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Laparoscopic Sleeve Gastrectomy: A Single Egyptian Center Experience with Anesthetic and Surgical Complications

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Authors' contributions

This work was carried out in collaboration between all authors. Author KH contributed to the study design, anesthetized and followed up patients and helped in collecting data. Authors AH and AM contributed to the study design, supervised anaesthesia and follow-up of patients, helped perform the statistical analysis and drafted the manuscript. Authors SA and GO contributed to the study design and revised the manuscript. Author SA helped collecting data and revised the medical charts. All authors read and approved the final manuscript.

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ABSTRACT

Introduction: Laparoscopic sleeve gastrectomy (LSG) as bariatric operation is gaining popularity nowadays. Many studies reported patient surgical outcome after LSG, however little is known about perioperative anesthesia-related complications. In this study we are reporting our experience in an university hospital with perioperative complications and adverse events in morbidly obese patients undergoing LSG.

Methods: A prospective cohort study was conducted in Cairo university hospitals. All patients scheduled for LSG during a period of seven months were included. Anesthesia-related complications were reported as well as surgical outcomes. Major anesthesia complications were defined as: intraoperative or postoperative cardiac arrest, failed intubation, postoperative ventilation, and postoperative inotropic support. Possible risk factors for developing perioperative complications were also analyzed using univariate and multivariate analysis.

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Results: One hundred and fifty patients were included. Mean age was 33±6 years and mean Body mass index (BMI) was 48±6. No major anesthesia related complications were reported. We reported three cases (2%) of surgical anastomotic leakage and four cases (2.6%) of difficult intubation. Regarding minor complications, the most common were intraoperative and postoperative tachycardia (75%), increased plateau airway pressure (75%), and postoperative nausea and vomiting (60%). By multivariate analysis; independent risk factors for respiratory complications are BMI above 50 and STOP-BANG questionnaire score.
Conclusion: LSG is done in our center with a low rate of major anesthesia-related complications. Difficult intubation is not common in morbid obese patients. Risk factors for pulmonary complications in this population were BMI above 50 and STOP-BANG questionnaire.

Keywords: Laparoscope; sleeve gastrectomy; morbid obesity; perioperative complications.

1. INTRODUCTION

Laparoscopic sleeve gastrectomy (LSG) as bariatric operation is gaining popularity nowadays. Many studies reported patient surgical outcome after LSG, [1,2,3] however little is known about perioperative anesthesia-related complications. LSG is usually done in morbidly obese patients with frequent co-morbidities, this type of patient needs meticulous preoperative assessment, risk stratification, and special anesthetic care.

In this study we are reporting our experience in a university hospital with perioperative complications and adverse events in morbidly obese patients undergoing LSG. More attention was paid to anesthesia-related complications and possible risk factors for these complications.

2. MATERIALS AND METHODS

This *prospective observational study* was conducted in Cairo university hospitals. The study was approved by anesthesia department research committee and by faculty of medicine and Cairo university councils. A written informed consent was taken from the patients before enrollment in the study. All patients scheduled for LSG during a seven-month period were included. Patients excluded were those who are younger than 18 years old and patients scheduled for another surgical procedure in the same setting (e.g. laparoscopic cholecystectomy).

2.1 Preoperative Data and Assessment

2.1.1 Preoperative evaluation

1- Demographic data: Age, gender, smoking, weight, height, and Body mass index (BMI)
2- Examination: Airway assessment (Mallampati score, thyromental distance and neck circumference) and chest auscultation.
3- Routine preoperative investigations in addition to: arterial blood gases – Lipid profile (cholesterol, triglycerides and LDL) – pulmonary functions tests – echocardiography.
4- History of other comorbidities: Diabetes mellitus, hypertension, ischemic heart diseases, heart failure, and obstructive sleep apnea OSA using STOP-BANG questionnaire (Snoring, tiredness, obstruction of sleep, blood pressure >140/90, BMI >35, age> 50 years, neck circumference >40 cm, male gender; if the score is >3/8, this represents high risk of OSA).
5- Obesity Surgery Mortality Risk (OSMR)

2.2 Intra-operative Management and Monitoring

On arrival to operating patients were positioned on the suitable operating table in a semi-setting position. Routine monitoring (ECG, pulse oximetry and non-invasive blood pressure) were applied before induction of anesthesia. Besides the conventional Macintosh laryngoscope, various sizes of supra-glottic airway devices, endotracheal tubes and laryngoscopic blades, fiberoptic bronchoscope, elastic bougie and kit for emergency tracheostomy were prepared before induction.

