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Original Article

Anesthesia management in sleeve gastrectomy: Single center experience

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Abstract

Aim: Sleeve gastrectomy surgery is performed by laparoscopic method and preferred by obesity surgeons, frequently. Because these patients are morbidly obese,many additional diseases are seen and anesthesia management is challenging for anesthesiologist. In this study, demographic and perioperative data of 23 patients undergoing sleeve gasterectomy surgery (SGS) in our hospital were presented.

Material and Methods: This study was performed in 23 adult patients undervent SGS with laparoscopic bariatric surgery. The demographic and operative data, hemodynamics and blood glucose values of the cases were recorded at specified times. The data were evaluated by mean ± SD and the ranges of the data were also calculated.

Results: The mean age of patients was 37.6±10.2 years.The mean body mass index was 45.8±5.4 kg/m^2. The mean duration of anesthesia was 153.3±65.6 min, and the mean duration of surgery was 136.6±63.8 min.There were no statistically differences in terms of heart rate and peripheral oxygen saturation. There was significant increase in mean arterial pressure at T3 when compared to T2(p=0,09). End-tidal carbon dioxide value significantly decreased at T2 when compared toT1(p<0,001) and significantly increased at T6 when compared toT5 (p=0,005). Blood glucose values were increased significantly at T2 and T7 when compared to T0 values (p<0,001).

Conclusion: Anesthesia management of morbid obese patients is challenging for anesthesiologist, because the hemodynamic stability and hormonal values of the patients can be changed due to the increased BMI. Preoperative hemodynamics and blood glucose values should be closely monitored and necessary interventions should be applied considering the operation periods.

Keywords: Sleeve Gastrectomy; Morbid Obesity; Hemodynamics; Laparoscopic Surgery; Anesthesia.

INTRODUCTION

Obesity is an important condition in developed and developing countries, due to reduced energy expenditure and some hormonal disorders while increasing energy intake. Today, the second important cause of preventable deaths after smoking is obesity. Morbid obesity is accepted as body mass index (BMI) ≥40 kg/m^2. The prevalence of obesity in our country is reported as 30% at the end of 2000s which is similar to North America (1).

Obesity surgery like sleeve gastrectomy or etc. is a recommended method for treatment of morbid obesity. Patients are carefully selected, and cases with BMI>35 kg/m^2 in the presence of comorbid factors and BMI> 40 kg/m^2 in the absence of comorbid factors are evaluated in terms of surgery. There has been increasing interest in the surgical treatment of morbid obesity. Roux-en-Y gastric bypass (46.6%), vertical sleeve gastrectomy (27.8%), adjustable gastric banding (17.8%), and bilio-pancreatic diversion with duodenal switch (2.2%) are the most commonly performed procedures (2). SGS is performed by laparoscopic method and now preferred by obesity surgeons frequently. Especially, with the evolution of laparoscopy, this operation type became very popular because of the shortened length of hospitalization, shortening of the collection time, fewer scars and the reduced possibility of the operation site hernia.

Severe obesity is a highly prevalent chronic disease (3), which leads to substantial morbidity (4), premature mortality (5), impaired quality of life (6) and excess healthcare expenditures (7). In morbid obese people, the incidence of many chronic diseases such as hypertension, diabetes mellitus, pulmonary embolism and cerebrovascular disease has increased. During airway

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access such as intubation and tracheostomy, excess fat tissue can inhibit access to and openness of the upper airway. Decreased residual capacity and worsening of ventilation perfusion mismatch disturb lung function when compared with patients with normal BMI (8). Because of these additional diseases and abnormalities, anesthesia management may be challenging for anesthesiologists. Morbidly obese patient's surgeries are rare procedures for anaesthetists and comorbidity and emergency settings complicate treating morbidly obese patients. The aim of this study is to raise awareness and guide the anesthesia management of the morbidly obese patients with SGS. In this study,demographic and perioperative data of 23 patients undergoing SGS in our hospital were presented.

