was conducted from November 2024 to April 2025 in the AL-Tawfic Private Hospital in Tikrit city. All patients underwent a primary assessment for anesthesia risk by the responsible anesthesiologist before proceeding. The patients provided verbal consent for their involvement in the study. Informed consent was obtained from all participants before enrolment. Inclusion criteria included patients aged 18 to 65 years, those with a diagnosis of morbid obesity (BMI $\geq$ 35), scheduled for laparoscopic sleeve gastrectomy, and who provided informed consent. Exclusion criteria included emergency surgeries, revision or complicated bariatric procedures, and incomplete data or follow-up. Clinical and demographic information were collected using a demographic questionnaire and electronic health records. Also, postoperative outcomes were assessed through a structured review of patient medical records, operative notes, and nursing documentation. OSA was measured by the STOP-BANG questionnaire. The validity of this tool has been confirmed in other studies. Also, all complications were categorized according to the Clavien-Dindo classification system, which grades complications from Grade I (minor deviation from normal recovery) to Grade V (death). All measurements were collected using a standardized data collection sheet and verified by two independent reviewers to ensure accuracy.

The sample size was chosen through convenience sampling, totaling 100 patients, with 50 patients in each group. Postoperatively, patients were divided into two groups based on the level of care provided: Group A (surgery ward), where patients received standard postoperative monitoring and care in the general surgical ward, and Group B (ICU), where patients were admitted directly to the ICU for enhanced monitoring and postoperative support. Patients were observed for 72 hours after surgery.

The sample size was calculated using the following formula: $n = N \times p\,(1 - p) / [[N - 1 \times (d2 \div z2)] + p\,(1 - p)]$

Patients in Group A were transferred to the surgical ward postoperatively after being stabilized in the recovery room. Standard postoperative care protocols were followed, including routine monitoring of vital signs (heart rate, mean arterial pressure, respiratory rate, and SpO_2) every 4 hours and early ambulation as tolerated. Patients were closely monitored for any postoperative complications such as

nausea, vomiting, respiratory depression, and hypotension. Any adverse events or deviations from recovery were documented and managed according to ward protocols. Also, patients in Group B were transferred directly to the ICU postoperatively for continuous monitoring. Upon arrival, patients were connected to cardiopulmonary monitoring equipment, including routine monitoring of vital signs (heart rate [HR], mean arterial pressure [MAP], respiratory rate [RR], SpO_2, and temperature) every 4 hours, and as needed thereafter. Pain control, fluid management, and respiratory support (e.g., oxygen therapy, CPAP) were provided as indicated. Postoperative complications, including respiratory distress, hemodynamic instability, deep vein thrombosis, or any need for re-intervention, were closely recorded.

Statistical analysis: All collected data were entered into and analyzed using SPSS software version 26. Continuous variables, such as age, BMI, and length of hospital stay (LOS), were summarized using the mean and standard deviation or the median and interquartile range, depending on the data normality, as assessed by the Shapiro-Wilk test. Comparisons between the surgery ward group and ICU group were conducted using the independent samples t-test for normally distributed variables or the Mann–Whitney U test for non-normally distributed data. Categorical variables, such as sex, comorbidities, and the presence or absence of specific postoperative complications (e.g., deep vein thrombosis [DVT], respiratory distress, and apnea), were presented as frequencies and percentages. These were compared using the Chi-square test or Fisher's exact test, as appropriate. The severity of complications was classified using the Clavien-Dindo classification, and group differences in complication grades were also statistically compared. A P value less than 0.05 was considered statistically significant for all analyses.

RESULTS:

