ANESTHESIA IN LAPAROSCOPIC BARIATRIC SURGERY (GASTRIC SLEEVE) - PRELIMINARY EXPERIENCE

Mirela Sarandan¹, Carmen Guragata-Balasa², Marius Papurica², Ciprian Dută³, Eniko Hordovan³, Claudia Rus³, Zorin Crainiceanu⁴, Mihaela Mastacaneanu⁴

REZUMAT


Cuvinte cheie: anestezie, gastrectomie laparoscopică, obezitate morbidă

ABSTRACT

Introduction: Nowadays, bariatric surgery is the most efficient method in treating morbid obesity. These patients represent a great challenge for the anesthesiologist due to the complex anatomic and functional changes in the obese patient as well as due to the associated comorbidities. The following study analyzes our experience in the anesthetic management of a group of patients operated in the Emergency County Hospital Timisoara. Material and methods: We retrospectively studied a series of 18 obese patients who underwent laparoscopic sleeve gastrectomy (LSG) between December 2006 and May 2009. All patients have been operated under general anesthesia. We analyzed the preoperative morbidity, the anesthetic management and the immediate postoperative recovery. Results: The average body mass index (BMI) was 48.05 kg/m² and the patients were both women (10) and men (8). Multiple comorbidities were encountered in both groups, but they were more frequent among women. All patients have been monitored postoperatively according to the local protocols in the intensive care unit (ICU); there were no anesthetic incidents. Early postoperative complication was reported in one patient, who developed gastric fistula; she was managed surgically and fully recovered after three months. Conclusions: Specific protocols in the anesthetic management and perioperative care should be implemented to allow effective and safer treatment for this unique group of patients.

Key Words: anesthetia, laparoscopic gastric sleeve, morbid obesity

INTRODUCTION

Obesity represents nowadays a worldwide public health issue due to its epidemic proportions, to the associated comorbidities and the tremendous medical and social costs.

¹ Department of Anesthesiology and Intensive Care, Casa Austria, ² Clinic of Anesthesiology and Intensive Care, ³ General Surgery Clinic No. 2, ⁴ Clinic of Plastic Surgery, Casa Austria, Clinical Emergency County Hospital, Timisoara

Correspondence to:
Dr. Mirela Sarandan, Emergency County Hospital, 10 I. Bulbuca Blvd., 300736 Timisoara, Romania, Tel. +40-74-833-1196
Email: mirelasara@yahoo.com

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Long term studies showed that conservative medical treatments are inefficient in patients with morbid obesity, with a recurrence rate of up to 90% no matter the treatment chosen.⁵ At present, the bariatric surgery is the most efficient method to reduce weight and to maintain it in patients with BMI >35 kg/m² and severe associated comorbidities, as well as in those with BMI >40 kg/m².⁶ Although there is no gold standard surgical procedure in treating obesity, laparoscopic sleeve gastrectomy (LSG) represents the first choice, being more effective than the gastric banding when considering the long term results.⁷ It is part of the therapeutic bariatric surgical plan in restrictive surgery either as a single procedure, or as a first stage (in a two-stage procedure, followed by gastric bypass) to those in which the weight loss is not the one expected.⁸ It involves the surgical removal of the left side of the
stomach, resulting an organ which is approximately the size and shape of a banana and does not require rerouting of the intestine or implantation of an artificial device in the abdomen, weight loss being achieved by the reduction of the stomach size.47

Because of the simplicity of the procedure, reduced operative time and low complication rate, LSG is elected not only as a single stage restrictive operation in patients with morbid obesity, but also in patients with BMI > 50 kg/m². Perioperative care of the obese patient requires a multidisciplinary team, in which the anesthesiologist plays a very important role in the preoperative assessment, as well as in the anesthetic management and the postoperative care.

MATERIAL AND METHODS

The study included 18 patients, with an average BMI of 48.05 kg/m² (weight 97 - 170 kg), who underwent this procedure in the General Surgery Clinic No. 2, Clinical Emergency County Hospital Timisoara, between December 2006 and May 2009.

Patients’ age range was between 18 and 61 years old; the patients were both men (8) and women (10), with ASA (American Society of Anesthesiologists) risk between III-IV. All procedures have been executed by the same surgeon. All patients received general anesthesia for the surgery. Preoperative investigations have followed the local protocol introduced to evaluate the bariatric patients, and included hemoglobin, hematocrit levels, blood sugar levels, serum urea, serum electrolytes, liver function tests, coagulation profile, respiratory functional tests, cardiothoracic radiography, ECG, abdominal ecography and barium meal. All these evaluations have been realized by a multidisciplinary team: nutritionist, cardiologist, radiologist, which constantly take care of the preoperative assessment of the bariatric patients. Patients have been assessed for hypertension, coronary disease, diabetes mellitus, obstructive apnea syndrome, or other medical conditions that all have been stabilized before the surgical procedure. Patients’ informed consent has been obtained at least 72 hours before surgery by the surgical and anesthetic team.