MATERIAL and METHODS

Study Protocol

The Local Ethics Committee of our institution approved this study protocol. We conducted a retrospective cohort clinical study with 23 patients who underwent SGS from January 2007 to December 2017 at our university hospital. This study was prepared in accordance with the Consolidated Standards of Reporting Trials (CONSORT) guidelines (9).

Study Participants

Patients with American Society of Anesthesiology (ASA) scores of III, who underwent SGS were included in our study. Patients were excluded if they had incomplete or missing anesthesia records and refused informed consent were excluded.

Study design

Demographic data such as age, gender, weight, height, BMI, Ideal Body Weight(IBW), ASA and Mallampati scores were recorded from anesthesia charts. Surgical procedures such as duration of anesthesia and surgery were calculated.

Preoperative Procedures

Patients were taken to the operating room after premedication with midazolam. Standard monitoring procedures were used, including electrocardiogram (ECG), heart rate (HR), noninvasive blood pressure (NIBP), and peripheral oxygen saturation (SpO_2). Preoperative blood preparation was made for each patient before the procedure.

Anesthesia procedures

General anesthesia protocol was administered to all patients by an experienced anesthesiologist. In management of anesthesia and surgery, the anesthetic and operative treatments were uniform for all patients. All operations were performed by the surgical team in the morning after the patients had fasted overnight. After preoxygenation (100% 4 L/min O_2 for 3 min) patients were induced with propofol (2-2.5 mg/kg), rocuronium (0.6 mg/kg) or atracurium (0.5 mg/kg) and fentanyl (0.1 µg/kg) via intravenous (IV) route at doses calculated according to IBW. Patients were intubated by anexperienced anesthesiologist and ventilated mechanically with a tidal volume of 8-10 mL/kg based on IBW and a frequency of 8–12 breaths/min using a Dräger Primus ventilator (Dräger AG, Lubeck, Germany). After intubation, invasive arterial monitoring was performed by radial artery cannulation in all patients, routinely. End-tidal carbon dioxide (Et-CO_2) was continuously monitored after intubation. Tidal volume and ventilation rate were adjusted to maintain Et-CO_2 partial pressure at 35-45 mmHg. Age-related minimum alveolar concentration values were determined and expressed as a percentage of volume. Anesthesia was maintained with desflurane or sevoflurane inhalation in a 1.5 L O_2 /oxygen-air mixture. A Bispectral Index Monitor Model 2000 (Aspect, Medical Ssytems, Inc, Newton, MA) was used for assessing the depth of anesthesia, which was kept between 40 and 60. In addition, for neuromuscular monitoring, a train-of-four (TOF) measurement was performed using a TOF-Watch SX (Organon Ltd, Drynam Road, Swords, Co, Dublin, Ireland) intraoperatively and rocuronium or atracurium were intermittently injected according to neuromuscular monitoring. Neuromuscular blockage was reversed using sugammadex (IV, 2–4 mg/kg, Bridion®, MSD, Greenville, USA) and all cases were extubated without any problem. Following extubation in the operating room, all patients were taken tothe intensive care unit (ICU).

Procedure Data

The duration of anesthesia was defined as the times tarting from the arrival of the patients to the operating room until their transfer to the ICU.The duration of the procedure was defined as the time from the first incision until the closure of the last skin sutures.

Outcome Measures

We evaluated demographic characteristics, procedure data and hospital records of 23 patients who underwent SGS. HR, mean arterial pressure(MAP), SpO_2 and Et-CO_2 were enrolled at clinically important time points (T0; before anesthesia, T1; after intubation, T2; before CO_2 insufflation, T3; after CO_2 insufflation, T4; after reverse Trendelenburg position, T5; after supine position, T6; CO_2 after desufflation, T7; after anesthesia awakening). Blood glucose values were recorded at clinically important time points (T0; before anesthesia, T2; before CO_2 insufflation, T7; after anesthesia awakening)

Postoperative Management

All patients were transferred to the ICU after the surgery and monitored. In all patients, postoperative analgesia was achieved using appropriate doses of tramadol (0.5-1 mg/kg, IV) and paracetamol (1 gr, IV) at the beginning of skin sutures.Paracetamol was administered in 4 hours in ICU and ifthe visual analog score (VAS) was above 5, tramadol (0.5 mg/kg, IV) was administered, additionally.

