Airseal During Laparoscopic Radical Prostatectomy and Regional Extended Lymphadenectomy: Intraoperative Advantage

Abstract

Aim: We retrospectively compared two different carbon dioxide insufflators: Thermoflator (standard gas flow rate) and Airseal IFS (continuous bidirectional gas flow, lower flow rate), during laparoscopic radical prostatectomy and extended pelvic lymphadenectomy (t-LRP) in order to detect any differences in the anesthetic respiratory management.

Materials and methods: 77 consecutive patients underwent t-LRP. The last 38 patients treated using Thermoflator (group A) have been compared with the first 39 patients treated using Airseal (group B). Mean intrabdominal pressure was maintained at 12 mmHg in all patients. Baseline tidal, minute ventilation and positive end expiratory pressure (PEEP) were set at 8 ml/Kg, 10 breaths/minute and 5 cm H₂O respectively in both groups. End-tidal CO₂ and arterial blood gas analysis were monitored during surgery. Changes of the baseline mechanical ventilator parameters have been made in the case of et CO₂ greater than 40 mmHg.

Results: Mean introperative et CO₂ was 38.21 mmHg in group A and 39.28 mmHg in group B. Baseline mechanical ventilator parameters had to be modified in 21/38 group A patients and in 5/39 group B patients (p<0.01). These changes allowed to maintain the et CO₂ within 40 mmHg in all patients of both groups. Discussion: Laparoscopic urological interventions were always demanding for statistical analysis. Changes of the baseline mechanical ventilator parameters have been made in the case of et CO₂ greater than 40 mmHg.

Conclusion: In our experience the Airseal system simplified the anesthetic respiratory management and potentially limited the pulmonary damage.

Introduction

Laparoscopic access provided for the formation of pneumoperitoneum by insufflation of carbon dioxide (CO₂) inside the human body. Currently the traditional insufflators inject gas in a single direction: from the insufflator to the patient. Recently AirSeal appeared on the market. This new insufflator has created a continuous flow of CO₂ from and towards the patient. This condition should prevent the gas to escape from the body, thus allowing using dedicated trocars without valves. The presence of a filter has allowed obtaining a cleaning of the fumes generated in the operating field by the electrified instruments. We used the Airseal in patient whose underwent laparoscopic radical prostatectomy and extended pelvic lymphadenectomy (t-LRP) with transperitoneal access at our Institution and compared it in a retrospective study, with the traditional Thermoflator, in order to detect any differences in the kinetics of carbon dioxide.

Materials And Methods

From January 2011 to June 2012, 77 consecutive patients underwent t-LRP at our Department. All cases were performed by single surgeon who previously performed 272 t-LRP. Thermoflator was used until November 2011. Thermoflator was replaced by Airseal since November 2011. The last 24 patients treated using Thermoflator (group A) have been compared with the first 27 patients treated using Airseal (group B). Patients’ preoperative characteristics are shown in Table 1. Patient position, Trendelenburg tilt, trocars layout and perioperative care were the same in both groups. Trocars features were the same, except for one dedicated valveless 12 mm Airseal trocar. Mean intraabdominal pressure was maintained at 12 mmHg in group A and B. CO₂ insufflation was set at the maximum rate allowed for each device. All t-LRP were performed under general anesthesia, using anesthesia delivery management system Aisys Carestation™ (General Electric’s, CT and USA). The same three anesthesiologists performed all t-LRP. Baseline tidal, minute ventilation and positive end expiratory pressure (PEEP) were set at 8 ml/Kg, 10 breaths/minute and 5 cm H₂O respectively in both groups. During operation, end-tidal CO₂ as displayed by mechanical ventilator and arterial blood gas analysis were recorded every 10 minutes and 90 minutes respectively. Blood gas analysis was also performed when end-tidal (et) CO₂ greater than 40 mmHg in order to confirm the value. Changes of the baseline mechanical ventilator parameters have been made in the case of et CO₂ greater than 40 mmHg. At first, breaths were increased up to 16/minute. In a second step, the tidal was increased up to 12 ml/Kg. These changes have been made to keep the et CO₂ lower than 40 mmHg. Additional perioperative data were recorded: operative time, estimated blood loss, blood transfusions, hospital stay and early complications (Table 1). Student T test was used for statistical analysis.
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Table 1: Student T-Test was used for statistical analysis.