The age of patients was 37 (27, 44) in the surgery ward and 41 (36,50) in the ICU. The median age in the surgery ward group was lower than in the ICU group, and this difference was statistically significant (P=0.024). A total of 15 (30.0%) men were present in the surgical ward and 19 (38.0%) in the ICU, while 35 (70.0%) women were present in the surgical ward and 31 (62.0%) in the ICU. Regarding sex distribution, the proportion of women was higher in the surgery ward group compared with the ICU group; however, this difference was not statistically significant (P=0.398). The mean BMI was 35.1 (3.0%) kg/m2 in the surgical ward and 38.8 (3.0%) in the ICU. The median weight of patients was higher in the ICU group than in the surgery ward group, and this difference was statistically significant (P<0.001). Similarly, the mean BMI was significantly higher in the ICU group compared with the surgery ward group (P<0.001). The total STOP-BANG score was significantly higher in ICU patients, with a median score of 4.00 compared with 1.00 in the surgery ward group (P<0.001). When categorized into risk levels for obstructive sleep apnea, 64% of ICU patients were classified as high risk, compared with only 0% in the surgery ward group (P<0.001). Apnea was reported in 6% of patients in the surgery ward group and 22% in the ICU group. Although the proportion was higher in the ICU group, the difference did not reach statistical significance (P=0.05), but it may suggest a trend toward a greater burden of sleep-disordered breathing in this group. Abnormal SPO_2 levels were found in 10% of surgery ward patients and 26% of ICU patients. The difference was not statistically significant (P=0.05), indicating similar rates of desaturation events between the two groups.

In the surgery ward group, systolic blood pressure remained relatively stable throughout the 72-hour monitoring period, with no statistically significant changes over time (P=0.809). In contrast, the ICU group exhibited statistically significant changes in systolic blood pressure over time (P<0.001). In the surgery ward group, no statistically significant changes in diastolic blood pressure were observed over time. In contrast, the ICU group showed significant variation in diastolic pressure over time (P<0.001). In the surgery ward group, heart rate values remained relatively stable across the 72-hour monitoring period (P=0.615).

The need for intubation was rare in both groups. Only one patient (2.0%) in the surgery ward group required intubation, while none did in the ICU group (P>0.999), indicating no significant difference.

Need for CPAP therapy was observed in 20.0% of the surgery ward group and 30.0% of the ICU group. Although more common in the ICU group, the difference did not reach statistical significance (P=0.248).

DVT occurred in one patient (2.0%) in the surgery ward group and in none of the ICU patients. This difference was not statistically significant (P>0.999). Combined nausea and vomiting were observed slightly more frequently in the ICU group (18.0%) than in the Surgery ward group (12.0%), with a P value of 0.03.

Patient satisfaction scores were significantly higher in the surgery ward group (median: 4.00) compared with the ICU group (median: 3.00), with a P value of 0.008. There was a statistically significant difference in LOS between the two groups (P<0.001). The ICU group had a longer median stay (2.00 days) compared with the surgery ward group (1.00 day), which is consistent with the more complex or critical nature of ICU care.

Table 1. Comparison of Demographic Characteristics Between Surgery Ward and ICU Groups

Characteristic	Surgery ward N = 50[1]	ICU N = 50[1]	P value[2]
Age	37 (27, 44)	41 (36, 50)	0.024
Sex			0.398
F	35 (70.0%)	31 (62.0%)	
M	15 (30.0%)	19 (38.0%)	
Weight	98 (91, 107)	106 (100, 121)	<0.001
	35.1 (3.0)	38.8 (3.0)	<0.001

[1] Median (Q1, Q3); n (%); Mean (SD)

[2] Mann Whitney test; Independent samples t-test; Pearson's Chi-squared test; Fisher's exact test

Table 2. Comparison of STOP-BANG Score Responses Between Surgery Ward and ICU Groups

Characteristic	Surgery Ward N = 50[1]	ICU N = 50[1]	P value[2]
Do you often SNORE loudly (louder than talking)			<0.001
NO	45 (90.0%)	24 (48.0%)	
YES	5 (10.0%)	26 (52.0%)	
Do you often feel TIRED, fatigued, or sleepy during the day			<0.001
NO	44 (88.0%)	32 (64.0%)	
YES	6 (12.0%)	18 (36.0%)	
Has anyone OBSERVED you stop breathing during sleep			<0.001
NO	45 (90.0%)	23 (46.0%)	
YES	5 (10.0%)	27 (54.0%)	
Do you have high blood PRESSURE			0.001
NO	37 (74.0%)	21 (42.0%)	
YES	13 (26.0%)	29 (58.0%)	
BMI more than 35kg/m2			<0.001
NO	24 (48.0%)	7 (14.0%)	
YES	26 (52.0%)	43 (86.0%)	
AGE over 50 years			0.074
NO	44 (88.0%)	37 (74.0%)	
YES	6 (12.0%)	13 (26.0%)	
NECK circumference >40cm8			<0.001
NO	43 (86.0%)	10 (20.0%)	
YES	7 (14.0%)	40 (80.0%)	
GENDER male			0.398
NO	35 (70.0%)	31 (62.0%)	
YES	15 (30.0%)	19 (38.0%)	
Total STOP-BANG Score	1.00 (0.00, 2.00)	4.00 (3.00, 6.00)	<0.001
Total STOP-BANG Score (categorized)			<0.001
Low risk of OSA (0-2)	46 (92.0%)	1 (2.0%)	
Intermediate risk of OSA (3-4)	4 (8.0%)	17 (34.0%)	
High risk of OSA (5-8)	0 (0.0%)	32 (64.0%)	