After three minutes of pre-oxygenation with 100% oxygen, anaesthesia was induced with IV boluses of 2 mg/kg propofol and 2 µg/kg fentanyl (all doses are corrected to ideal body weight). When mask ventilation was confirmed possible, 0.5 mg/kg atracurium was administered followed by endotracheal intubation 3 minutes later. Endotracheal intubation was performed by an anesthesiologist with at least 2-year experience.

After intubation, mechanical ventilation was adjusted to maintain end tidal CO_2 value of 35-40 mmHg, using a volume controlled mode with a tidal volume of 8 ml/kg, and respiratory rate of 12/min. Anesthesia was maintained with 2-3% sevoflurane in O_2/Air mixture and intermittent IV shots of Atracurium 0.1 mg/kg every 20 min (corrected to ideal body weight).

By the end of surgical procedure, sevoflurane was discontinued and patients received 100% O_2. Thereafter, 5 mg IV neostigmine and 2 mg atropine was administered to reverse neuromuscular blockade. When spontaneous respiration was adequate patients were extubated in semi-sitting position and 100% O_2 was administered by a face mask. After a short follow-up, patients were transported to the post-anaesthesia care unit (PACU) with a 45° head-up tilt and O_2 face mask. Full monitoring was applied for two hours after which they shifted to the general surgery ward.

2.3 Intraoperative Data Collection

All intraoperative events were reported:

1- Airway related events: chipped or loosened tooth, airway bleeding or trauma, difficulty of intubation with or without hypoxia. Difficult intubation was defined as the need for more than one intubation trial by an experienced anesthesiologist (more than 2-year experience).
2- Respiratory events: hypoxia (oxygen saturation less than 92%), hypercarbia (end-tidal CO_2 more than 40 mmHg), increased plateau airway pressure (more than 30 mmHg).
3- Cardiovascular events: cardiac arrest, significant hypertension (increase > 30 % in systolic blood pressure), significant hypotension (decrease > 30% in systolic blood pressure), significant bradycardia (40% below preoperative heart rate), significant tachycardia (40% above preoperative heart rate), and new onset dysrhythmias.
4- Neurological: prolonged neuromuscular block, delayed recovery.
5- Miscellaneous: wrong medication dosage, lack of proper equipment size (e.g. NABP cuff).

2.4 Post-operative Data

Patients were observed postoperative for any events or complications as:

1- Airway related events: airway edema or airway obstruction.
2- Respiratory events: significant hypoxemia or hypercarbia, the need for re-intubation, unplanned postoperative ventilator assistance, pneumothorax or pulmonary edema.
3- Cardiovascular events: as intraoperative cardiovascular events
4- Miscellaneous: Oliguria (urine output < 0.5 ml/Kg/hr), nausea and vomiting.
5- Surgical complications: surgical leakage, hemorrhage and infection.

2.5 Statistical Analysis

Data was analyzed using SPSS 14 package (Chicago IL). Continuous variables were presented as mean and standard deviation and analyzed using unpaired student t test or Mann-Whitney test. Categorical data were presented as frequency (%) and analyzed using Chi square test. Factors that had P value of less than 0.2 level in univariate analysis were included in multivariate logistic regression analysis, and only the significant ($p < 0.05$) factors were considered statistically significant.

3. RESULTS

Among our cohort of patients (150 patients); patients' age was 33.3±6.6 years, BMI was 47.6±5.6, 48 patients (32%) showed BMI above 50. Other patient characteristics are summarized in (Table 1).

We didn't report any case of major anesthetic complications (e.g. failed intubation, perioperative cardiac arrest, postoperative ventilation, and postoperative ICU admission). Three cases (2%) of surgical complications (surgical leak, massive hemorrhage) were reported and managed surgically without adverse final outcome (Table 2).

Other important complications included airway trauma (20.7%), difficult intubation or ventilation (2.7%), intraoperative tachycardia (77.3%), intraoperative hypertension (44.7%), postoperative tachycardia (73.3%), postoperative hypertension (12%), and PONV (68%) (Table 2).

3.1 Risk Factors for Perioperative Complications

Risk factors for airway complications by univariate analysis included: male gender, BMI above 50, smoking, Mallampati score, OSMR

and STOP-BANG. Multivariate analysis showed only smoking and Mallampati score as independent risk factors for acquisition of airway complications (Table 3).

