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Implications of Early Non-invasive CPAP Therapy on Postoperative Respiratory Outcomes in Morbidly Obese Patients after Bariatric Surgery: A Randomized Controlled Trial

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ABSTRACT

Background: Morbid obesity in Egypt is linked to increased perioperative pulmonary risks. Despite bariatric surgery's efficacy, postoperative respiratory complications persist.

Objective: The aim of this work was to evaluate the effect of early noninvasive CPAP therapy on postoperative pulmonary functions and radiological atelectasis in 24 hours in morbidly obese patients after bariatric surgery.

Patients and Methods: In this randomized, single-blinded trial (at Sohag University Hospitals, July 2019–July 2022), 60 patients were assigned to receive either noninvasive CPAP ventilation (n = 30) for the first 6 hours then nasal oxygen for 24 hours post-extubation (CPAP group) or nasal oxygen (n = 30) for 24 hours post-extubation (Nasal group). Baseline and 24 hours postoperative pulmonary function tests (PFT) as; functional vital capacity (FVC), forced expiratory volume in first second FEV1 and FEV_1/FVC ratio, chest X-ray, and CT were done and analysed. Respiratory, non-respiratory complication and hospital stay duration were reported and compared between the studied groups.

Results: CPAP group had significantly improved FEV1, FVC, and FEV1/FVC ($p < 0.05$) and reduced atelectasis (chest X-ray: 46.67% vs. 90%; CT: 46.67% vs. 86.7%; $p < 0.001$) than Nasal group in the first 24 hours postoperatively. CPAP group also had higher SpO_2 ($p < 0.05$), fewer reintubations (6.67% vs. 26.67%; $p = 0.001$), and shorter hospital stays (86.67% vs. 60% discharged within 48 h; $p = 0.003$). No observed differences were found in non-respiratory complications.

Conclusions: Early noninvasive CPAP therapy in post-bariatric surgery enhances pulmonary recovery, reduces respiratory complications and shortens hospital stay; supporting its routine use in morbidly obese patients**.**

Keywords: Morbid obesity; Bariatric surgery; CPAP; Postoperative respiratory complications.

INTRODUCTION

Obesity is a growing global health concern, affecting over one-third of Egyptian adults by 2010 (BMI ≥ 30 kg/m²) [1].

It is linked to increased mortality and comorbidities such as type 2 diabetes, cardiovascular disease, and obstructive sleep apnea (OSA) [2]. In morbid obesity, life expectancy may be reduced by 5–20 years [3,4].

Bariatric surgery is the most effective intervention for sustained weight loss and improvement in metabolic health [5]. However, obese patients face elevated perioperative risks, particularly pulmonary complications like atelectasis, hypoxemia, and airway obstruction, due to impaired respiratory mechanics and anesthesia effects [6-8].

The post-extubation period is especially high-risk, with residual anesthetics and OSA increasing the likelihood of airway compromise [9,10]. Early use of continuous positive airway pressure (CPAP) may reduce these risks by improving lung expansion and oxygenation [11]. OSA often persists after surgery, necessitating continued respiratory support [12]. CPAP may also influence broader outcomes, including cardiovascular events and hospital stay, yet data on its short-term use in the post-anesthesia care unit (PACU) are limited [13].

The primary outcome was to evaluate the effect of early noninvasive CPAP therapy on postoperative pulmonary functions and radiological atelectasis in 24 hours in morbidly obese patients after bariatric surgery.

Secondary outcomes included effects on oxygenation, respiratory and non-respiratory complications and hospital stay duration.

PATIENTS AND METHODS

This single-blinded trial enrolled 60 morbidly obese adults (BMI ≥ 40 kg/m²) aged from 18 to 60 years old, of both sexes, at Sohag University Hospitals (July 2019–July 2022).

Inclusion required ≥3 years of obesity, failed conservative treatment, and negative COVID-19 PCR. Exclusions included open surgical procedures, pulmonary disease (except OSA), recent MI, CT chest CORAD ≥ 3 or positive COVID-19.

Preoperative Preparation

The pre-op evaluation in addition to routine labs included; BMI (kg/m²), neck circumference (cm), sleep apnea hypopnea index (AHI), degree of OSA, electrocardiogram (ECG), thyroid profile (TSH), serum cortisol, glycated hemoglobin (HbA1c), pulmonary function tests (PFT) as; functional vital capacity (FVC) and forced expiratory volume in first second FEV1 and FEV_1/FVC ratio (using MIR Spirolab II, USA), Echocardiography, X-ray chest and CT chest. Patients were kept NPO for 6–8 hours and received IV fluids and midazolam (0.03 mg/kg) for anxiolysis in the holding area under monitoring.