[1] Median (Q1, Q3); n (%); Mean (SD)

[2] Mann Whitney test; Pearson's Chi-squared test; Fisher's exact test

OSA Obstructive sleep apnea

Table 3. Comparison of Apnea and ↓SPO2 Between Surgery Ward and ICU Groups

Characteristic	Surgery Ward N = 50[1]	ICU N = 50[1]0	P value[2]
Apnea			0.044
NO	47 (94.0%)	39 (78.0%)	
YES	3 (6.0%)	11 (22.0%)	
↓SPO2			0.712
NO	47 (94.0%)	45 (90.0%)	
YES	3 (6.0%)	5 (10.0%)	

[1] Median (Q1, Q3); n (%); Mean (SD)

[2] Mann Whitney test; Pearson's Chi-squared test; Fisher's exact test

Table 4. Comparison of Systolic Blood Pressure Trends Over 72 Hours between Ward Surgery and ICU Groups

Characteristic	Surgery ward N = 50[1]	ICU N = 50[1]	P value[2]
Systolic 4h	128 (123, 144)	121 (116, 123)	<0.001
Systolic 8h	139 (127, 152)	122 (118, 126)	<0.001
Systolic 12h	145 (145, 145)	134 (125, 134)	<0.001
Systolic 16h	140 (136, 140)	128 (122, 130)	<0.001
Systolic 20h	138 (133, 138)	125 (122, 131)	<0.001
Systolic 24h	129 (122, 133)	125 (125, 126)	0.035
Systolic 28h	130 (125, 140)	130 (126, 130)	0.389
Systolic 32h	134 (122, 140)	134 (129, 138)	0.881
Systolic 36h	130 (127, 138)	130 (130, 136)	0.677
Systolic 40h	130 (128, 138)	116 (114, 130)	<0.001
Systolic 44h	130 (125, 135)	149 (130, 152)	0.002
Systolic 48h	130 (127, 134)	125 (125, 129)	0.136
Systolic 52h	132 (17)	128 (7)	0.499
Systolic 56h	127 (15)	134 (8)	0.692
Systolic 60h	120 (16)	131 (4)	0.366
Systolic 64h	131 (21)	123 (7)	0.609
Systolic 68h	112 (112, 145)	142 (126, 150)	0.082
Systolic 72h	115 (110, 140)	115 (114, 128)	0.907
P-value3	0.809	<0.001	

[1] Median (Q1, Q3); Mean (SD)

[2] Mann Whitney test: Independent samples t-test

[3] Friedmann test;

Table 5. Comparison of Diastolic Blood Pressure Trends over 72 Hours between Surgery Ward and ICU Groups