Statistical analysis

Statistical Package for the Social Sciences program was used for analyzing all statistical analyses(SPSS 22.0, Chicago, USA). Quantitative data are submitted as mean or standard deviation and categorical data are shown as numbers or percentage. Spearman rank correlation coefficient was preferred when the data had normal distribution and Pearson correlation coefficient when data were not distributed normally. For defining statistically significant difference, p value was accepted as <0.05.

RESULTS

Demographic Characteristics

The mean age of 23 patients was 37.6 ± 10.2 years(range,19-60 years). Twenty one of the patients were female and 2 were male. Mean BMI of patients was 45.8 ± 5.4 kg/m^2 (range, 40-56 kg/m^2). Mean IBW of patients was 53.9 ± 6.5 kg (range, 43-68 kg). Other demographic characteristics of patients are presented in Table 1.

Pre-existing illness data

One of the patients (3,4%) had hypertension, 2 of the patients (6,9%) had diabetes mellitus, 1 of the patients (3,4%) had obstructive sleep apne syndrome and 1 of the patients (3,4%) had asthma. In addition, 18 of the patients (82,9%) had no pre-existing illness data.

Procedure Data

Mean duration of anesthesia was 153.3 ± 65.6 min (range 75-316 min). Mean duration of surgery was 136.6 ± 63.8 min (range, 70-295 min). SGS was performed to all patients. Surgical Procedure data is presented at Table 1.

Haemodynamics,blood glucose and respiratory values

HR, MAP, SpO^2 and Et-CO_2 are presented in Table 2. There were no statistically differences in terms of HR and SpO^2. There was significant increase in MAP at T3 when compared to T2 (p=0,09). Et-CO_2 value significantly decresed at T2 when compared to T1 (p<0,001) and significantly increased at T6 when compared to T5 (p=0,005) (Figure 1). We did not use vasopressor inotrops intraoperatively in patients.

Blood glucose values are presented in Table 3. Mean blood glucose value was 116.80 ± 23.30 mg/dl (range, 60-167 mg/dl), 127.90 ± 21.60 mg/dl (range, 98-172 mg/dl) and 180.70 ± 45.70 mg/dl (range, 109-289 mg/dl) at T0, T2 and T7, respectively. Blood glucose values were increased significantly at T2 and T7 when compared toT0 values (p<0,001) (Figure 2).

Table 1. Demographic and Surgical Procedures (n = 23)

	Range	mean ± SD
Age, year	19 – 60	37.6 ± 10.2
Gender, male/female	2/21	-
Height, cm	140 – 173	158.5 ± 13.9
Weight, kg	98 – 167	118.7 ± 16.9
BMI, kg/m^2	40 – 56	45.8 ± 5.4
IBW, kg	43 – 68	53.9 ± 6.5
ASA, I/II/III	0/0/23	-
Mallampati Score, I/II/III	0/0/23	
Sleeve gastrectomy	23	-
Duration of anesthesian, min	75 – 316	153.3 ± 65.6
Duration of surgery, min	70 – 295	136.6 ± 63.8

ASA; Society of American Anesthesiologist, BMI; Body mass index, IBW; Ideal body weight, SD; Standard Deviation

Table 2. Heart rate (HR), mean arterial pressure (MAP), peripheric oxygen saturation (SpO_2) and End-tidal carbon dioxide ($EtCO_2$) values (mean ± SD) (n = 23)