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Intraoperative Management: All patients received standardized anesthesia with fentanyl, propofol, rocuronium, and isoflurane, followed by mechanical ventilation. Postoperatively, neuromuscular blockade was reversed, and extubation was performed once stable and all patients were transferred to the PACU.

Postoperative Management: In the PACU, arterial blood gases (ABG) (pH, PaO_2, $PaCO_2$ and HCO_3), ECG, echocardiographic findings and vital signs (heart rate, mean arterial blood pressure, oxygen saturation and respiratory rate) were recorded at 0, 2, 4, 6, 8, 10, 12 and 24 hours. A semi-sitting chest X-ray, PFT (FEV1, FVC and FEV1/FVC) and CT chest were done 24 hours postoperatively.

Randomization: participants were randomized into two groups 1:1 using a computer-generated sequence to ensure allocation concealment. The CPAP group (n = 30) received noninvasive CPAP (FiO_2 35%, PEEP 5 cm H_2O, pressure support 8–12 cm H_2O) for 6 hours immediately after extubation, then nasal cannula for oxygen on 3L/minute for 18 hours. The Nasal group (n = 30) received oxygen via nasal cannula only for oxygen on 3L/minute for 24 hours. Incidence of respiratory complications (reintubation, hypoxia, barotrauma, pneumothorax, or intervention intolerance), cardiovascular system complications (arrhythmia, myocardial infarction or hypotension) and gastrointestinal tract (GIT) system complications (abdominal distention and vomiting) and hospital stay time were reported and analyzed.

Ethics approval:

This study followed the Declaration of Helsinki and was approved by the Institutional Ethics Committee of Sohag University (KBET/126/B/2014). Informed consent was obtained from participants before enrollment. This work has been carried out in accordance with The Code of Ethics of the World Medical Association (Declaration of Helsinki) for studies involving humans.

Sample size and statistical analysis:

Based on a 30% expected improvement in pulmonary function, 30 patients per group were required ($\alpha = 0.05$, power = 90%). Data were analyzed using SPSS v26.0. Quantitative data were presented as means ± SD and were compared between the 2 groups by independent t test and between pre- and post- intervention in the same group by paired t test. Categorical data were compared with Chi-square. Significance was set at $p < 0.05$.

RESULTS

Eighty-six patients were allocated in this study, 19 patients didn't meet the inclusion criteria, 7 patients declined to participate, and 60 patients completed the trial (Study flowchart figure 1)

