

Title

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

Text

In this paper¹ 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.

1. During laparo-endoscopy, carbon dioxide (CO₂) insufflation into peritoneal (and extra-peritoneal) cavities produces a wide range of pathophysiological hemodynamic changes. Vigilance in monitoring and diligence in management are essential in order to prevent complications, because CO₂ absorption may lead to hypercarbia and acidosis.

Clearance of CO₂ is related to adequate alveolar ventilation: CO₂ absorbed through the peritoneum is eliminated by respiratory exchange in the lungs and a rapid increase in CO₂ 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 CO₂ absorption, such as the extraperitoneal approach during RARP, as we recently demonstrated².

Although the increase in PaCO₂ is not fully compensated by hyperventilation, most healthy patients can easily adapt to the increase in end-tidal CO₂. However, some are unable to tolerate the increased CO₂ 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 concentrations³. 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 compliance⁴.

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 hysterio-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 CO₂ 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 surface⁵.

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, respectively⁶. 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 insufflation⁷.

The use of 'gasless' laparoscopy/robotic technique, in order to reduce the risk of wound or peritoneal metastasis, has been suggested since the '90s⁸, but further multicentric studies are needed to confirm or not the role of the pneumoperitoneum in cancer seeding.

References

1. An observational study: Effects of tenting of the abdominal wall on peak airway pressure in Robotic Radical Prostatectomy(RRP) surgery. Saudi J Anesth in press
2. Dal Moro F, Crestani A, Valotto C, Guttilla A, Soncin R, Mangano A, Zattoni F. Anesthesiologic Effects of Transperitoneal Versus Extraperitoneal Approach During Robot-Assisted Radical Prostatectomy: Results of a Prospective Randomized Study. *Int Braz J Urol* 2015;41:466-72.
3. Kanwer DB, Kaman L, Nedounsejane M, Medhi B, Verma GR, Bala I. Comparative study of low pressure versus standard pressure pneumoperitoneum in laparoscopic cholecystectomy-a randomised controlled trial. *Trop Gastroenterol* 2009;30:171-4.
4. Hasukić S, Mesić D, Dizdarević E, Keser D, Hadziselimović S, Bazardzanović M. Pulmonary function after laparoscopic and open cholecystectomy. *Surg Endosc* 2002;16:163-5.
5. Thian YL, Tan KH, Kwek JW, Wang J, Chern B, Yam KL. Leiomyomatosis peritonealis disseminata and subcutaneous myoma – a rare complication of laparoscopic myomectomy. *Abdominal Imaging* 2009;34:235-8.
6. Ploumidis A, Panoskaltsis T, Gavresea T, Yiannou P, Yiannakou N, Pavlakis K. Tumor seeding incidentally found two years after robotic-assisted radical nephrectomy for papillary renal cell carcinoma. A case report and review of the literature. *Int J Surg Case Rep* 2013;4(6):561-4.
7. Tsivian A, Sidi AA. Port site metastases in urological laparoscopic surgery. *J Urol* 2003;169:1213-8.
8. Watson DI, Mathew G, Ellis T, Baigrie CF, Rofe AM, Jamieson GG. Gasless laparoscopy may reduce the risk of port-site metastases following laparoscopic tumor surgery. *Arch Surg.* 1997;132:166-8.