The preanesthetic examination noted the BMI, the premedication with 10 mg Metoclopramide and 150 mg Ranitidine during the evening before intervention and the morning of the procedure. Sedative medication has been routinely avoided; the medication associated to comorbidities has been continued according to the prescriptions, excepting the insulin and the oral hypoglycemic medication. Deep venous thrombosis prophylaxis has been done with Enoxaparine 0.5 mg/kg lean body weight (LBW) bid (first dose 12 h before the intervention) and elastic stockings. Preoperative antimicrobial prophylaxis has been done according to the hospital’s protocol, with Cefuroxime 1.5 g 30 minutes before the intervention.

Intraoperative considerations

Positioning

The operating table elected for such interventions can sustain about 375 kg weight and has the possibility of applying parallel extensions, also it is under electric command to facilitate adequate patient positioning during the operation. A special attention is paid to the maneuvers for protection of the compression zones in order to avoid nervous lesions (brachial plexus, ulnar and sciatic nerve).

Monitoring

Venous puncture was made with an 18 G cannula. Before the anesthetic induction, the cannulation of the radial artery was done under local anesthesia. A standardized anesthesia monitoring protocol was used (ECG, non – invasive arterial blood pressure, pulse oxymetry, anesthetic gas, CO₂ analyzer and peripheral neuromuscular monitoring - TOF guard). Arterial invasive monitoring has been done only for those with associated cardiopulmonary disease and also for those with inadequate sphygmomanometer cuff. Central venous catheterization was used in patients with poor peripheral venous capital and in those where postoperative prolonged i.v. treatments have been anticipated.

Induction, intubation and maintaining of anesthesia

Preparations have been done accordingly to the difficult intubation predictions; therefore the difficult intubation trolley has been prepared, including flexible tip blade laryngoscope, bougie, laryngeal mask and alternatives to the conventional laryngoscopy (video laryngoscope). The patient was positioned in elevated cervical position, with sand bag under head and shoulders – the aim of this maneuver was to increase the sternomental distance and therefore facilitate laryngoscopy and intubation; additional traction of big breasts with adhesive bands was also performed.

All patients received previous oxygenation with O₂ 100% for 5 minutes and were premedicated with Midazolam 0.05 mg/kg and Fentanyl 1 µg/kg LBW. The anesthetic induction was done with Thiopental...
5 mg/kg LBW and Succinylcholine 1mg/kg total body weight (TBW). Trachea was intubated with appropriate size endotracheal tube. After intubation, the nasogastric tube was inserted to decompress the stomach and to further inject methylene blue. The neuromuscular agent used was a steroidal compound (Esmeron, Norcuron) in adjusted dose / ideal body weight (IBW) in order to obtain a unique response to train of four (TOF) stimulus during the entire surgical time. Fentanyl has been readminstered at 30 minutes interval in dosage of 1 µg/kg LBW.

The volatile agent used was Sevoflurane in concentrations adjusted to age. Ventilator settings were adjusted to maintain EtCO₂ between 35-40 mmHg and SPO₂ between 94-100%. Positive end expiratory pressure PEEP of 5 cm H₂O has been added to all patients. Tidal volume was set to 10-12 ml/kg IBW, the inspire:expire rate was 1:2 and FiO₂ 0.6. The operation was executed in reverse Trendelenburg position, with lower limbs abducted. Pneumoperitoneum was initiated to 20 mm Hg intraabdominal pressure (IAP). At the end of the procedure the neuromuscular block has been reversed with Neostigmine 0.04 mg/kg and Atropine 0.01 mg/kg at 50% responsiveness to TOF stimulus. The trachea was extubated with patient awake and with TOF response at 90% of control.

**Postoperative period**

Postoperative monitoring protocol consisted in four hours surveillance in the post anesthesia care unit (PACU), under the supervision of anesthetist nurse and resident. Admission in the surgery department was done after reevaluation by the senior anesthesiologist that led the anesthetic team. Patients with respiratory and cardiac comorbidities were monitored in the intensive care unit (ICU) over night. Postoperative analgesia consisted in Paracetamol 1000 mg and Fenoldopam 20 mg, given 30 minutes before the end of the procedure and repeated every 8 hours. Patients’ mobilization started in the first postoperative day.