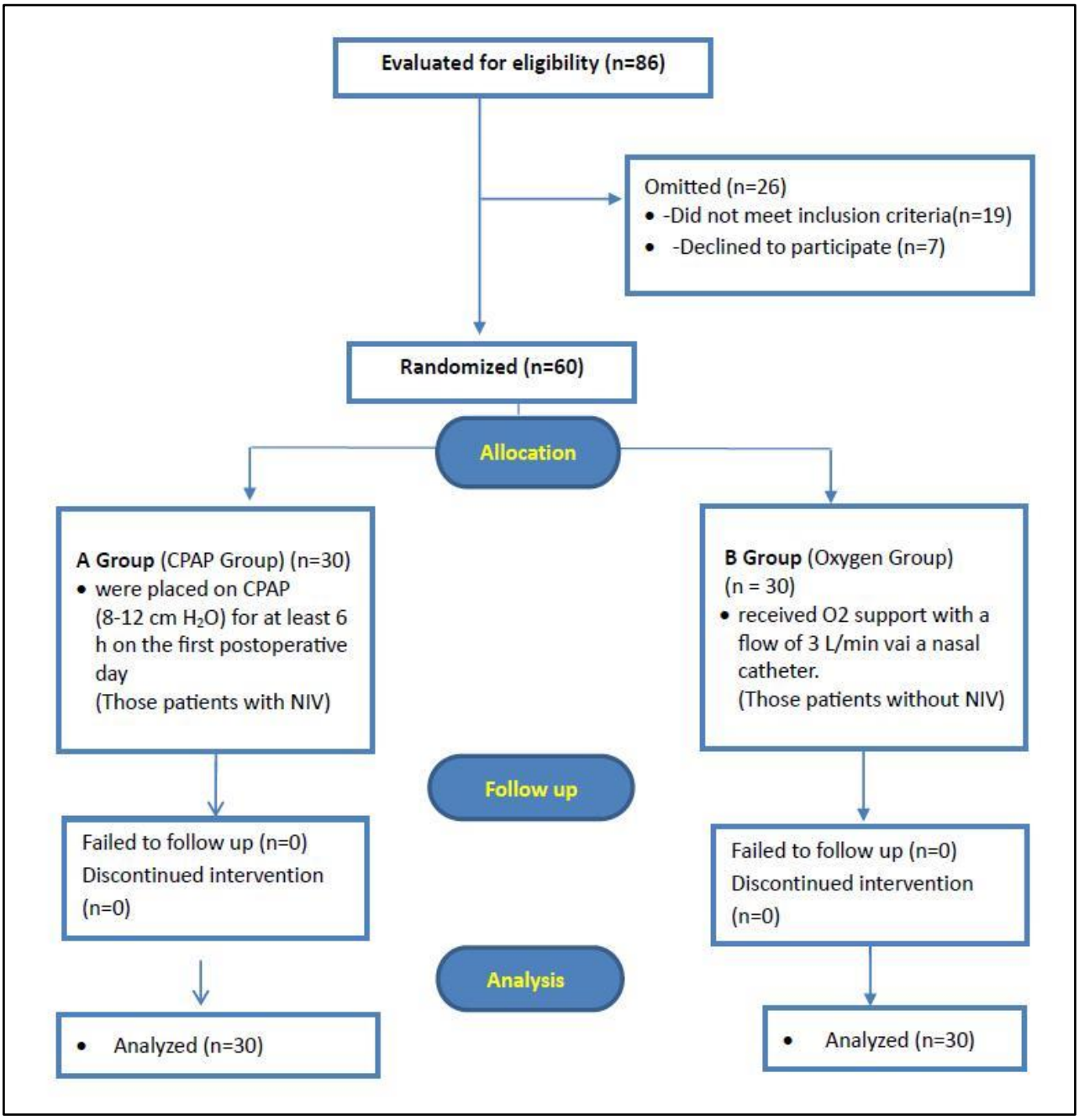

Fig (1): Study flow chart.

Baseline Characteristics

In relation to the baseline demographic and preoperative clinical data, there were no significant differences found between the studied groups in terms of age, sex distribution, BMI, neck circumference, apnea-hypopnea index (AHI), OSA severity, thyroid function, glycated hemoglobin (HbA1c), cortisol levels, ECG findings or echo findings (**Table 1**).

Table (1): Demographic Data, Preoperative Laboratory Investigations, and Cardiac Assessment

Variable	CPAP Group (n = 30)	Nasal Group (n = 30)	P Value
Age (years)	37.1 ± 12.29	38.1 ± 10.36	0.726
Sex			
Male	11 (36.67%)	10 (33.33%)	0.787
Female	19 (63.33%)	20 (66.67%)	
BMI (kg/m²)	55.1 ± 8.55	57.8 ± 10.02	0.263
Neck circumference (cm)	37.7 ± 5.11	38.9 ± 3.64	0.323
Sleep AHI	43.5 ± 20.54	44.8 ± 16.55	0.786
OSA Degree			
Moderate	11 (36.67%)	9 (29.33%)	0.584
Severe	19 (63.33%)	21 (70.67%)	
Laboratory Investigations			
TSH (uIU/ml)	1.7 ± 1.01	2.1 ± 0.9	0.138
Cortisol (9 a.m.) (µg/dl)	12.6 ± 1.5	14.1 ± 3.91	0.57
Cortisol (9 p.m.) (uIU/ml)	5 ± 2.35	6.2 ± 2.23	0.54
HbA1c (mmol/mol)	5 ± 1.01	4.8 ± 1.81	0.633
ECG Findings			
Normal	25 (83.35%)	27 (90%)	
Inverted T	1 (3.33%)	0 (0%)	
Depressed ST	2 (6.67%)	3 (9.99%)	0. 512
Infrequent PVCs	1 (3.33%)	0 (0%)	
Bradycardia	1 (3.33%)	0 (0%)	
Elevated ST	0 (0%)	1 (3.33%)	
ECHO Findings			
Normal	25 (83.35%)	27 (90%)	
Ischemic Changes	3 (9.99%)	1 (3.33%)	0.492
Mild TR, MR	1 (3.33%)	0 (0%)	
Mild TS, MS	1 (3.33%)	2 (6.67%)	

Data presented as mean ± standard deviation or frequency (%).

AHI: Apnea Hypopnea Index; OSA: Obstructive Sleep Apnea; TSH: Thyroid-Stimulating Hormone; ECG: Electrocardiogram; ECHO: Echocardiogram; TR: Tricuspid Regurgitation; MR: Mitral Regurgitation; TS: Tricuspid Stenosis; MS: Mitral Stenosis; PVCs: Premature Ventricular Contractions.

