Letter to Editor

Respiratory acidosis in obese gynecological patients undergoing laparoscopic surgery independently of the type of ventilation

Keywords:
respiratory acidosis; airway pressure; CO₂ pneumoperitoneum; hypercapnia; inverse ratio ventilation; lung compliance; lung ventilation; obesity

To the Editor,

An article by Zhang and Zhu recently published in Acta Anaesthesiologica Taiwanica attracted our interest because it aimed to cast light on lung physiology changes depending on ventilation modes during laparoscopic surgery (LS) in gynecological obese patients (OPs).

This is an important multidisciplinary topic involving respiratory physiology, anesthesiology, obesity, and minimally invasive LS. Based on their own investigation, the authors concluded that inverse ratio ventilation (IRV) outperforms conventional ratio ventilation (CRV) in terms of oxygenation, respiratory mechanics, and inflammatory cytokines in OPs undergoing gynecological LS. This procedure does not have any adverse respiratory and hemodynamic effects in comparison with those of conventional ratio ventilation (CRV). Subsequently, the authors stated that IRV is superior to CRV in terms of oxygenation, respiratory mechanics, and inflammatory cytokine in OPs undergoing gynecological LS.

Upon closer reading of this article, we have several questions because the conclusions do not completely meet the results and study design. Briefly, the authors designed their investigation as a comparative study of conventional ventilation with a ratio of 1:2 and IRV with a ratio of 2:1 during gynecological LS upon CO₂ pneumoperitoneum with an intraperitoneal pressure (15 mmHg) and the patient in the 30° Trendelenburg position. End tidal carbon dioxide tension (PETCO₂) was continuously monitored in order to maintain its concentration below 50 mmHg. Respiratory parameters (breathing rate or tidal volume) were adjusted to keep this parameter below 50 mmHg; however, the increased amount of the minute ventilation value was missing. Such kind of study should be designed in order to perioperative monitoring of hemodynamic parameters by the same way and order, registered at 5 minutes before anesthesia induction (T0), immediately before the onset of pneumoperitoneum (T1), 60 minutes after the onset of pneumoperitoneum (T2), and the end of surgery (T3) with appropriate statistical tests for repeated measures.

We reanalyzed the results in order to understand the importance of the findings of this study concerning respiratory changes and lung mechanics (Figures 1A–C) in order to demonstrate changes in pCO₂ and pH values and their correlation with parameters of lung mechanics (Ppeak, Pmean, Compliance, and auto positive end-expiratory pressure [Auto-PEEP]).

The authors concluded that IRV resulted in beneficial respiratory outcomes without adverse respiratory effects, although pCO₂ and pH values were significantly changed during LS in both ventilation modes (Figure 1A). Moreover, after 60 minutes of CO₂-pneumoperitoneum onset, respiratory changes were more pronounced in patients with IRV, which resulted in high partial pressure of carbon dioxide (pCO₂) value (48.65 ± 5.44 mmHg) with a low pH (7.32 ± 0.06), than those of patients with CRV (46.87 ± 4.86 mmHg and 7.34 ± 0.07 mmHg, respectively). It is well known that when arterial blood pH is < 7.35, the condition is considered as acidosis. The reason for these changes is definitely related to the authors’ decision to control CO₂ accumulation in their patients’ body at the level of PETCO₂ 50 mmHg. Usually, this parameter was adjusted at a physiological level of 35–40 mmHg in most of the analogous studies, taking into account physiological arterial-to-end tidal CO₂ gradient; considered about 5–10 mmHg.

IRV optimally decreased both airway pressure values (Ppeak and Pplat) in comparison with those of conventional ventilation; however, the adversely affected Pmean value was significantly increased in all monitored points (Figure 1B). Another two parameters of lung mechanics (lung compliance and auto-PEEP) were lower in overall monitored points before and 60 minutes after the onset of pneumoperitoneum in patients with IRV in comparison with those of the conventional ventilation group (Figure 1C).

An increased rate of individuals with obesity among patients undergoing LS is a health care concern due to anesthesia and ventilation difficulties in the obese population. Therefore, understanding of physiology and pathophysiology of lung function is an important issue during long-lasting LS, with an increased insufflation pressure in order to avoid possible side effects of CO₂ pneumoperitoneum.

We suggest that cause–effect mechanisms of CO₂ accumulation manifested with increased arterial pCO₂ and decreased pH (Figure 1A) during LS observed in this study are associated with...
the relatively high level of $P_{ET}CO_2$ concentration and reduced capacity of CO$_2$ elimination of both these ventilation modes due to highly adjusted $P_{ET}CO_2$ concentration at 50 mmHg. In our opinion, most patients in this study experienced acute respiratory acidosis during gynecological LS; therefore, the design of such studies should be more precise in order to prevent such conditions. Further studies are needed in order to study CO$_2$ elimination capacity of IRV in OPs with more precisely designed study methodology.

**Conflict of interest**

The report was not externally funded, and none of the authors have any conflicts of interest.

**References**


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