<table>
<thead>
<tr>
<th>Patients (n)</th>
<th>Group A (Thermoflator)</th>
<th>Group B (Airseal)</th>
<th>P Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean Age</td>
<td>64</td>
<td>66</td>
<td>ns</td>
</tr>
<tr>
<td>Mean ASA Score</td>
<td>2</td>
<td>2</td>
<td>ns</td>
</tr>
<tr>
<td>COPD (n)</td>
<td>1</td>
<td>2</td>
<td>ns</td>
</tr>
<tr>
<td>Smoking History</td>
<td>7</td>
<td>9</td>
<td>ns</td>
</tr>
<tr>
<td>Mean Preop. Serum Haemoglobin (g/dl)±SD (Range)</td>
<td>14.3±1.8 (10.5 - 15.9)</td>
<td>14.7±1.7 (9.3 - 17.2)</td>
<td>ns</td>
</tr>
<tr>
<td>Mean Operative Time (minutes)±SD (Range)</td>
<td>178±50 (156 - 225)</td>
<td>173±48 (152 - 230)</td>
<td>ns</td>
</tr>
<tr>
<td>Estimated blood Loss (ml)±SD (Range)</td>
<td>380±30 (320 - 410)</td>
<td>370±40 (310 - 400)</td>
<td>ns</td>
</tr>
<tr>
<td>Mean Postop. Serum Haemoglobin (g/dl)±SD (Range)</td>
<td>12.4±1.8 (9.5 - 14.4)</td>
<td>11.9±2.0 (9.7 - 14.2)</td>
<td>ns</td>
</tr>
</tbody>
</table>

Results

Mean intraoperative et CO₂ was 38.21 mmHg in group A and 39.28 mmHg in group B. Baseline mechanical ventilator parameters had to be modified in 21/38 group A patients and in 5/39 group B patients (p < 0.01). These changes allowed maintaining the et CO₂ within 40 mmHg in all patients of both groups. Mean operative time was 212 minutes in group A and 224 minutes in group B. Estimated blood loss was 389 cc and 404 cc respectively in group A and B. Two patients in group A and 3 patients in group B received autologous blood transfusion (one unit each). Mean hospital stay was 4 days for each group. No major complication (III or IV according to Clavien-Dindo classification) occurred. Two persistent lymphorrhoeas and one self-limiting anastomotic fistula occurred in group A, while three persistent lymphorrhoeas in the remaining group.

Discussion

Laparoscopic surgery is known to have adverse effects on pulmonary gas exchange and respiratory mechanics [1-3]. The Trendelenburg position and tilt needed to perform t-LRP and patient’s underlying respiratory problems (both obstructive and restrictive) complicate anesthetic management [4]. Another key variable to be considered is operative time, influenced by the type of surgery and the surgeon’s skill. The management of mechanical ventilation during laparoscopic surgery, as in our experience, enables to overcome respiratory problems. To cope with blood CO₂ increase, anaesthetists can change minute ventilation, tidal volume, inspiratory time and PEEP [5-7]. But this protective ventilator strategy can increase the potential pulmonary damage, known to be present every time the invasive ventilation is applied. In our series patient position, pulmonary comorbidities, operative time and surgeon were comparable in both groups. Maximum et CO₂ has been kept below 40 mmHg in every patient in both groups. However in group an et CO₂ intraoperatively increased beyond 40 mmHg in a greater number of patients than in group B, thus in group A more patients needed modifications of respiratory parameters than in group B. Hence a reduction of potential pulmonary damage can be achieved when Airseal system is employed, even if our study was not able to identify clinical differences between groups. Previously Herati et al. [8] documented a lower CO₂ consumption when the Airseal system was used, compared to the standard insufflator.

Conclusion

In our experience the Airseal system simplified the anesthetic respiratory management and potentially limited the pulmonary damage.

References