Primary Outcomes

***In relation to Pulmonary Function* tests** 24 hours post-intervention, the CPAP group demonstrated significantly improved FEV1, FVC, and FEV1/FVC ratios compared to the Nasal group (**Table 2)**.

Table (2): Pulmonary Function Pre-intervention and 24 h Post-intervention

Parameter	CPAP Group (n = 30)	Nasal Group (n = 30)	P Value (Between Groups)
FEV1 (L) – Pre-intervention	2.82 ± 0.76	2.88 ± 0.68	0.860
FEV1 (L) – 24 h Post-intervention	3.30 ± 0.81	2.43 ± 0.66	<0.001*
P (Within Group, Before vs After)	0.040*	0.100	—
FVC (L) – Pre-intervention	3.30 ± 0.82	3.40 ± 0.74	0.440
FVC (L) – 24 h Post-intervention	3.80 ± 0.84	3.20 ± 0.72	0.004*
P (Within Group, Before vs After)	0.003*	0.023*	—
FEV1/FVC (%) – Pre-intervention	85.45 ± 4.79	84.70 ± 5.83	0.588
FEV1/FVC (%) – 24 h Post-intervention	86.84 ± 5.36	75.93 ± 5.52	<0.001*
P (Within Group, Before vs After)	0.020*	0.001*	—

Note: Data presented as mean ± SD, (FVC): functional vital capacity, FEV1: forced expiratory volume in first second, *: Significant P.

Radiological Assessment of Atelectasis

Postoperative 24 hours imaging showed no atelectasis in chest X-rays in 90% of CPAP group vs. 46.67% in Nasal group, and no atelectasis on CT in 86.7% of CPAP group vs. 46.67% in Nasal group (**Table 3)**.

Table (3): Radiological Assessment Pre-intervention and 24 h Post-intervention

Radiological Assessment	CPAP Group (n = 30)	Nasal Group (n = 30)	P Value
Chest X-ray			
Pre-intervention – Normal	11 (36.66%)	10 (33.33%)	0.787
Pre-intervention – Atelectasis	19 (63.33%)	20 (66.67%)	
24 h Post-intervention – Normal	27 (90%)	14 (46.67%)	<0.001*
24 h Post-intervention – Atelectasis	3 (10%)	16 (53.33%)	
CT Chest			
Pre-intervention – Normal	10 (33.33%)	9 (30%)	0.781
Pre-intervention – Atelectasis	20 (66.67%)	21 (70%)	
24 h Post-intervention – Normal	26 (86.7%)	14 (46.67%)	0.002*
24 h Post-intervention – Atelectasis	4(13.3%)	16(53.33%)	

Note: Data presented as frequency (%), *: Significant P.

Secondary Outcomes

Hemodynamic Monitoring: Post-intervention oxygen saturation (SpO_2) was significantly higher in CPAP group than nasal group at all times of the measurements except at baseline postoperatively, with no significant differences in HR, MAP, respiratory rate (RR) between both groups (**Figure 2)**.

