**Protocol ID 10398/14**

# Effects on Respiratory mechanics of two different ventilation strategies during roboticgynecological surgery.

## Introduction:

For many years, the mechanical ventilation during general anesthesia has been conducted using high tidal volumes (Vt) and without applying Positive End Expiratory Pressure (PEEP). This ventilatory strategy was considered to avoid alveolar collapse to improve ventilationperfusion mismatch and to reduce the oxygen fraction. The potential harmful effects of short term intra-operative ventilation are increasingly recognized [1]. The mechanical ventilation may cause a pulmonary complication defined Ventilator-Induced Lung Injury (VILI). This respiratory condition is characterized by alveoli overdistension or repetitive opening and closing of atelectasic lung area. Alveolar overdistension could be prevented applying lower Vt [2] and higher levels of PEEP could prevent alveolar derecruitment [3]. Recently, two conventional meta-analyses of observational studies and randomized controlled trials on intra-operative ventilation have supported the use of lung protective ventilation, with lower Vt and higher levels of PEEP in order to prevent VILI and postoperative pulmonary complications [4,5]. Further studies are necessary to understand if the outcome improvement was related to lower Vt  or high levels of PEEP. Laparoscopy is a well-established procedure for gynecologic surgery, with an induced pneumoperitoneum to facilitate the laparoscopic manipulation and it is often performed in Trendelemburg position (the head down body position). The increase of abdominal pressure related to both pneumoperitoneum and Trendelemburg position has demonstrated to impair the respiratory function, mainly inducing atelectasis area in the dependent lung regions [6-9]. In case of atelecasis, the distribution of Vt to the limited amount of functional lung parenchyma may induce alveolar stress and strain. These conditions are the main mechanisms underlying VILI [10-11] and the hypothesis that a protective ventilation has some benefits and should be applied during general anesthesia has been widely demonstrated [ 6,9,12-15]. Recently, the concept of “lung protective ventilation strategy” has been adapted from acute respiratory distress syndrome to the anesthesiologic management. In fact, the application of an “open lung” strategy, consisting in a recruitment maneuvers (RMs) followed by the consequent application of PEEP has been suggested to be able to improve oxygenation through the re-expantion of penumoperitoneum-induced atelectasis area. The effects of open lung ventilatory strategy on respiratory mechanics and postoperative pulmonary complications in healthy patients underwent robotic–laparoscopic surgery in deep Trendelemburg position have not been specifically investigated. The aim of this study was to evaluate the effects of two ventilatory strategies (protective mechanical ventilation versus conventional mechanical ventilation), during general anesthesia in robotic laparoscopic gynecological surgery in deep Trendelemburg position, on respiratory mechanics and postoperative pulmonary complications in healthy patients.

**Methods:**

The ventilation protocol consisted in volume-controlled mechanical ventilation thought Servo I Ventilator, inspiratory to expiratory ratio of 1:2, and a respiratory rate adjusted to normocapnia (end-tidal carbon dioxide partial pressure between 30 and 40 mmHg). Patients were randomly assigned to Standard (SV) or Protective (PV) group. Patients in the SV group received a Vt of 10 ml/kg of Ideal Body Weight (IBW) and a PEEP of 5 cmH2O, patients in the PV group a Vt of 6 ml/kg of IBW and a PEEP of 8-10 cmH2O, associated to recruitment maneuvers (RMs). IBW was calculated according to a predefined formula: 50 + 0,91(height [cm] −152,4) for men and 45,5 + 0,91 (height [cm]−152,4) for women [16]. RMs were performed only in hemodynamic stable conditions and at pre-set moments: after the induction of anesthesia, after any disconnection from the mechanical ventilator, each hour during the surgical procedures and immediately before extubation. RMs were performed in Pressure Control mode as follows: the limit of peak inspiratory pressure was set at 45 cmH2O and the pressure control was set at 30 cmH2O, therefore three consecutive thirty seconds lasting inspiratory pauses were performed. At the end of RMs, respiratory rate, inspiratory to expiratory ratio, inspiratory pause, and Vt were set back at values preceding the RMs.

**Statistical Analysis:**

All data are expressed as mean ± standard deviation (DS). We use the 2 –side T tests to compare the respiratory variables and gas exchange between the two groups tested. The analysis of variance for repeated measures in each group was performed by one-way ANOVA. When detected, post hoc analysis was performed using Bonferroni Test. P values ≤ 0,05 were considered statistically significant.

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