Time	HR (/min) (mean ± SS)	MAP (mmHg) (mean ± SS)	SpO_2 (%) (mean ± SS)	Et-CO_2 (mmHg) (mean ± SS)
T0	85.00 ± 10.20	105.80 ±11.11	96.60 ± 2.03	-
T1	95.90 ± 10.90	92.50 ± 18.20	99.40 ± 0.66	34.20 ± 4.60
T2	87.90 ± 13.30	78.80 ± 14.40	98.60 ± 1.40	30.90 ± 4.20**
T3	88.08 ± 10.20	93.30 ± 16.50*	98.00 ± 1.60	34.40 ± 5.20
T4	85.70 ± 17.30	80.87 ± 19.91	97.08 ± 1.70	34.51 ± 4.90
T5	83.80 ± 11.30	92.20 ± 15.64	98.10 ± 1.60	35.80 ± 3.60
T6	84.30 ± 10.90	94.60 ± 16.40	98.60 ± 1.50	38.80± 3.60***
T7	94.04 ± 12.96	99.80 ± 24.30	95.60 ± 1.90	-

T0; before anesthesia, T1; after intubation, T2; before CO_2 insufflation, T3; after CO2 insufflation, T4; after reverse Trendelenburg position, T5; after supine position, T6; after CO2 desufflation, T7; after anesthesia awakening
*when compared T2, p=0,009, **when compared T1, p<0,001,***when compared T5,p=0,005

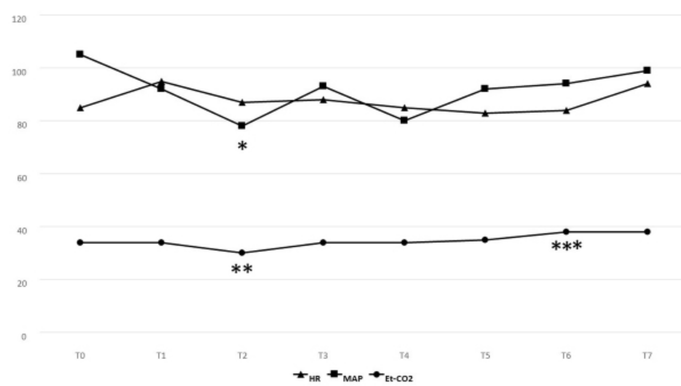

Figure 1. HR(beats/min), MAP(mmHg) and $EtCO_2$ (Et-CO_2) values HR; Heart Rate, MAP; mean arterial pressure, $EtCO_2$; End-tidal carbon dioxide T_0; Before anesthesia, T_1; after intubation, T_2; before CO_2 insufflation, T_3; after CO_2 insuflasyonu Sonrası, T_4; after reverse Trendelenburg position, T_5; after supine position, T_6; CO2 after desufflation, T_7; after anesthesia awakening
*when compared T_2, p=0,009, **when compared T_1, p<0,001,***when compared T_5,p=0,005

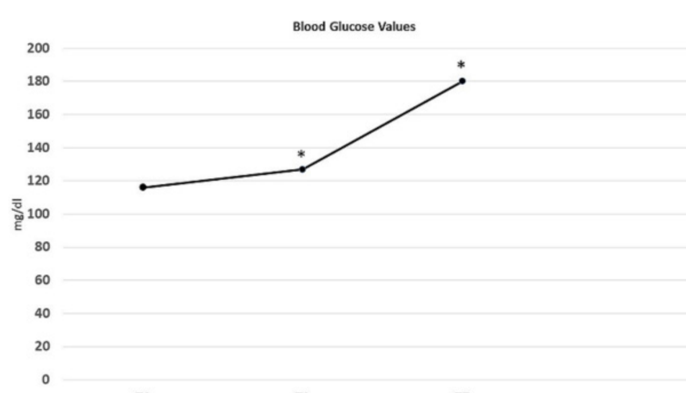

Figure 2. Blood glucose values (mg/dl)
T_0; before anesthesia, T_2; before CO_2 insufflation, T_7; after anesthesia awakening
*when compared T_0, p<0,001 significantly difference

DISCUSSION

In this retrospective cohort study, we evaluated 23 morbidly obese patients undergoing SGS from January 2007 to December 2017 at our university hospital. This study showed that mean duration of anesthesia was 153.3 ± 65.6 min and mean duration of surgery was 136.6 ± 63.8 min. MAP significantly increased after CO^2 insufflation when compared before CO^2 insufflation. Et-CO^2 significantly increased after CO^2 desufflation following supin position. According to the values measured at specific times (T2 and T7), it was shown that blood glucose values significantly increased regularly during the surgery when compared tobaseline values.