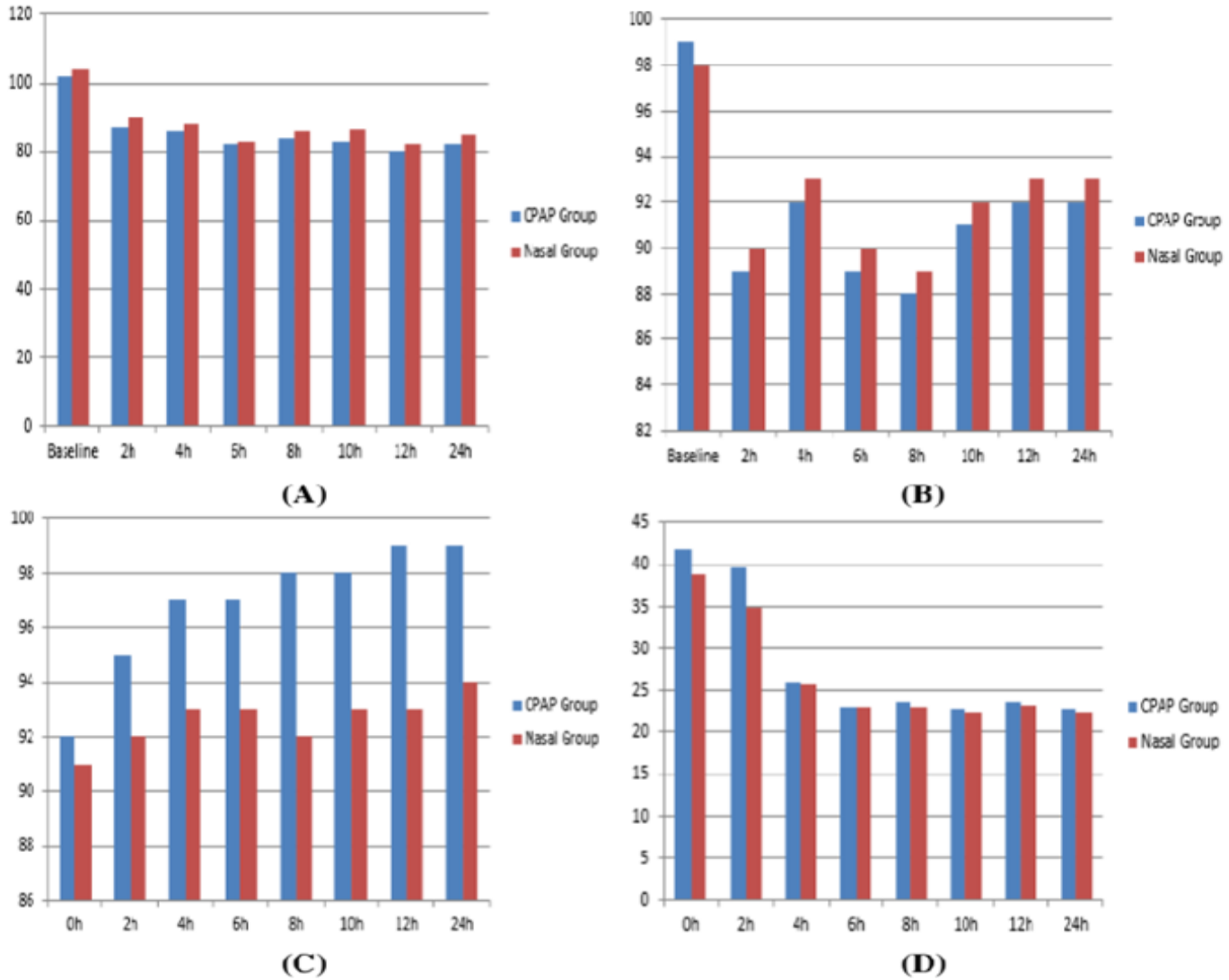

Figure (2): (A) Heart rate, **(B)** Mean arterial blood pressure, **(C)** Oxygen saturation (SpO_2), and **(D)** Respiratory rate of the studied groups

In relation to arterial blood gas, pH at 6, 8, 10, 12 and 24 hours, $PaCO_2$ at all times of the measurements except at baseline and HCO_3 at 4, 6, 10, and 24 hours were significantly different in in the studied groups. pH at baseline, 2- and 4-hours post-intervention and HCO_3 at baseline, 2, 8 and 12 hours were insignificantly different between both groups. PaO_2 at baseline postoperatively was insignificantly different between both groups (**Table 4)**.

Table (4): Arterial blood gas in the studied groups

	Baseline	**2h**	**4h**	**6h**	**8h**	**10h**	**12h**	**24h**
PH								
CPAP group (n=30)	7.31±0.03	7.34±0.03	7.38±0.04	7.40±0.03	7.40±0.03	7.39±0.03	7.40±0.04	7.40±0.02
Nasal group (n=30)	7.33±0.05	7.35±0.03	7.37±0.04	7.37±0.03	7.36±0.05	7.36±0.04	7.37±0.04	7.36±0.04
P	0.291	0.143	0.213	**0.001***	**0.001***	**0.001***	**0.004***	**<0.001***
$PaCO_2$ (mmHg)								
CPAP group (n=30)	55.87±8.15	43.43±5.81	42.67±3.80	41.40±5.40	41.93±4.65	40.57±3.30	40.80±3.58	40.97±3.45
Nasal group (n=30)	55.53±9.98	46.53±8.51	46.20±6.17	45.40±6.89	45.63±8.90	46.37±8.59	44.90±5.37	45.93±7.92
P	0. 71	**0.031***	**0.029***	**0.015***	**0.048***	**0.001***	**0.001***	**0.003***
HCO_3 (mmol/l)								
CPAP group (n=30)	25.20±4.56	24.87±3.74	22.13±2.47	22.87±2.71	23.53±2.91	22.80±2.67	23.27±2.53	22.20±1.79
Nasal group (n=30)	25.57±3.95	24.53±3.26	23.30±3.43	24.53±2.98	24.10±4.29	24.67±3.94	23.87±3.42	24.27±4.34
P	0.740	0.709	**0.031***	**0.027***	0.551	**0.036***	0.443	**0.019***
PaO_2 (mmHg)								
CPAP group (n=30)	89.30±7.94	98.87±8.95	105.10±22.65	105.03±19.73	108.73±22.23	115.57±21.72	109.10±14.10	108.57±21.07
Nasal group (n=30)	88.97±5.87	92.73±9.39	98.63±12.18	100.57±14.28	95.60±15.78	96.03±23.70	103.07±29.08	91.47±7.38
P	0.297	**0.018***	**0.0174***	**0.0319***	**0.011***	**0.002***	**0.031***	**<0.001***