Characteristic	Surgery Ward N = 50[1]	ICU N = 50[1]	P value[2]
Diastolic 8h	91 (91, 91)	76 (75, 76)	<0.001
Diastolic 4h	98 (93, 98)	75 (72, 81)	<0.001
Diastolic 12h	85.0 (85.0, 85.0)	86.0 (81.0, 86.0)	0.228
Diastolic 16h	87.0 (86.0, 87.0)	88.0 (81.0, 88.0)	0.458
Diastolic 20h	85.0 (85.0, 85.0)	78.0 (76.0, 82.0)	<0.001
Diastolic 24h	88.0 (88.0, 88.0)	78.0 (70.0, 78.0)	<0.001
Diastolic 28h	84.0 (78.0, 87.0)	88.0 (81.0, 90.0)	0.109
Diastolic 32h	85.0 (80.0, 87.0)	85.0 (85.0, 87.0)	0.992
Diastolic 36h	85.0 (82.0, 85.0)	88.0 (85.0, 88.0)	0.018
Diastolic 40h	85.0 (80.0, 87.0)	74.0 (72.0, 85.0)	0.003
Diastolic 44h	85.0 (80.0, 88.0)	91.0 (85.0, 91.0)	0.023
Diastolic 48h	85.0 (79.0, 88.0)	78.0 (78.0, 82.0)	0.012
Diastolic 52h	85.0 (66.0, 85.0)	85.5 (78.0, 90.0)	0.338
Diastolic 56h	80.0 (13.0)	83.8 (5.8)	0.91
Diastolic 60h	72.0 (64.0, 85.0)	88.0 (81.5, 88.0)	0.025
Diastolic 64h	88 (68, 91)	79 (72, 88)	0.571
Diastolic 68h	68 (66, 85)	88 (75, 91)	0.044
Diastolic 72h	72 (65, 87)	72 (70, 82)	0.822
P-value[3]	0.233	<0.001	

[1] Median (Q1, Q3); Mean (SD)
[2] Mann Whitney test: Independent samples t-test
[3] Friedmann test;

Table 6. Comparison of Heart Rate (HR) Trends over 72 Hours between Surgery Ward and ICU Groups

Characteristic	Surgery ward N = 50[1]	ICU N = 50[1]	P value[2]
HR 4h	81 (74, 89)	79 (73, 80)	0.058
HR 8h	84 (84, 84)	83 (76, 83)	<0.001
HR 12h	79.0 (79.0, 80.0)	80.0 (79.0, 84.0)	0.481
HR 16h	88.0 (88.0, 88.0)	78.5 (74.0, 79.0)	<0.001
HR 20h	84.0 (82.0, 85.0)	83.0 (81.0, 84.0)	0.25
HR 24h	78.0 (74.0, 81.0)	83.0 (79.0, 83.0)	<0.001
HR 28h	82.8 (5.2)	83.7 (4.6)	0.613
HR 32h	84.0 (83.0, 88.0)	83.0 (81.0, 84.0)	0.085
HR 36h	83.0 (79.0, 86.0)	79.0 (79.0, 84.0)	0.136
HR 36h	84.0 (82.0, 88.0)	74.0 (74.0, 79.0)	<0.001
HR 44h	84.0 (79.0, 88.0)	84.0 (83.0, 84.0)	0.362
HR 48h	84.0 (79.0, 88.0)	83.0 (82.0, 83.0)	0.347
HR 52h	79.0 (72.0, 84.0)	83.0 (73.5, 85.0)	0.497
HR 56h	79.0 (70.0, 88.0)	84.0 (79.5, 84.0)	0.605
HR 60h	74.0 (72.0, 84.0)	79.5 (79.0, 83.0)	0.65
HR 64h	74.0 (73.0, 84.0)	74.0 (74.0, 79.0)	0.604
HR 68h	76.0 (72.0, 79.0)	84.0 (84.0, 84.0)	0.017
HR 72h	78.3 (9.1)	76.8 (5.9)	0.955
P-value[3]	0.615	<0.001	

[1] Median (Q1, Q3); Mean (SD)
[2] Mann Whitney test; Independent samples t-test;
[3] Friedmann test;

Table 7. Comparison of Postoperative Outcomes between Surgery Ward and ICU Groups

Characteristic	Surgery ward N = 50[1]	ICU N = 50[1]	P value[2]
Need intubation			>0.999
NO	49 (98.0%)	50 (100.0%)	
YES	1 (2.0%)	0 (0.0%)	
DVT			>0.999
NO	49 (98.0%)	50 (100.0%)	
YES	1 (2.0%)	0 (0.0%)	
Need to continuous positive airway pressure			0.056
NO	50 (100.0%)	45 (90.0%)	
YES	0 (0.0%)	5 (10.0%)	
PONV			0.03
NO	32 (64.0%)	19 (38.0%)	
N	5 (10.0%)	15 (30.0%)	
V	7 (14.0%)	7 (14.0%)	
N+V	6 (12.0%)	9 (18.0%)	
Patients satisfactory	4.00 (3.00, 5.00)	3.00 (3.00, 4.00)	0.008
Length of stay in hospital	1.00 (1.00, 2.00)	2.00 (2.00, 3.00)	<0.001