**RESULTS**

Patients’ average age was 38.11 years (range 19-60 years), average weight – 135.27 kg (range 97-170 kg), average height - 150.96 cm (range 150-183 cm) and BMI - 48.05 kg/m² (range 38 -70 kg/m²). One patient presented BMI less than 40 kg/m², 12 patients had BMI between 40-49.9 kg/m² and 5 patients had a BMI over 50 kg/m².

Significant comorbid conditions were present preoperatively in most patients, with the mean number of comorbidities being 2.79 per patient (Table 1).

**Table 1. Type and incidence of comorbidities.**

<table>
<thead>
<tr>
<th>Co-morbidity</th>
<th>Number (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hypertension</td>
<td>6 (33.33%)</td>
</tr>
<tr>
<td>Obstructive sleep apnea syndrome</td>
<td>8 (44.44%)</td>
</tr>
<tr>
<td>Coronary disease</td>
<td>4 (22.22%)</td>
</tr>
<tr>
<td>Chronic obstructive pulmonary disease</td>
<td>2 (11.11%)</td>
</tr>
<tr>
<td>Type 2 diabetes on oral antidiabetic medication</td>
<td>3 (16.66%)</td>
</tr>
<tr>
<td>Hepatic steatosis - fatty liver</td>
<td>11 (61.11%)</td>
</tr>
<tr>
<td>Dyslipidemia</td>
<td>7 (38.88%)</td>
</tr>
<tr>
<td>Degenerative joint disease</td>
<td>7 (38.88%)</td>
</tr>
<tr>
<td>Venous insufficiency</td>
<td>6 (33.33%)</td>
</tr>
<tr>
<td>Depression</td>
<td>2 (11.11%)</td>
</tr>
</tbody>
</table>

The results of the preoperative laboratory tests are listed in Table 2.

**Table 2. Preoperative laboratory investigations.**

<table>
<thead>
<tr>
<th>Test</th>
<th>Mean</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hemoglobin (g/dL)</td>
<td>14.2</td>
<td>10.2-14.7</td>
</tr>
<tr>
<td>Hematocrit (%)</td>
<td>46.2</td>
<td>32-48</td>
</tr>
<tr>
<td>Blood sugar (mg/dL)</td>
<td>136.4</td>
<td>72-260</td>
</tr>
<tr>
<td>Serum urea (mg/dL)</td>
<td>22.3</td>
<td>18-52</td>
</tr>
<tr>
<td>Creatinine (mg/dL)</td>
<td>0.79</td>
<td>0.5-1.2</td>
</tr>
<tr>
<td>Bilirubin, total (mg/dL)</td>
<td>0.80</td>
<td>0.5-1.1</td>
</tr>
<tr>
<td>Bilirubin, direct (mg/dL)</td>
<td>0.21</td>
<td>0-0.9</td>
</tr>
<tr>
<td>ALAT (U/L)</td>
<td>32</td>
<td>22-42</td>
</tr>
<tr>
<td>ASAT (U/L)</td>
<td>34</td>
<td>19-90</td>
</tr>
<tr>
<td>Serum alkaline phosphatase (U/L)</td>
<td>101</td>
<td>42-160</td>
</tr>
<tr>
<td>Cholinesterase (U/L)</td>
<td>6256</td>
<td>4500-9095</td>
</tr>
</tbody>
</table>

**Table 3. ASA risk score according to body weight.**

<table>
<thead>
<tr>
<th>BMI</th>
<th>ASA risk class</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ideal body weight</td>
<td>20 - 24.9</td>
</tr>
<tr>
<td>Overweight</td>
<td>25 - 29.9</td>
</tr>
<tr>
<td>Morbid obesity</td>
<td>30 - 49.9</td>
</tr>
<tr>
<td>Super morbid obesity</td>
<td>&gt; 50</td>
</tr>
</tbody>
</table>

Preanesthetic airway assessment noted a Mallampati score = 1 in 2 patients, Mallampati score = 2 in 8 patients, Mallampati = 3 in 3 patients and Mallampati = 4 in 5 patients.

The ASA risk classification is also influenced by the person’s weight.⁸ (Table 3).

In our study 13 patients (72.22%) were classified as ASA III, and 5 patients (27.77%) as ASA IV.

