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Surgery in Motion

Safer Surgery by Learning from Complications: A Focus on Robotic Prostate Surgery

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Abstract

Background: The uptake of robotic surgery has led to changes in potential operative complications, as many surgeons learn minimally invasive surgery, and has allowed the documentation of such complications through the routine collection of intraoperative video.
Objective: We documented intraoperative complications from robot-assisted radical prostatectomy (RARP) with the aim of reporting the mechanisms, etiology, and necessary steps to avoid them. Our goal was to facilitate learning from these complications to improve patient care.
Design, setting, and participants: Contributors delivered videos of complications that occurred during laparoscopic and robotic prostatectomy between 2010 and 2015.
Surgical procedure: Surgical footage was available for a variety of complications during RARP.
Outcome measurements and statistical analysis: Based on these videos, a literature search was performed using relevant terms (*prostatectomy, robotic, complications*), and the intraoperative steps of the procedures and methods of preventing complications were outlined.
Results and limitations: As a major surgical procedure, RARP has much potential for intra- and postoperative complications related to patient positioning, access, and the procedure itself. However, with a dedicated approach, increasing experience, a low index of suspicion, and strict adherence to safety measures, we suggest that the majority of such complications are preventable.
Conclusions: Considering the complexity of the procedure, RARP is safe and reproducible for the surgical management of prostate cancer. Insight from experienced surgeons may allow surgeons to avoid complications during the learning curve.
Patient summary: Robot-assisted radical prostatectomy has potential for intra- and postoperative complications, but with a dedicated approach, increasing experience, a low index of suspicion, and strict adherence to safety measures, most complications are preventable.

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1. Introduction

Intraoperative complications are a rare but an inevitable part of surgery. Although many complications are unreported, prospective series suggest intraoperative iatrogenic complications occur in approximately 1% of cases. Variations in anatomy, body habitus, experience, and pathology make each case unique, and surgeons continuously tailor their approach to each operation. During training, experience and planning minimize risk. Surgeons must learn from complications that occur, lest history repeat itself. Large prospective national projects, such as the National Confidential Enquiry into Patient Outcome and Death (NCEPOD), have demonstrated that confidential reporting of operative outcomes can improve patient care by identifying common risk events, practices of concern, and strategies to overcome them.

Minimally invasive surgery (MIS) plays a major role in the contemporary management of benign and malignant diseases of the pelvis. MIS is generally perceived as having a lower complication rate than its open counterpart; however, uptake of MIS, particularly robotic surgery, has been rapid, and many surgeons have undertaken parallel MIS learning curves simultaneously. This, combined with potentially distinct types of difficulties compared with open surgery, has meant that complications inherent to MIS methodology have become apparent and more frequent. The routine collection of intraoperative video is of benefit and has allowed complications to be documented and analyzed in more depth than previously possible. MIS has different risks than open surgery, for example, complications are not restricted to the target organ and can occur in adjacent viscera outside the field of view. Because complications are rare and the length of hospital stay is typically shorter for MIS than for open surgery [1,2], physicians must be acutely attuned to signs and symptoms suggesting that the postoperative course is veering such that delayed diagnoses could compound the impact of a given complication.

Robotic assisted radical prostatectomy (RARP) is the most common of all pelvic surgeries [3] and one with which many urologists begin their robotic experience; therefore, it might serve as a template for other pelvic procedures, both benign and malignant and in both men and women. With this in mind, we aimed to elucidate the risks, dangers, and pitfalls leading to immediate or delayed complications and to highlight precautionary measures to preclude them. We hope to encourage routine anonymized self-reporting of complications to further patient care.

2. Methods

Robotic surgeons from high-volume centers of excellence were asked to contribute video content of intraoperative complications. Videos were anonymized, centers deidentified, and dates or times of surgery removed. Surgeons gave consent for their video material to be used in this study and accompanying video, and patients consented to video recording of portions of their operations for educational purposes as part of general surgical consent.

3. Results

3.1. *Patient positioning*

Transperitoneal robotic radical prostatectomy requires steep Trendelenburg position (20–35°) to permit adequate pelvic exposure (Supplementary Fig. 1). Readjustment of table position is not possible midprocedure without undocking the patient side cart (although future tables may allow table and robotic movement). Proper patient positioning can prevent countless complications that may be confused with other diseases [4]. During the beginning of a robotic program, it is advisable that positioning be done by the same team. Secure fixation of the patient on the table requires a soft mattress such as a memory foam or gel mattress, the friction of which will, in part, prevent movement [5].

3.1.1. *Patient fixation*

The most feared event during the procedure is sliding of the patient, which might lead to transient or permanent severe skin, muscle, or nerve injuries. Patient slippage when robotic trocars are already connected to the patient side cart can cause incisional tear, postoperative hernia formation, and increased postoperative pain due to overstretching of the abdominal wall. Some tools such as shoulder straps, shoulder braces, restraints, body straps, or head rests intended to prevent slippage may actually contribute to injury and should be avoided.

3.1.2. *Arms and chest*

A safe way to position the arms is to put a sheet measuring approximately 100 × 50 cm horizontally in the middle of the table, corresponding to the position of the patient's arms. A layer of egg-crate foam or a gel mattress are put on the sheet on each side to protect the arms when the sheet is tucked later, such that arms are fixed closely to the patient's body. In particular, the level of the elbow, at which the ulnar nerve passes through the olecranon channel, should be taken care of to prevent ulnar lesions [6], which may present later as sensitive damage to the fourth and fifth fingers in the palmar region (Supplementary Fig. 2) and can progress to motor nerve damage and, ultimately, to a claw hand [7–9]. Placing the arms on the side prevents hyperabduction of the upper limb, also causing brachial plexus injury. The hands should be in an anatomically neutral position. Improper fixation might cause the hand to drop laterally and hyperextend, causing radial nerve injury (Supplementary Fig. 3)

3.1.3. *Lower extremities*

However the legs are positioned (eg, split-leg table, stirrups), it is crucial to avoid hyperextension at the hips, which risks femoral nerve stretch injury. The risk of rhabdomyolysis is increased particularly in long procedures, in (morbidly) obese patients, and in steep Trendelenburg combined with other common risk factors such as diabetes, hypertension, or peripheral vascular disease [10–12]. Gluteal, back, calf, and shoulder muscles are at