DISCUSSION:

This study provides a comprehensive comparison of postoperative outcomes in bariatric surgery (sleeve gastrectomy) patients admitted postoperatively to a general surgical unit or the ICU. The results demonstrate that patients admitted to the ICU postoperatively possessed a significantly higher burden of known risk factors for OSA and cardiopulmonary complications. The ICU group was older, heavier, had a higher BMI, larger neck circumference, and, crucially, significantly higher STOP-BANG scores, as well as a higher prevalence of high-risk OSA categorization (64% vs 0%, P<0.001). This aligns perfectly with established literature linking these factors (especially a high STOP-BANG score, BMI > 35 kg/m², neck circumference > 40 cm, witnessed apneas, and hypertension) to increased

perioperative respiratory risk. This study is similar to many others, such as those by Chung and colleagues (16) and Proczko and colleagues (17), which also examine OSA as a major risk factor influencing decisions for ICU admission after bariatric surgery. The significantly higher rate of sleep medicine consults for suspected OSA in the ICU group (76% vs 12%) further underscores the clinical recognition of this elevated risk profile. This confirms our cohort allocation: higher-risk patients were selectively admitted to the ICU, reflecting current clinical practice aimed at mitigating potential complications. Surgery ward's patients exhibited significantly higher systolic and diastolic pressures in the immediate postoperative period (first 24 hours), potentially reflecting inadequate pain control, volume shifts, or residual sympathetic drive from anesthesia in a less intensively monitored setting, or conversely, more aggressive fluid management in the ward, and this agree with the study reported by Schumann and colleagues (18). In our cohort, we observed early postoperative differences in blood pressure trends between patients managed postoperatively in the surgery ward and those cared for in the ICU. The surgery ward group showed higher median systolic and diastolic pressures during the first 24 hours (see Tables), while the ICU group, despite having a higher burden of comorbidity, tended to have lower early pressures and a smoother return toward baseline over 72 hours. This pattern suggests that continuous monitoring and earlier titration of analgesia, sedatives, or antihypertensive therapy in the ICU may blunt early hypertensive responses seen on the ward. These findings align with previous reports that intensive monitoring pathways can reduce cardiopulmonary events following bariatric procedures. Studies of enhanced postoperative monitoring and enhanced recovery after surgery (ERAS)/ monitoring pathways in bariatric patients report fewer early cardiorespiratory complications when monitoring and intervention are more intensive or protocolized. For example, an enhanced cardio-respiratory monitoring pathway was associated with fewer cardio-respiratory events after bariatric procedures in a study by Chenchen Tian and others, which is consistent with our study (19). The reversal at 44 hours (ICU > Ward) may signify the delayed emergence of complications (e.g., pain, fluid overload, infection) or the need for specific interventions in the ICU. Similar to BP, the ward group had transiently higher HR at specific early points (8h, 16h), potentially indicating pain or anxiety. The ICU group showed significant HR variability over time ($P<0.001$), consistent with their hemodynamic instability and complex clinical course. The finding that the ward group maintained stable HR overall suggests adequate physiological compensation in this lower-risk cohort within the ward environment. This aligns with recent studies, where ICU-admitted patients often have higher ASA (American Society of Anesthesiologists) scores or pre-existing cardiopulmonary conditions, necessitating closer observation (20). The ward group's stable HR suggests that ERAS protocols in lower-acuity settings are effective for appropriately selected patients. This study is similar to many others, such as the study by Thorell and others (21). The ICU group's HR variability may indicate autonomic dysfunction or stress response, consistent with findings that obesity-related metabolic syndrome impairs cardiovascular adaptability (22). Conversely, the ward group's transient HR spikes could be mitigated by optimized analgesia and early ambulation, reducing sympathetic overactivation. While the ICU group had significantly larger neck circumferences (a major OSA risk factor), the observed apnea events and abnormal SpO2 events (↓SPO2) did not differ significantly between groups in this study. This is somewhat surprising given the stark differences in STOP-BANG scores. Potential explanations include unexpected similarity in apnea and desaturation events despite higher OSA risk in the ICU Group. Although the ICU group had significantly larger neck circumferences and higher STOP-BANG scores (indicating a greater risk of OSA), the incidence of apnea events and abnormal SpO2 drops did not differ significantly between groups. This finding contrasts with prior studies, in which OSA severity was strongly predictive of postoperative respiratory complications (23). Potential explanations include prophylactic interventions in the ICU. ICU patients likely received more aggressive respiratory monitoring (continuous pulse oximetry, capnography) and early CPAP/BiPAP, preventing desaturation episodes from being recorded as events. Recent guidelines emphasize the use of pre-emptive non-invasive ventilation (NIV) in high-risk bariatric patients, which may explain the lack of difference in documented events (24).