Obesity is defined by the World Health Organization (WHO) as "abnormal or excessive accumulation of fat in the body to the extent that it can impair health"(10). As a criterion for defining obesity, the "BMI" is usually used, which is determined by dividing body weight (kg) by body height in meters (12). According to WHO, patients with BMI ≥40kg/m2 are classified as Grade 3 obese (morbid). In our country, morbid obesity was shown more in females than males (11). When Turkey Diabetes, Obesity and Hypertension Epidemiology Research-II (TURDEP) results evaluated, the prevalence of obesity in women was 44%, 27% in men, and 31,2% in general. When examined according to age distribution, it is seen that the prevalence increased at the age of 30 and reached to the highest level at the age of 45-65 (12). In current study, majority of patients were female in accordance with the statistical data with 21 of the patients (91,3%) being female and 2 being male (8,7%).

Obesity is a common health cause in all communities and is increasingly becoming a global epidemic. In some countries it is estimated that in the next 10 years, two out of every three person will be obese (13). The increase in the number of obesity increases the importance of surgical treatment in the world and in our country day by day. Surgical treatment is recommended in patients with BMI>40 kg/m^2 or BMI=35-39.9 kg/m^2 with severe medical conditions according to The Turkish Department of Endocrinology and Metabolism and Obesity Treatment Guidelines and Lifestyle Recommendations report (14). Along with the increase in weight, some symptoms occur periodically. Early term symptoms are drowsiness, excessive sweating, snoring, difficulty in sleeping, lack of resistance to sudden physical needs, constant fatigue, joint and back pain. Hypertension and hypercholesterolemia are long-standing symptoms. The results of three retrospective cohort studies have suggested that bariatric surgery is associated with reduced incidence of cardiovascular disease events (15,16), but there is a lack of data from prospective studies.In our study, there was no additional disease in the majority of the patients. Only a few patients had hypertension, asthma and diabetes mellitus. Therefore, SGS was preferred in these patients.

Studies conducted in eligible cohorts in the United States have shown that over 300,000 people in the world die as a result of obesity-related problems. The overall mortality rate was reported as 17% of the peoplewhose BMI was greater than 30 kg/m^2. 80% of the deaths in this BMI are due to obesity. The average life span of people with a BMI value of 30-35 kg/m^2 was found to be 2-4 years, and with a BMI value of 40-45 kg/m^2, 8-10 years. It is claimed that bariatric surgery lowers these risks within 2 years (17-20). We did not encounter mortality in our patients. If a larger study is conducted, the mortality rate can be specified.

Beginning in the middle of the past century, obesity surgery has become renewed, altered, and more widely implemented with the introduction of endoscopic techniques. Laparoscopic surgical techniques, which are accepted as Gold standard today, are used for this patient group formore than 10 years. Especially, SGS more commonly preferred (21-23). So, in thiscurrent study, we included patients undergoing SGS. In SGS, the stomach is vertically scarred parallel to the small curvature, about 100 ml in volume. In this technique, a large part of the waste is removed. It is basically an obstructive attempt because the stomach volume is getting smaller. Also ghrelin which is also called the appetite hormone is reduced. Especially blood sugar changes are important. In our study, significant increases in blood sugar values were also detected at before CO^2 insufflation and after anesthesia awakening. These elevations may be due to hormonal changes that may be caused by surgical stress or obesity.