Date was presented as mean± SD. *: Significant P, $PaCO_2$: arterial partial pressure of carbon dioxide, HCO_3: Bicarbonate, PaO_2: arterial partial pressure of oxygen; CPAP: continuous positive airway pressure.

Incidence of Respiratory Complications: The CPAP group experienced significantly fewer respiratory complications than Nasal group. Hypoxia was reported in 10% of CPAP group versus 26.67% in the nasal group. Re-intubation were recorded in only 6.67% of CPAP group versus 26.67% in the nasal group. No cases of barotrauma, pneumothorax, or intervention intolerance were reported in either group (**Table 5)**.

Incidence of Cardiovascular Complications: Postoperative myocardial infarction, ischemia or hypotension were comparable (**Table 5)**.

Incidence of Gastrointestinal Complications: Gastrointestinal (GI) events (vomiting or abdominal distension) occurred in both groups with no significant difference, indicating CPAP did not increase GI risk postoperatively (**Table 5)**.

Length of Hospital Stay: Hospital stay was significantly shorter in the CPAP group, with 86.67% discharged within 48 hours vs. 60% in the nasal group, indicating faster recovery and reduced healthcare use (**Table 5)**.

Table (5): Respiratory, Gastrointestinal, Cardiovascular Complications and Hospital Stay in the Studied Groups

Complication / Parameter	CPAP Group (n = 30)	Nasal Group (n = 30)	P Value
Respiratory Complications			**0.001***
No	27 (90%)	14 (46.67%)	
Hypoxia	3 (10%)	8 (26.67%)	
Re-intubation	2 (6.67%)	8 (26.67%)	
Cardiovascular Complications			0.123
No	22 (73.66%)	20 (70%)	
Ischemia	1 (3.33%)	2 (6.67%)	
Myocardial Infarction	1 (3.33%)	1 (3.33%)	
Hypotension	2 (6.66%)	1 (3.33%)	
Gastrointestinal (GIT) Complications			0.961
Vomiting – Yes	3 (10%)	4 (13.3%)	
Abdominal Distension – Yes	8 (26.67%)	7 (23.33%)	
Hospital Stay Duration (Days)			**0.003***
0–2 Days	26 (86.6%)	18 (60%)	
3–4 Days	3 (10%)	7 (23.3%)	
>5 Days	1 (3.33%)	5 (16.67%)	

Note: Data presented as frequency (%), *: Significant P, CPAP: Continuous Positive Airway Pressure; GIT: Gastrointestinal Tract.

Postoperative ECG showed significant arrhythmias in the Nasal group than CPAP group at 2, 4, 8, 10, 12 and 24 hours postoperatively (**Table 6)**.

Table (6): Electrocardiogram Findings in the Studied Groups at Various Postoperative Time Points

Time Point	Group	Normal ECG n (%)	Arrhythmias n (%)	P
Baseline	CPAP Group	13 (43.3%)	17 (56.7%)	0.057
	Nasal Group	11 (36.7%)	19 (63.3%)	
2 hours	CPAP Group	25 (83.3%)	5 (16.7%)	0.027*
	Nasal Group	22 (73.3%)	8 (26.7%)	
4 hours	CPAP Group	27 (90%)	3 (10%)	0.021*
	Nasal Group	24 (80%)	6 (20%)	
6 hours	CPAP Group	26 (86.7%)	4 (13.3%)	0.051
	Nasal Group	23 (76.7%)	7 (23.3%)	
8 hours	CPAP Group	25 (83.3%)	5 (16.7%)	
	Nasal Group	20 (66.7%)	10 (33.3%)	0.041*
10 hours	CPAP Group	27 (90%)	3 (10%)	
	Nasal Group	23 (76.7%)	7 (23.3%)	0.001*
12 hours	CPAP Group	27 (90%)	3 (10%)	
	Nasal Group	24 (80%)	6 (20%)	0.003*
24 hours	CPAP Group	28 (93.3%)	2 (6.7%)	
	Nasal Group	25 (83.3%)	(16.7%)	0.003*

Note: Data presented as frequency (%), CPAP: Continuous Positive Airway Pressure.

