The Effects of Pneumoperitoneum on Respiratory Mechanics During General Anesthesia for Bariatric Surgery

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Introduction

Morbid obesity has deleterious effects on respiratory mechanics, decreasing lung volumes, functional residual capacity, compliance and arterial oxygenation.¹ In one study it was shown that general anesthesia with reverse Trendelenburg position (RTP) and pneumoperitoneum (PPM) improved lung compliance and gaseous exchange in morbidly obese patients undergoing surgery.² Laparoscopic adjustable gastric banding was designed to be a minimally invasive, reversible and effective surgical procedure for morbid obesity. As a result, there has been renewed interest in the anesthetic management of this group of patients. Hemodynamic changes have been extensively studied under anesthesia among this group of patients. Also, respiratory mechanical properties before or after bariatric surgery have been studied.³ However, there is little information in the literature about intraoperative changes in respiratory mechanics and patient tolerance to PPM during laparoscopic banding in the morbidly obese. The aim of this study was to evaluate the effects of PPM on respiratory mechanics in obese patients undergoing LAGB surgery.

Patients and Methods

After written informed consent was obtained, 10 adult morbidly obese male patients scheduled to undergo laparoscopic adjustable gastric banding with the Swedish band (SAGB, Obtech associated with Ethicon EndoSurgery) under general anesthesia were enrolled in the study. Exclusion criteria...
included patients with cardiorespiratory disease. The patients were ASA I or II. Their mean age, weight and height values were 34 ± 10 yr, 137 ± 19 kg and 162 ± 9 cm respectively. Mean body mass index (BMI) was 50.5 ± 8 kg/m² (range 40.9-66.8). Chest X-ray, arterial blood gases on room air (ABG), pulmonary function tests and ECG were obtained on all patients preoperatively. The patients were premedicated with oral lorazepam 2 mg 2 hr preoperatively. Intra-operative monitoring consisted of: ECG lead II; heart rate; arterial oxygen saturation (SpO₂) measured by pulse oximeter; blood pressure measured by the non-invasive automated method, end-tidal CO₂ (EtCO₂); muscle relaxation by Myotest; and body temperature by rectal route (Hewlett Packard, Sarno, Italy). After preoxygenation, induction of anesthesia was achieved with sufentanil 0.1 mcg/kg and thiopentone 4 mg/kg of ideal body weight, followed by cricoid pressure and succinylcholine 1 mg/kg of ideal body weight to facilitate endotracheal intubation. The patients’ lungs were ventilated with 50% O₂/aír and 1 minimum alveolar concentration (MAC) of sevoflurane with the anesthesia delivery unit (Datex Ohmeda type A Elec, Promma, Sweden) using a tidal volume of 10 ml/kg of ideal body weight, and a rate of 10 breaths/min, with inspiration equal to 33% of respiratory cycle time, including a 10% end-inspiratory pause. Analgesia was maintained with incremental dosages of sufentanil when required. Cisatracurium was used for muscle relaxation based on the reading from the Myotest to ensure zero train-of-four and low twitch height.

Surgery was performed in all patients by the same surgeon. Upon completion of surgery atropine and neostigmine were given I.V. (1.2/2.5 mg) followed by tracheal extubation. The patients were then sent to the recovery room and later to the ward.

The following respiratory data were obtained during RTP before, during and after PPM (at stages 1, 2 and 3 respectively): peak and plateau inspiratory airway pressures, tidal volume (inspiratory and expiratory), minute volume (inspiratory and expiratory), and dynamic lung compliance (DLC). The hemodynamic data (heart rate and mean blood pressure) were also obtained before, during and after PPM (stages 1, 2 and 3 respectively).

Statistical analyses were performed with the aid of a computer program (SPSS 9.0 for Windows, SPSS Inc., Chicago, IL). The results were expressed as mean ± SD. One-way analysis of variance (ANOVA) was used for analysis of differences of the data before, during and after PPM. For all comparisons, P<0.05 was considered significant.

Results

The preoperative pulmonary function tests and ABG were within accepted ranges. Chest X-ray and ECG were normal. The average surgical time was 1.8 ± .6 hr (range 1.5-2 hr). The intraoperative mean values of the heart rate were 80.5 ± 7.8, 89.0 ± 15.7 and 89.0 ± 9.1 in stages 1, 2 and 3 respectively, with no significant differences (P>0.05). The mean blood pressure values were 74.6 ± 9.5, 83.5 ± 13.7 and 86.0 ± 9.4 mmHg in stages 1, 2 and 3 respectively, with no significant differences (P>0.05). There was a significant difference between the peak airway pressure before (PE 1) and during (PE 2) PPM (P<0.05) (Figure 1). There was no significant difference in the tidal volumes (inspiratory and expiratory) before and during PPM. The mean values of DLC were 44.6 ± 7.8, 31.8 ± 5.5 and 44.5 ± 8.3 ml/cmH₂O before (Compl 1), during (Compl 2) and after (Compl 3) PPM respectively. Comparing DLC mean values before (Compl 1) and during (Compl 2) PPM revealed significant differences (P<0.05).

![Figure 1. Peak airway pressure changes before PMM (PE 1), during PMM (PE 2) after gas deflation (PE 3). PE=peak airway pressure.](image-url)