Table 1. Summary of patient characteristics. Data are presented as mean ± standard deviation (SD) and frequency (%)

Patient characteristics	All patients (n=150)
Age (years)	33.3±6.6
Male gender	53(35%)
Weight (Kg)	128.8±19.4
BMI	47.6±5.6
BMI above 50	48(32%)
Neck circumference	47.4±3.3
Smoking	33(22%)
Hypertension	19(12.7%)
Diabetes	24(16%)
Restrictive lung disease	27(18%)
Mallampati score	
- I	18(12%)
- II	118(78.7%)
- IV	14(9.3%)
STOP-BANG	
- Two	51(34%)
- Three	32(21.3%)
- Four	28(18.7%)
- Five	30(20%)
- Six	6(4%)
- Seven	3(2%)
Obesity surgery mortality risk	
- Zero	60(40%)
- One	57(38%)
- Two	21(14%)
- Three	12(8%)

Table 2. Complications. Data are presented as frequency (%)

Complication	Incidence
Airway trauma or bleeding	31(20.7%)
Difficult intubation or ventilation	4(2.7%)
Lack of proper equipment size	25(16.7%)
Increased plateau airway pressure	88(58.7%)
Intraoperative hypertension	67(44.7%)
Intraoperative hypotension	17(11.3%)
Intraoperative bradycardia	1(0.7%)
Intraoperative tachycardia	116(77.3%)
Postoperative hypertension	18(12%)
Postoperative tachycardia	110(73.3%)
PONV	102(68%)
Surgical complications	3(2%)

PONV: Postoperative nausea and vomiting

For respiratory complications, univariate analysis showed increased age, male gender, smoking, BMI above 50, neck circumference, Mallampati score, obesity surgery mortality risk and STOP-BANG score as risk factors. Multivariate analysis showed only STOP-BANG score and BMI above 50 as independent risk factors for acquisition of respiratory complications (Table 4).

4. DISCUSSION

According to our findings, LSG is done in our center with very low rate of major complications. We reported no cases of intraoperative or postoperative mortality, ICU admission, failed intubation, postoperative ventilation or inotropic support. To the best of our knowledge, this is the first report for LSG outcomes in Egyptian population.

A large retrospective study [1] conducted on 24,117 patients in USA reported similar findings to our study with regard to major postoperative events; the incidence was 0.1% for 30-day mortality, 0.04% for cardiac arrest, 0.1% for pulmonary embolism, and less than 0.2% in most other major events such as myocardial infarction, strokes, and sepsis. Many other observational [4,5], and randomized controlled trials [6,7] reported no cases of mortality during 6 month period after LSG.

We reported only four cases (2.7%) of difficult intubation; none of them resulted in any unfavorable outcome. The association between high BMI and difficult intubation is an area of conflicting evidence, Neligan et al. [8] reported difficult intubation in 3.3% of morbidly obese patients, Lindauer et al. [9] reported a Cormak-Lehane Laryngoscopic grade III, IV in 5.5% of their patients, many other authors reported that high BMI is not an indicator of difficult intubation [10,11]. On the other side The association between high BMI and difficult intubation has been reported by in many observational studies [12,13] as well as meta-analysis [14]. Although the definition of difficult intubation differed between the aforementioned studies, however the difference in definitions of difficult intubation cannot account alone for the different results. This raises the need for more studies to give stronger evidence.

Multivariate analysis revealed smoking and Mallampati score as independent risk factors for development of airway complications. In agreement with our finding; Mallampati score was reported by many authors as a risk factor for difficult intubation in morbidly obese patients [8,10].

Table 3. Risk factors for airway complications

	Univariate analysis			Multivariate analysis		
	OR	**Lower limit**	**Upper limit**	**OR**	**Lower limit**	**Upper limit**
Age	1.04	0.98	1.1	1.05	0.96	1.05
Male gender*	3.8	1.7	8.5	3.5	0.32	38.1
BMI	1.06	0.99	1.13	1.04	0.91	1.19
BMI above 50*	3	1.3	6.5	7.5	0.93	60.8
Smoking*†	7	2.9	16.6	5.8	2.4	14.08
Neck circumference	1.08	0.96	1.2	0.83	0.69	1.001
Mallampati score*†	3.7	1.48	9.48	2.8	1.01	7.79
STOP-BANG*	1.6	1.2	2.1	1.4	0.74	2.65
OSMR*	1.82	1.2	2.7	0.26	0.07	1.04