DISCUSSION

Obesity has become a worldwide health concern. Bariatric surgery and complications associated with bariatric surgery are becoming increasingly frequent [14].

In the current research, **Pulmonary function tests** (FEV1, FVC and FEV1/FVC) 24 hours postoperatively showed statistically significant increase in CPAP group than Nasal group, statistically significant increase in the same CPAP group and statistically significant decreased in the same Nasal group, p-value < 0.05. This is because CPAP enhances postoperative lung mechanics by stabilizing the airway and improving compliance in patients with reduced functional residual capacity. In agreement with our results **Hewidy *et al.*** [15] who did the same study design after sleeve gastrectomy in morbidly obese patients; 24 patients (group A) received immediate CPAP and 22 patients with no nasal cannula (group B), reported that there was statistically significant difference between both groups as regards FEV1. Disagreed with our results, **Chiumello *et al.*** [16] who conducted a blind randomized study to assess the impact of immediate post-extubation use of noninvasive CPAP on oxygenation and FEV1 in morbidly obese patients undergoing laparoscopic Roux-en-Y gastric bypass versus Venturi mask immediately after extubation in the operating room and was maintained during the first 2 hours in the recovery room, reported that there was no statistically significant difference between both groups as regards oxygenation and FEV1.

Our results showed that preoperative atelectatic areas by X-ray and CT chest were statistically insignificantly different between both groups but 24 hours postoperatively were statistically significantly lower in the CPAP group than Nasal group (p-value < 0.05). In CPAP group atelectasis was statistically significantly lower in 24 hours postoperatively than preoperatively. In Nasal group atelectatic areas were statistically significantly higher in 24 hours postoperatively than preoperatively. Atelectasis reduction in the CPAP group likely contributed to the improved FEV1, FVC, and FEV1/FVC ratio. In agreement with our results about incidence of atelectasis by radiology, **Hewidy *et al.*** [15] observed a statistically significant decrease in atelectasis in CPAP group than nasal group 24 hours postoperatively, a statistically significant decrease in atelectasis after 24 hours postoperatively in CPAP group than preoperatively in the same group but in nasal group there was no significant decrease preoperatively than postoperatively. Our results disagreed with **Chalhoub *et al.*** [17] who found that high inspired concentrations of oxygen increase the extent of absorption atelectasis and reduce FRC further.

In relation to hemodynamic parameters; post-intervention **O_2 saturation (SpO_2)** values showed statistically significant increase in CPAP group than Nasal group (p-value < 0.05), at 2- 24 hours postoperatively, comparable only at base line (0 hour). This is because in the postoperative period, the use of (CPAP) opens the atelectatic alveoli, so increasing end-expiratory lung volume enhancing gas exchange, improving the oxygenation and reducing ventilator induced lung injury (VILI). Our results agree with **Hewidy *et al.*** [15] who reported a significant increase in **(SpO_2)** during the postoperative period in CPAP group than those of nasal group. **Chalhoub *et al.*** [17] also, found that noninvasive CPAP group demonstrated an increase in **(**SpO_2) during the postoperative period than non CPP group (p=0.005). As regard HR and MAP, they were insignificantly different between both groups at all times of measurements. This indicates that the CPAP settings used (moderate PEEP and pressure support) were well tolerated and hemodynamically safe. Several studies showed agreement with our results in relation to HR and MAP [15-18]. In this work as regard Respiratory rate, it was insignificantly different between both groups at all times of the measurements except at baseline and 2 hours postoperatively, it showed significant increase in CPAP group than Nasal group. In agreement with our results **Chiumello *et al.*** [16] reported that, after the initiation of treatment, non-invasive intermittent positive pressure ventilation (NPPV) significantly improved the arterial oxygenation and respiratory rate.

Our results about ABG; at 2 to 24 hours postoperatively, **PaO_2** values showed statistically significant increase in CPAP group than Nasal group (p-value < 0.05), except at base line (0 hour) where it was statistically insignificant between both groups. This this is because in the postoperative period, the use of (CPAP) opens the atelectatic alveoli, so increasing end-expiratory lung volume enhancing gas exchange, improving the oxygenation and reducing ventilator induced lung injury (VILI). Our results agree with **Hewidy *et al.*** [15] who reported a significant increase in **(PaO_2)** during the postoperative period in CPAP group than those of nasal group. **Chalhoub *et al.*** [17] also, found that noninvasive CPAP group demonstrated an increase in PaO_2 during the postoperative period than non CPP group (p=0.005). **Postoperative pH** showed that at 6, 8, 10, 12 and 24 hours postoperatively, it was significantly lower in Nasal group than CPAP group (p=<0.05) but at baseline, 2- and 4-hours post-intervention it was insignificantly different between both groups. In agreement with us **Guimarães *et al.*** [18] reported that **pH values** showed statistically significant increase in CPAP group than conventional oxygenation Group at all-time points.