In obese patients, some complications or difficulties may develop due to some anatomical changes. Collection of fat occipitally can cause limitation of neck extension and cause difficult laryngoscopy. Especially, colllection of neck fat superficially, further may complicate the airway management and this difficulty may be decreased by external compression to larynx (24). Colllection of parapharyngeal fat narrows the airway and makes air passage difficult in the obese. These changes such as limited neck movement due to collection of occipital fat causes some ventilation problems such as failed mask ventilation. Incidence of difficult intubation in obese patients has been reported to be up to 15.8% compared with only 5.8% in the normal weight population (25). Difficult airway was seen in patients with android-type (central) fat distribution and there is a stronger correlation with increasing BMI (26). In patients with Mallampati score I or II, difficult intubation is seen less than in patients with normal neck configuration (27). In current study, Mallampati scores of all patients were class III. However, there was no complication or difficulty associated with airway management.In our clinic, all patients were intubated with direct laryngoscopy. But, if there is a failed intubation, videolaryngoscope or fiberoptic bronchoscope are preferred for obtaining airway security. Before anesthesia, all devices for difficult intubation management are ready in the operating room. Experienced anesthetists in morbid obese surgery management apply all interventions personally. In our clinic, we also use direct laryngoscopy, routinely. In the case of failed intubation, videlaryngoscope, especially C-MAC videolaryngoscope or McGRATH videolaryngoscope, is preferred for laryngoscopy.

The anesthetic drugs preferred in anesthesia management may vary in obese patients.Most lipid soluble drugs (induction agents and opioids) call on widespread distribution due to increased body fat and dose of drug may be less when IBW is accepted for dosing based upon adjustment criterion. Appropriate dosing regimens for anesthesia induction in obese patients was suggested (28). Neuromuscular blockers should be dosed based upon IBW with the exception of succinylcholine. Succinylcholine is applied with a higher dose based on total body weight (29). Combinations of sevoflurane with intravenous agents may be effective for maintainining of anesthesia in terms of hemodynamic and respiratory stability (30). In our clinic, propofol, fentanyl and rocuronium were preferred for anesthesia induction and sevoflurane or desflurane were preferred for anesthesia maintenance during surgery.

In obese patients, there are precautions to be taken according to non-obese patients and some applications that need to be done. Use of preoxygenation with 100% oxygen can ensure significant increase in apnea time. Baraka et al noticed that passively insufflating oxygen at 5 L/min through a nasopharyngeal catheter in obese patients have shown a significant increase in apnea time (31).Obese patients must be extubated when fully awake to avoid complications due to difficult airway. Obese patients must be in semisitting or sitting position during extubation on the operating table.

As seen in our study, hemodynamics and respiratory values may changestatistically and anesthetist must be able to cope with these difficulties. For example, in our study, blood glucose values increased regularly towards the end of surgery and this increase was not significant clinically. But, there could be clinically significant increases. For this reason, close monitoring should be done and frequent measurements should be provided if necessary. Consequently, preanaesthetic evaluation, preinduction positioning the patient, preoxygenation, anesthesia induction and intubation, dosage of induction agents and muscle relaxants, maintenance of anesthesia, extubation, and postanaesthesia management are important in obese patients, especiallyin morbid obese patients.

LIMITATIONS

Our study had some limitations. This retrospective study based on data analysis was only reviewed from anesthesia tracing charts. All the patients were from a single center and the sample size was relatively small. Data of patients did not contain some important information such as post-operative mental state, the use of vasopressor inotropes intraoperatively, and postoperative pain management. Additionally, not all our results may be generalizable to other races and countries because this study population was mainly Turkish.

CONCLUSION

The most efficient method to treat obesity and comorbid factors is bariatric surgery. Anesthesia management of morbid obese patients is challenging for anesthesiologist, because the hemodynamic stability and hormonal values of the patients can be changed due to the increased BMI. At conclusion, (1) preoperative hemodynamic data and blood glucose values should be closely monitored, (2) preoperative preparations should be made for the situations that may develop especially difficult airways, and (3) necessary interventions should be performed during the operation periods.

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Ethical approval: This work has been approved by the Institutional Review Board.

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