Why should a ‘gasless’ oncologic robotic procedure be performed?

Abstract

In this paper the authors describe a challenging approach during Robotic Prostatectomy (RARP) performing the procedure without gas insufflation and using (after the ‘docking’ of robot) a so-called ‘tenting of the abdominal wall’. They demonstrate that this technique reduces the peak airway pressure while maintaining an adequate intrabdominal space.

This work is particularly interesting for both its anesthesiologic and oncologic impact.

Keywords

Carbon Dioxide, Robotic Surgery, Tumour Seeding
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1. During laparoscopy, carbon dioxide (CO$_2$) insufflation into peritoneal (and extraperitoneal) cavities produces a wide range of pathophysiological hemodynamic changes. Vigilance in monitoring and diligence in management are essential in order to prevent complications, because CO$_2$ absorption may lead to hypercarbia and acidosis. Clearance of CO$_2$ is related to adequate alveolar ventilation: CO$_2$ absorbed through the peritoneum is eliminated by respiratory exchange in the lungs and a rapid increase in CO$_2$ levels may be compensated by hyperventilation of the lungs. While the patient is under general anesthesia, minute ventilation volumes must be increased to maintain normocarbia. There are some situations associated with an increased CO$_2$ absorption, such as the extraperitoneal approach during RARP, as we recently demonstrated. Although the increase in PaCO$_2$ is not fully compensated by hyperventilation, most healthy patients can easily adapt to the increase in end-tidal CO$_2$. However, some are unable to tolerate the increased CO$_2$ load during insufflation, and this condition may lead to myocardial depression and vasodilation. The patient counteracts these effects by centrally mediated sympathetic stimulation, which causes persistent increases in blood pressure and heart rate, increasing catecholamine concentrations. In addition, the pneumoperitoneum, as a consequence of direct compression of the diaphragm, leads to a significant reduction in forced expiratory volume, peak expiratory flow and forced vital capacity, with a consequent decrease in pulmonary compliance. For all the points mentioned above, RARP is associated with various anesthesiologic challenges due to pneumoperitoneum and ‘tenting’ can be helpful in improving ventilation and reducing complications of high peak airway pressure above all in men with an impaired cardiopulmonary function, such as in broncopneumopatic or cardiopatic patients.

While in our Department we are used to performing completely gasless procedures during some robotic interventions, such as pyeloplasty and hystero-sacropexy, it is not always possible to conclude all the steps of RARP because the risk of massive bleeding, above all during dissection of Santorini venous complex or during complete nerve-sparing lateral dissection of the prostate: in these cases, sometimes it is necessary to restart the CO$_2$ insufflation until the closure of venous vessels.

2. From the oncological point of view, there are some concerns about the possible role of gas insufflation during laparoscopic/robotic procedures to treat (urological) cancers in the seeding of neoplastic cells. Indeed, tumour spillage is a phenomenon observed after laparoscopic surgical manipulation for both benign and malignant diseases and it is usually a result of dissemination and concomitant implantation of neoplastic cells on the peritoneal surface. In literature port-site metastasis or peritoneal spread after laparoscopic surgery for urological malignancies is a rare occurrence accounting for 0.09% and 0.03% of the cases, respectively. Although the etiology of this phenomenon is not clearly understood, different factors have been implicated, such as the aggressiveness and the type of tumour, host immune response and local processes, and (last, but not least) laparoscopic/robotic related factors.
Although there is no doubt that a poor surgical technique with traumatic manipulation of the cancer (surgical manipulation, tumour handling, morcellation, specimen removal methods, ...) may violate the boundaries of the tumour, consequently promoting seeding, the mechanism involved in cancer cell wounds or peritoneal implantation is uncertain. One possible explanation is gas insufflation\textsuperscript{7}.

The use of ‘gasless’ laparoscopy/robotic technique, in order to reduce the risk of wound or peritoneal metastasis, has been suggested since the ‘90s\textsuperscript{8}, but further multicentric studies are needed to confirm or not the role of the pneumoperitoneum in cancer seeding.
References