In the current study, $PaCO_2$ values showed statistically significant decreased in CPAP group than Nasal group at all time of measurements (p=<0.05) except at 0 hour postoperatively, it was insignificantly different between both groups. **Zoremba *et al.*** [19] detected a significant decline in **$PaCO_2$** in the NIV-group postoperatively compared to Nasal Group at 1 and 2 hours. As regard **HCO_3** values were statistically significantly lower in CPAP group than Nasal group at 4, 6, 10, and 24 hours postoperatively and was

statistically insignificantly different at 0, 2, 8 and 12 hours postoperatively, in our study. In line with us **Zoremba *et al.*** [19] detected a significant decline in HCO_3 in the NIV-group postoperatively compared to nasal group at 2 and 24 hours.

In relation to post-intervention ECG abnormalities our results showed statistically significant decreased in CPAP group than Nasal group all time of the measurements (2, 4, 6, 8, 10, 12, and 24 hours) except at baseline postoperatively, it was insignificantly different between both groups. Agreed with our results **Abe *et al.*** [20] who found that CPAP therapy significantly reduced the amount of nocturnal paroxysmal AF and supraventricular extra systoles from 14% to 4%. Also, CPAP therapy determines a significant improvement with an essential role in preventing and even abolishing these arrhythmias. Disagreed with our results, **De Jong *et al.*** [21] as they reported that CPAP therapy was ineffective in preventing cardiac remodeling and reduction of arrhythmogenicity. **Peker *et al.*** [22] concluded that the CPAP therapy didn't result in a statistically significant reduction in incidence of hypertension or cardiovascular events in patient treated with CPAP therapy.

Post-intervention respiratory complications were significantly lower in CPAP group than nasal group. Less hypoxia and the reduced need for reintubation in the CPAP group than Nasal group reflects improved respiratory mechanics and airway protection, besides reducing apnea and hypopnea frequency and related hypoxemia ($p<0.05$). As regard cases of barotrauma, pneumothorax, or intervention intolerance, they were not reported in either group. In agreement with our results about incidence of respiratory complications, **Cavalcanti *et al.*** [23] observed that in the Nasal group there were more events of respiratory complications. Disagreed with our results, **Carron *et al.*** [24] highlighted that NIV wasn't associated with a decreased risk of reintubation after tracheal extubation.

In the current research Hospital stay length showed significant lower values in CPAP group than nasal group ($p<0.05$), likely reflects better respiratory stability, fewer complications, and faster recovery. This is supported by **Abrard *et al.*** [25] who reported faster recovery and reduced ICU admissions with postoperative noninvasive ventilation in high-risk surgical patients. Disagreed with our results, **Carron *et al.*** [24] highlighted, postoperatively, that NIV wasn't associated with a decreased risk of unplanned intensive care unit admission.

Post-intervention cardiovascular and gastrointestinal complications were insignificantly different between both groups of our study (p value was 0.123 and 0.961 respectively), supporting the safety of low-pressure CPAP after bariatric surgery. In agreement with our results is **Cavalcanti *et al.*** [23] who reported no statistical differences in cardiovascular and GI complications in both groups. In the current study there were no statistically significant differences between CPAP group and Nasal group as regard demographic data (age, sex, BMI, neck circumference) and preoperative laboratory investigation (TSH, cortisol 9 am, cortisol 9 pm, HbA1c, ECG and echo). Also as regard the preoperative pulmonary function tests (FEV1, FVC and FEV1/FVC), normal or atelectasis percent by chest X-ray and CT, oxygen saturation and tension (PaO_2), which are the primary outcome of our study, they showed no statistically differences between both groups. In agreement with us the studies done by many authors with similar study design [15-18], which reported that there were no statistically significant differences between CPAP group and Nasal group as regard demographic data and as regard the preoperative pulmonary functions tests (FEV1, FVC and FEV1/FVC), normal or atelectasis percent by chest X-ray and CT, oxygen saturation (SpO_2), and tension (PaO_2).

CONCLUSION

Early postoperative CPAP improves pulmonary function, reduces respiratory complications, and shortens hospitalization in morbidly obese patients undergoing bariatric surgery. These findings support CPAP as a safe, effective strategy to enhance perioperative outcomes in this high-risk population. Further studies are warranted to explore long-term benefits and broader applications.

Limitations of this study including that it was single-center study, conducted in a hospital with an obesity surgical treatment unit thus, our results may not be able to generalize other populations.

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