We used central venous catheters in 3 cases in which peripheral iv access could not be obtained, and invasive arterial pressure monitoring in 8 patients, 6 of them requiring further monitoring in ICU postoperatively.
All patients were intubated endotracheally with rapid sequence induction; intubation has been difficult in one patient, but successful at second attempt with McCoy laryngoscope (flexible tip blade) and bougie. Tracheal intubation has been performed in all patients with conventional laryngoscopy, without any incidents or complications during the maneuver.

All interventions were done by the same surgeon, the average surgical time being 156.11 min (range between 110 - 235 minutes).

Postoperatively, 12 patients were extubated in the operating room with an average extubation time of 14.8 minutes (range 16 - 28 minutes), and after four hours surveillance in PACU they were transferred to the surgical department.

Six patients, 3 males and 3 females (2 male patients with BMI > 55 kg/m² and history of obstructive sleep apnea, 2 patients - 1 male, 1 female - with ischemic cardiopathy, high blood pressure and chronic obstructive pulmonary disease; and 2 female patients with ischemic cardiopathy and high blood pressure) have been admitted in the ICU, underwent continued BiPAP ventilation and have been extubated after an average of 4.2 hours (range 3.6 - 5.2 h); they continued with non invasive ventilation on CPAP mask during the night, were transferred to the ward and actively mobilized according to the surgical department's protocols.

In order to rule out the presence of gastric leak, patients underwent methylene blue dye test at the end of surgery. For the first two weeks following surgery only small amounts of oral liquids were taken by patients.

One 50 years old female patient, with BMI 38 kg/m² and diabetes mellitus, developed gastric leak two days postoperatively, complicated with secondary peritonitis and multiple fistulae (pleural, left perirenal and cutaneous). The patient needed prolonged intensive care and serial surgical interventions. She recovered completely and was discharged from hospital after 98 days. The other 17 patients were discharged from the hospital after 5 - 13 (mean 7.31) days.

DISCUSSIONS

The main objective of bariatric surgery is weight loss, amelioration of comorbidities and increase of life expectancy, as well as of the quality of life. Studies reported over 12 fold increased mortality rate in morbidly obese patients.9,10 In our study lot, one patient presented BMI less than 40 kg/m², 12 patients had BMI between 40-49.9 kg/m² and 5 patients had a BMI over 50 kg/m². The obese patients have anatomical and functional modifications and associated conditions which escalate their morbid condition; therefore, from the anesthetic point of view, they are regarded as a very high risk group of patients. Correlation between weight and ASA risk is showed in Table 3.

Preanesthesia evaluation is integrated in the local protocol of preoperative investigations; great emphasize was put on the physical examination, with the visualization of the oropharyngeal structure, the assessment of the tymoerental distance and of cervical spine mobility, whose management can be critical. Studies have shown that obesity itself and BMI do not predict difficult intubation. Instead, a high (> 3) Mallampati score and neck circumference > 40 cm can be predictive factors for a difficult intubation.11 In our series, 5 patients presented Mallampati score 3 and 3 patients Mallampati score 4, with one problematic intubation in the later group. A special attention is given to the positioning of the head and neck with elevation pillows in order to obtain an optimal tymoerental distance. A strategy that takes into account the ASA algorithm of a difficult intubation,8,12 with adequate equipment and alternatives to conventional laryngoscopy is mandatory.

Invasive arterial monitoring should be used for the super morbidly obese patients with severe cardiopulmonary disease and for those with poor fit of the non invasive blood pressure cuff (cuff that encircles a minimum of 75% of the upper arm circumference should be used).

Morbid obesity represents a major independent risk factor for sudden death through postoperative pulmonary thromboembolism. Femoral venous blood flow can be reduced by both pneumoperitoneum and Trendelenburg positioning, with an increased risk of lower extremity thrombosis.13,14 Scholten and al15 found that 40 mg Enoxaparine bid instead of 30 mg Enoxaparine bid determined a decreased incidence of postoperative DVT in bariatric patients without an increase in bleeding complications. The American Society for Bariatric Surgery is in favour of low doses of Heparin (5000 UI tid) combined with elastic stockings.16 Recently a venous thromboembolism prophylaxis protocol for bariatric patients was proposed17, patients being divided into those who are at high risk and those who are at low risk; high risk patients should receive either an inferior vena cava filter or intraoperative Heparin infusion as well as at least 3 months oral anticoagulant therapy. Our patients received 0.5 mg/kg LBW Enoxaparine bid and elastic stockings. During hospital stay thromboembolic complications were not recorded.
Anesthesia and laparoscopic surgery