*BMI: Body mass index, OSMR: Obesity surgery mortality risk. *denotes statistical significance by univariate analysis. † denotes statistical significance by multivariate analysis*

Table 4. Risk factors for respiratory complications

	Univariate analysis			Multivariate analysis		
	OR	**Lower limit**	**Upper limit**	**OR**	**Lower limit**	**Upper limit**
Age*	1.07	1.01	1.13	1.06	0.985	1.14
Male gender*	5.8	2.5	13.3	2.3	0.35	15.3
BMI	1.04	0.98	1.11	0.9	0.8	1.02
BMI above 50*†	2.4	1.1	5.2	8.07	1.15	56.3
Smoking*	7.1	2.3	21.5	0.59	0.096	3.63
Neck circumference*	1.27	1.13	1.43	1.17	0.98	1.39
Restrictive PFTs	1.03	0.44	2.4	1.2	0.6	2.9
Mallampati*	3.2	1.4	7.4	2.67	0.856	8.34
STOP-BANG*†	2.3	1.69	3.27	2.58	1.37	4.83
OSMR*	2.4	1.5	3.7	0.5	0.17	1.45

*BMI: Body mass index, OSMR: Obesity surgery mortality risk. *denotes statistical significance by univariate analysis. † denotes statistical significance by multivariate analysis*

In our patients, independent risk factors for pulmonary complications were STOP-BANG questionnaire and BMI above 50. In line with our findings STOP-BANG questionnaire was reported by Proczko and colleagues [15] as a good predictor for post-operative pulmonary complications in patients undergoing bariatric surgery. Villamere et al. [16] reported BMI above 60 kg/m^2 as a risk factor for major complications after LSG.

We didn't report any other independent risk factors for airway and pulmonary complications. In contrast to our findings, a large multicenter study conducted by Gupta et al. [17] showed many other risk factors for postoperative pulmonary complications in bariatric operations. The difference between our results and Gupta et al findings is most probably due to: 1- The fewer number of patients in our study (150 VS 32,889 patients). 2- The type of the procedure (Gupta et al. [17] included all types of bariatric operations not only LSG as our study).

Other anesthesia-related complications were reported; the most common complications were increased plateau pressure, intraoperative and postoperative tachycardia, postoperative nausea and vomiting (PONV). To the best of our knowledge no reports in literature addressed the incidence of these complications in LSG. In our study we reported a high incidence of PONV (60%), the incidence of PONV was reported in laparoscopic gynecological procedures in a meta-analysis to be 70% [18].

The rate of surgical complications in our cohort was 2% (3 patients); this rate is similar to that reported by many authors [1]. Lower rate of surgical complications was reported in some centers [6,5] which is most probably due to the small sample size of their studies. A higher rate of surgical complications was reported by Van Rutte et al. [19] among 1041 patients (2.6% intra-abdominal bleeding and 2.3% staple-line leakage). The lower incidence of surgical complications in our study as well as other

similar studies compared to Van Rutte et al. [19] might be due to increased surgical experience with time; Van Rutte et al. [19] included patients between 2006 and 2012 however our study was done at 2014.

The limitation in our study was the number of patients, one hundred and fifty patients was a sufficient number to give information about the incidence of perioperative complications; however, this number was not sufficient to give reasonable analysis for risk factors of the complications.

Another limitation in our study that we reported our experience with LSG in a tertiary center in a developing country. We did not face major problems with anesthetic drugs and equipment; however, we faced some difficulties with patient monitoring. We do not have monitors for neuromuscular function; thus, we depended on traditional clinical signs of neuromuscular status. The lack of education of some patients lead to difficulties in postoperative follow up.

5. CONCLUSION

In conclusion, LSG is done in our center with a low rate of major anesthesia-related complications. Difficult intubation is not common in morbid obese patients. Risk factors for airway complications among our cohort were smoking and Mallampati score. Risk factors for pulmonary complications included BMI above 50 and STOP-BANG questionnaire.

CONSENT AND ETHICAL APPROVAL

The study was approved by anesthesia department research committee and by faculty of medicine and Cairo university councils. A written informed consent was taken from the patients before enrollment in the study.

DISCLAIMER

The abstract of this manuscript was previously presented and published in the following conference.
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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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