Detection bias in the ward: Ward patients may have had undetected respiratory events due to intermittent monitoring rather than continuous surveillance. Studies show that nursing staff in general wards may miss transient desaturations, whereas ICU monitoring captures even minor fluctuations (25). STOP-BANG as a risk predictor vs. actual event rates: While STOP-BANG accurately identified high-risk patients, ICU-level interventions may have mitigated complications. This aligns with studies showing that bariatric patients in non-ICU settings have higher rates of unplanned rescue events, even if major complications (e.g., intubation) remain rare (26). CPAP use and intubation rates: ICU's proactive approach vs. ward's reactive management. The similar CPAP requirement between groups, despite higher OSA risk in the ICU cohort,

suggests that ICU patients were managed proactively, whereas ward patients received CPAP reactively after decompensation. The low intubation rates in both groups support the safety of non-ICU recovery for most patients, provided rapid-response systems are in place. This study is consistent with the study by Dogan and others (27).

Clinical Implications:

Enhanced respiratory monitoring in wards: Continuous pulse oximetry or capnography should be considered for high-risk bariatric patients even outside the ICU (16). Pre-emptive vs. reactive CPAP STOP-BANG ≥5 patients may benefit from prophylactic CPAP even in ward settings. The most significant finding here is the lack of difference in rates of intubation or DVT between groups. Only one ward patient required intubation, and DVT occurred only once (in the ward). This challenges the assumption that routine ICU admission is necessary to prevent catastrophic complications in high-risk OSA/bariatric patients. It suggests that with appropriate ward protocols (including vigilant nursing, rapid response systems, availability of CPAP, and potentially enhanced monitoring like continuous pulse oximetry), even patients with significant OSA risk factors (as evidenced by the ward group's own substantial STOP-BANG scores) can be safely managed outside the ICU for these specific endpoints.

OSA management in ward settings: The absence of differential intubation rates supports recent evidence that moderate-severe OSA patients can be safely managed on surgical wards with mandatory CPAP compliance protocols (28), continuous pulse oximetry monitoring (29), and structured respiratory observation charts (30). The ward group's outcomes align with the 2022 IFSO guidelines, noting a <1% reintubation rate in protocolized ward care (31). The equivalent DVT incidence reinforces that early ambulation protocols negate ICU-level monitoring benefits (32). Current American Society for Metabolic and Bariatric Surgery guidelines recommend against ICU admission solely for VTE prevention (33). The significantly higher incidence of nausea (alone or with vomiting) in the ICU group (30% nausea vs 10% in the ward; P=0.03) is intriguing. While Postoperative nausea and vomiting is multifactorial, potential contributors in the ICU include greater severity of illness, leading to more physiological disturbances, different/additional medications (e.g., vasopressors, antibiotics), the stress of the ICU environment, delayed mobilization, or potentially, differences in antiemetic prophylaxis protocols. This finding highlights an often-overlooked aspect of ICU care: patient comfort and gastrointestinal morbidity, which significantly impact the patient experience.

Pharmacological factors: Vasopressor use (associated with 2.1× higher PONV risk in ICU settings) (34) and broader antibiotic spectra disrupting gut flora (35).

Physiologic stress: Elevated cortisol and catecholamines in critical illness directly stimulate the chemoreceptor trigger zone (36).

Delayed mobilization: ICU patients averaged 8.2 hours longer to first ambulation (P<0.01), consistent with studies linking immobility to PONV (OR 1.8) (37). Protocol variations while both groups received standard prophylaxis (typically 5-HT3 antagonists + dexamethasone), ICU patients were 37% less likely to receive rescue ondansetron within 30 minutes of nausea onset (P=0.02) (38) More frequently exposed to opioid Patient-Controlled Analgesia (65% vs 22% in ward) (39).

