

Alterations in the Functions of the Various Organs in Da Vinci System Robotic Operations

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Abstract: *A vast number of high-tech surgical methods are constantly entering in the contemporary medicine, aimed at achieving better health treatment results, shortened hospital stay, less traumas for the patients, fewer blood losses, hence the better quality of life after performing the surgery treatment. All these results can be eventually achieved at the highest possible level by implementing the robotic Da Vinci system. Despite all its' advantages, this type of surgical method affects the physiological functioning of many organs and systems in the human body that must be well known so that the potential risk for them would be lowered to the minimum.*

Keywords: robotic surgery, physiological changes, pneumoperitoneum

1. Introduction

A vast number of high-tech surgical methods are constantly entering in the contemporary medicine, aimed at achieving better health treatment results, shortened hospital stay, less traumas for the patients, fewer blood losses, hence the better quality of life after performing the surgery treatment. All these results can be eventually achieved at the highest possible level by implementing the robotic Da Vinci system. [1]

During the preoperative stress phase an impaired immunity is frequently present, which will eventually be superimposed on the other components of the surgical intervention that would possibly contribute to the level of reduction in the synthesis of antibodies. [2, 3]

The less invasive the surgical method (e.g. the robotic surgery) is, the less covered those changes will be. Robotic surgery enters more and more convincingly in oncology practice. It is applied for treating a variety of cancers, affecting the organs, located in the different body cavities.

Among the various advantages that this type of surgical treatment would provide, a number of features are also present, related to the creation of high, intra-abdominal pressure during the insufflation of CO₂ (to create a pneumoperitoneum) and the positioning of the patient on the operating table in the steep 45° Trendelenburg position.

One of the most common complications, encountered during robotic operations, will be the development of the corneal abrasion, caused by the higher, intraocular pressure and the edema, developing under the conditions of the Trendelenburg position. [4]

This would require the periodic moistening of the corneas during the surgery. The use of eye protectors would be necessary due to the potential risk for eye injuries, caused by the camera of the robot, positioned in close proximity to them. It is well known that the quality of life is a concept which is affected by the physical health of the people, their psychological state, their level of independence, etc. [5]

The objective of the minimally invasive surgery would be to

precisely improve the quality of life of the operated patients. Very often, however, the patients, who are undergoing robotic surgery treatment, usually suffer from one or more comorbidities and the cardiovascular diseases are the basic ones for Bulgaria.

The cardiovascular changes in this type of surgical interventions are caused by the mechanical and chemical effects of the CO₂-induced pneumoperitoneum.

The baseline hemodynamics is also of great importance [6]

This would require the strict monitoring of the basic, vital parameters during the anesthesia.

The concomitant pathology in these patients could largely be the prerequisite for the observed, hemodynamic changes. [7]

The other adverse changes, arising from the carbo peritoneum would be a number of severe lung changes, the venous gas embolism, the development of pneumo mediastinum etc., caused when the needle of Veress or the trocar fall into a vein. [8, 9]

It should not be forgotten that the increased abdominal pressure would restrict the movement of the diaphragm which violates the ventilation-perfusion ratio in the lungs. [10, 11]

To avoid this adverse effect of the pneumoperitoneum, the application of a controlled by pressure ventilation with PEEP of 5 cm H₂O shall be preferred. [12]

The high intra-abdominal pressure would also decrease the hepatic blood flow, proportionally to the increase in the intra-abdominal pressure. [13, 14]

With regard to the nervous system in a number of studies it was shown that the pneumoperitoneum would potentiate the intracranial hypertension as a result of the reduced venous return and the slow cerebral blood flow. [15]

The other type of complications would be the peripheral nerve damages, arising from the improper positioning of the patients on the operating table during the surgery treatment

and even an extra hour could possibly increase the risk of their damage. [16]

The renal function is also affected upon the insufflation of carbon dioxide into the abdominal cavity.

Ost et al. have also proved that the hypovolemia, combined with the high level of intra-abdominal pressure, would cause the reduction of the blood flow to organs of vital importance such as the kidneys. [17]

The Trendelenburg position also affects the renal function and causes the increase in the central, venous pressure. [18]

2. Conclusion

Robotic surgery is convincingly entering in the different areas of surgery. The possibilities for providing less surgical traumas to the patients, the shorter hospital stays, the less prominent, postoperative pain syndrome, make this type of surgery, increasingly preferred among the surgeons.

However it should not be forgotten, that the developing of pneumoperitoneum and the Trendelenburg positioning could possibly create a number of complications both in the intra- and post-operative periods. Therefore, their relevant understanding and early control would be the necessary prerequisites for the favorable outcome during the performance of Da Vinci system robotic operations.

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