Lung compliance is decreased due to increased pulmonary blood volume, and chest wall compliance is reduced due to weight of adipose tissue around the thoracic cage. Small airways collapse, cephalad displacement of abdominal contents and increased pulmonary blood volume contribute to a reduced functional residual capacity and a linear increase in alveolar – arterial (A-a) oxygen tension gradient with increasing BMI. Therefore, normal tidal volume ventilation is leading to airway closure, ventilation-perfusion mismatching and increased intrapulmonary shunt. All these changes may be accentuated during laparoscopic surgery and render the morbidly obese patient at risk of rapid desaturation, increased airway resistance, reduced functional residual capacity and increased incidence of atelectasis. Hypercarbia and hypoxemia may be caused by ventilation – perfusion mismatch due to restriction of diaphragmatic mobility from pneumoperitoneum, which leads to distribution of the ventilation volume to the non dependent part of the lung. Absorption of carbon dioxide can worsen hypercarbia and acidosis, which can be offset by hyperventilation. Catastrophic complications that should be kept in mind include massive gas embolism, pneumothorax and mediastinal emphysema.

Tidal volume of 10 - 12 mL/kg LBW to avoid barotrauma, respiratory frequency of 12 - 14/min to maintain normocapnia, and moderate PEEP of 5 cm H2O with preservation of hemodynamic stability have been applied to all patients. Pneumoperitoneum and Trendelenburg positioning determine an increase of intraabdominal pressure, with increase of vascular systemic resistance, decrease of venous blood return and cardiac performance. Also a growth of IAP > 20 mmHg decreases the renal blood flow and the glomerular filtration rate.

The necessary fluids estimated for this procedure (maintenance fluid requirement and the calculated deficit for a 12 h fasting period) is about 1 - 1.5 L crystalloids per hour, in order to avoid postoperative acute tubular necrosis.

Obesity causes changes in the pharmacology of the anesthetic drugs. High lipophilic drugs, such as barbiturics, benzodiazepines, opioids, have a large distribution volume, so calculation of the dosage is made according to the actual weight; for moderate lipophilic drugs the dosage is calculated according to the lean body weight, which varies by 20-40%. At the moment it is considered that 20% added to IBW correctly estimates LBW. Non depolarization agents are dosed according to IBW. Yet, although the distribution volume for the lipophilic anesthetic drugs is large, the pharmacology may vary due to protein binding and hepatic and renal clearance. Regarding the choice of the volatile agent, two randomized studies showed the superiority of Sevoflurane over Isoflurane in bariatric surgery, due to its hemodynamic stability, quick recovery, low incidence of nausea and vomiting, and low cost. Complete muscular relaxation is essential in laparoscopic bariatric procedures, in order to facilitate proper ventilation and to maintain an adequate space for visualizing and manipulating the laparoscopic instruments; therefore monitoring the depth of neuromuscular block is required.

Postoperative considerations

Studies have shown a 45% incidence of atelectasis in obese patients after superior abdominal surgery, hence the indication of initiating BiPAP postoperatively and maintaining it overnight. In our study 6 patients (2 supermorbidly obese males with BMI > 55kg/m² and 4 patients with significant cardiopulmonary comorbidities) required BiPAP and CPAP in the postoperative period in ICU.

Laparoscopic bariatric surgery is a less invasive procedure and causes less postoperative pain, thus interfering less with the respiratory mechanics. This was the reasons why the respiratory function was not significantly altered, the majority of patients being able to sustain efficiently spontaneous breathing. Considering the analgesic regimen, the administration of nonsteroidian analgesics is avoided because of the risk for gastric ulcer, but also for postoperative renal dysfunction after laparoscopy. Acetaminophen is used in standard dosage, because its distribution volume is small but its clearance is high in obesity, therefore frequent increase of the dosage is necessary.

Several studies have reported gastric leak and postoperative bleeding as the most common complications following laparoscopic sleeve gastrectomy. We have encountered one case of anastomotic leak in the second postoperative day; it required repeated surgical procedures and long term therapy in the intensive care unit, but recovered completely.

CONCLUSIONS

Surgical treatment should be offered to patients with morbid obesity that are well informed, motivated and with an acceptable operative and anesthetic risk. Among bariatric procedures, LSG gained widespread use because it is fast, minimally invasive and with a rapid learning curve. It provides fast recovery time and minimal complications rate.

The first step is a thorough medical assessment of the magnitude of obesity and its comorbidities;
it involves a multidisciplinary team in which the anesthesiologist plays a key role in careful patient selection, proposing well designed strategies for complications prevention and treatment.

Specific protocols in anesthetic management and perioperative care should be implemented to allow effective and safer treatment for this unique group of patients.

REFERENCES