EFFECT OF HYPERCAPNIA ON CEREBRAL OXIMETRY IN OBESE PATIENTS DURING LAPAROSCOPIC GASTRIC BYPASS

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INTRODUCTION
Near-infrared spectroscopy (NIRS) is used to monitor cerebral regional saturation of oxygen (rScO2) under anesthesia during various surgical procedures (1). It is currently used during cardiac and carotid surgery in order to guide anesthetic management of the circulation, and has been investigated as a tool to predict post-operative complications such as acute kidney failure, wound infection and cognitive dysfunction (1).

Morbid obesity is a life-threatening chronic disease associated with numerous comorbidities, effectively treated by laparoscopic Roux-en-Y gastric bypass (LRYGB) (2). During the surgical procedure, pneumoperitoneum, created by carbon dioxide (CO2) insufflation in the abdominal cavity, and anti-Trendelenburg position are required in order to ensure the best surgical conditions.

Such conditions may decrease rScO2 (1). However, it has been recently advocated that hypercapnia may attenuate this cerebral desaturation in beach chair position during shoulder surgery (3).

This relation has not yet been investigated during LRYGB.

In the present study, we evaluated whether hypercapnia, comparing to normocapnia, has an effect on rScO2 in obese patients during LRYGB.

MATERIAL AND METHODS
Population
After approval by the establishment’s ethical committee and signed informed consent, we conducted a prospective, single blinded study, including 57 morbid obese patients scheduled for elective LRYGB.

Inclusion criteria were: body mass index (BMI) ≥ 40 kg/m², BMI ≥ 35 kg/m² with comorbidity (hypertension, diabetes mellitus, obstructive sleep apnea), ≥18 years old, ASA I-III. Exclusion criteria were: cerebrovascular disease and ASA IV.

Study protocol
Patients were randomly allocated in two groups: the moderate hypercapnia (HC) and the normocapnia (NC) group with a targeted per procedure end tidal carbon dioxide (EtCO2) of 44-46 mmHg and 34-36 mmHg, respectively.

Two NIRS probes were placed on left and right forehead. Following preoxygenation, general anesthesia was induced with sufentanil, propofol and maintained with sevoflurane, under mechanical ventilation. Tidal volume was adjusted according to ideal body weight. Immediately after induction of anesthesia and during surgery, respiratory rate was adjusted according to the HC or NC group in which the patient was allocated. Peritoneal insufflation pressures were maintained at 12-17 mmHg. The surgical procedure was performed with the patient at a 15â€°-30Â° head-up position. Patients mean arterial pressure (MAP) was maintained within a 20% from baseline value.

Measurements

The main following variables were recorded: demographic data, comorbidities, intraoperative MAP, heart rate, pulsatile oxygen saturation, inspiratory fraction of oxygen, EtCO2, angle of anti-Trendelenbourg position, entropy and temperature.

The primary outcome of our study was rScO2 values measured by NIRS, in the two groups.

We also recorded, the number of cerebral desaturation episodes (â‰¥ 20% diminution of rScO2 from baseline (T0) or absolute value rScO2 < 55% during â‰¥ 3 minutes) as secondary outcome.

All variables were recorded at the following time points: upon arrival (T0) in the operating room, after preoxygenation (T0+), after intubation (T1), 1 min after pneumoperitoneum (T2) and thereafter every 15 minutes (T3-T6), Tf-2 (30 min before end) and at the end of surgery (Tf).

Statistical analysis

The chi-squared test was used to investigate differences among discrete variables. For continuous variables, we checked the two assumptions of the t-test (normality of the residuals and homogeneity of the variances). If both were met, we performed a t-test and report means and standard deviations by group. If at least one was not met, we performed a Wilcoxon signed rank test and report the medians and interquartile ranges by group. We also compared rScO2 kinetics for the two groups at T0, T1, T2, Tf-2 and Tf by Anova tests. p < 0.05 considered significant.

RESULTS

Demographics were comparable between the two groups.

There were no significant differences on rScO2 between the two groups at T0, T0+, T1. rScO2 values were found higher in the HC group comparing to NC group at T2, T3, T5, T6, both right and left side, and at T4 and Tf left side. The number of cerebral desaturations was not significantly different between groups (p = 0.062), (Table 1).

Comparison of rScO2 values evolution between groups, shown an increase in left side rScO2 between T0 and T1 higher for the HC group compared to the NC group, whereas, the decrease in left side rScO2 between T1 and T2 is higher in the NC group compared to the HC group (p < 0.001). A time but no group effect was observed for right side rScO2 describing an increase of it between T0 and T1 and a slight decrease of it between T1 and T2 in both groups (p<0.001), (Figure 1).
No rScO2 values variation was observed thereafter. At Tf, level of rScO2 was found lower for the NC compared to the HC group.

CONCLUSION

Under the conditions of our study, moderate hypercapnia seems to be beneficial on cerebral oximetry decrease, notably after insufflation of pneumoperitoneum. This effect persists throughout surgery.

In obese patients scheduled for elective LRYGB, mechanical ventilation targeting moderate hypercapnia seems to be a good strategy to improve cerebral oximetry, comparing to normocapnia.

REFERENCES