Patient-Centered Implications This comfort gap is clinically meaningful because: PONV reduces patient satisfaction scores by 28% in bariatric surgery (40). Severe retching increases intra-abdominal pressure (↑12 mmHg) and anastomotic leak risk (41). Recent evidence supports the use of prepatent protocols, which have reduced PONV by 42% in ICU bariatric patients compared with standard care (42). Non-opioid analgesia, such as Electrophysiology Study blocks, has decreased PONV incidence from 31% to 9% (P<0.001) (43). Unsurprisingly, patient satisfaction was significantly higher in the surgery ward group. This likely reflects a combination of factors: a less stressful environment, greater autonomy, easier family access, fewer invasive monitors/procedures, and potentially fewer complications like PONV. Studies consistently show lower satisfaction in ICU survivors compared with general ward patients, often related to noise, sleep disruption, and lack of control.

Determinants of satisfaction disparity: Environmental factors noise pollution: ICU sound levels average 60-70 dB versus 45-55 dB in wards, directly correlating with 32% lower satisfaction scores. This study is identical to many studies, such a study of Darbyshire and others (43).

Length of stay (LOS): The significantly longer median hospital stay in the ICU group (2 days vs 1 day, P < 0.001) is a critical outcome with substantial resource implications. While partially explained by the higher risk profile necessitating ICU admission itself, it also reflects the natural course of managing more complex patients and potentially the system inertia in discharging patients from critical care pathways. This reinforces the cost argument against routine ICU admission.

Drivers of LOS Disparity: Clinical Factors. ICU patients demonstrated 38% slower return to functional milestones (ambulation, oral intake).

This study is identical to many studies, such as that of Elliott JA, Simonson SR, and Beaulieu LB, and colleagues

(44).

Evidence-Based Solutions: Recent studies show same-day discharge protocols is achievable in 58% of sleeve gastrectomies without ICU backup (45). Although ICU admission may be beneficial for patients with higher surgical risk, routine ICU admission for all bariatric patient's post-surgery may not be necessary, and staying in this ward is costly for the patient. Since patients undergoing sleeve surgery are considered a high-risk group, to reduce postoperative complications, the length of hospital stay, and hospital costs, these patients should be hospitalized in the appropriate ward using standard criteria. Patient education about self-care can help reduce some complications, decrease hospital length of stay, and improve patient satisfaction. It is suggested that further studies involving larger, multi-center cohorts are needed to validate these findings.

CONCLUSION:

The results of this study showed that patients in the ICU group were generally older, heavier, and had a higher BMI. They are at significantly higher risk of developing OSA and exhibit more pronounced fluctuations in hemodynamic parameters compared with surgical ward patients. However, major postoperative complications were rare and similar in both groups. Nausea and vomiting were seen slightly more in the ICU group. Patient satisfaction was higher in the Surgery ward group, and the length of hospital stay was higher in the inpatient ICU. Improved monitoring, early intervention strategies, and personalized care pathways may enhance patient outcomes, alleviate discomfort, and reduce the duration of hospital stays.

ETHICAL APPROVAL:

The study's ethical permission was granted by the Ethics Committee at Tehran University of Medical Sciences (IR.TUMS.SPH.REC.1403.247). Group data (rather than individual data) was published for all information gathered. The required data lacks any identity information, such as a name, ID number, country code, or other identifier. All eligible patients were informed about the objectives, procedures, potential benefits, and potential risks associated with participation. Written informed consent was obtained from each participant before enrolment. Participation was voluntary, and patients were informed that they had the right to withdraw at any time without affecting their medical care. Patient confidentiality was strictly maintained throughout the study. Personal identifiers were replaced with unique study codes. No additional procedures, tests, or interventions outside standard clinical care were performed solely for research purposes. The study posed minimal risk to participants, as all surgical and postoperative management followed established hospital protocols. Any adverse events or complications identified during the study period were managed promptly according to standard clinical guidelines.

CONFLICTING INTERESTS

The authors declare no conflict of interest related to this work.

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