Development of a Surgical Safety Training Program and Checklist for Conversion during Robotic Partial Nephrectomies

Fabio Zattoni, Alessandro Morlacco, Francesco Cattaneo, Matteo Soligo, Luca Meggiato, Daniele Modonutti, Claudio Valotto, Fabrizio Dal Moro, and Filiberto Zattoni

OBJECTIVE To evaluate the impact of standardized training and institutional checklists on improving teamwork during complications requiring open conversion from robotic-assisted partial nephrectomy (RAPN).

MATERIALS AND METHODS Participants to a surgical team safety training program were randomly divided into 2 groups. A total of 20 emergencies were simulated: group 1 performed simulations followed by a 4-hour theoretical training; group 2 underwent 4-hour training first and then performed simulations. All simulations were recorded and scored by 2 independent physicians. Time to conversion (TC) and procedural errors were analyzed and compared between the 2 groups. A correlation analysis between the number of previous conversion simulations, total errors number, and TC was performed for each group.

RESULTS Group 1 showed a higher TC than group 2 (116.5 vs 86.5 seconds, P = .0.53). As the number of simulation increased, the numbers of errors declined in both groups. The 2 groups tend to converge toward 0 errors after 9 simulations; however, the linear correlation was more pronounced in group 1 ($R^2 = 0.75$). TC shows a progressive decline for both groups as the number of simulations increases (group 1, $R^2 = 0.7$ and group 2, $R^2 = 0.61$), but it remains higher for group 1. Lack of task sequence and accidental falls or loss of sterility were higher in group 1.

CONCLUSION OC is a rare but potentially dramatic event in the setting of RAPN, and every robotic team should be prepared to manage intraoperative emergencies. Training protocols can effectively improve teamwork and facilitate timely conversions to open surgery in the event of intraoperative emergencies during RAPN. Further studies are needed to confirm if such protocols may translate into an actual safety improvement in clinical settings. UROLOGY 109: 38–43, 2017. © 2017 Elsevier Inc.

The incidence of renal cancer has been constantly increasing over the last decades. In Europe there were approximately 84,400 new cases of renal cell carcinoma and 34,700 kidney cancer-related deaths in 2012.[1] By the end of 2016, 62,700 new cases of kidney cancer are estimated to develop in the USA, and 14,240 patients will die from the disease.[2] Growing popularity and improved technical feasibility of partial nephrectomy (PN) have encouraged urologists to treat complex renal masses with nephron-sparing surgery.[3,4] Furthermore, the adoption of robotic-assisted partial nephrectomy (RAPN) is now widespread and used to treat bigger and more complex tumors.[5-7] The literature published on RAPN often represents the results obtained by experienced leaders in the field of robotic renal surgery and reports conversion rate ranging from 0% to 7% in most series.[8] Many of these practitioners pioneered the techniques currently used for RAPN and therefore their results may not be replicated in less experienced centers with a smaller pool of cases. Thus, the true incidence of intraoperative complications may be underestimated, especially when it comes to less trained robotic teams.

Financial Disclosure: *The authors declare that they have no relevant financial interests.*

From the Department of Oncological and Surgical Sciences, Urology Clinic, University of Padua, Italy; and PhD Course in Clinical and Experimental Oncology and Immunology, Department of Surgery, Oncology and Gastroenterology, University of Padua, Italy

Address correspondence to: Fabio Zattoni, M.D., Department of Oncological and Surgical Sciences, Urology Clinic, University of Padua, Italy Via Giustiniani 2, 35100 Padua, Italy. E-mail: fabiozattoni@gmail.com

Submitted: January 8, 2017, accepted (with revisions): June 19, 2017

https://doi.org/10.1016/j.urology.2017.06.057
0090-4295

The operating theatre is a high-risk environment where patient safety should have the priority in all phases of the procedure. Considerable challenges are posed to surgical teams during a robot-assisted surgery, where a heterogeneous team of health-care providers needs to ensure a smooth interaction among its members while interacting with a complex machine. Previous research has shown that adverse events in surgery are primarily due to failures in nontechnical skills such as communication, teamwork, leadership, and decision-making.[9,10] The growing complexity of RARP cases has increased the procedure-related hazards and therefore patient safety may benefit from standardized checklists and established team roles.

The primary aim of this study was to assess if a structured training program may reduce the time and number of errors from RAPN to open surgery (open conversion [OC]).

The secondary aim was to describe errors and problems faced during OC simulations and how they were solved.

MATERIALS AND METHODS

This is a prospective study conducted during a surgical team safety-training program in December 2015 at the University of Padua. Supplementary Figure S1 depicts the steps of the study. Participants to the safety-training program were coworkers, who regularly operate together in the same urology department.

Simulations Groups

Members of the 2 groups were divided randomly according to their role in the operating room. Each group was composed of 1 first surgeon, 1 anesthesiologist, 1 second surgeon, 1 scrub nurse, 1 circulating nurse, 1 helping nurse, and 2 health-care assistants available outside of the surgical room. Group 1 performed 10 hands-on OC simulations and then a 4-hour theoretical training. Group 2 performed the same steps, but in reverse order.

Simulations

We simulated and analyzed a total of 20 emergencies that required an OC during RAPN. Each team simulated a total of 10 emergencies. The robotic system used was a 4-arm Da Vinci SI (Intuitive Surgical). A human simulation model was used. An OC simulation was considered completed only after the robot's arms were undocked, the robot's cart was moved away, the human simulation model was shifted in a supine position, and the suction machine, table, and instruments were prepared for open surgery. The time-to-conversion (TC) was measured from when the first surgeon ordered the beginning of the conversion and to when the first and second surgeons were ready for the skin incision. All the simulations were timed and recorded in the same fashion. Major errors were immediately evaluated and discussed after each conversion attempt.

Clinical Scenario

A coordinator with experience in urologic surgery and outside of the training group presented different hypothetical crisis scenario in a sequence that could eventually end up in a conversion. The human dummy had a preselected order of cardiac events, known only to the coordinator. The 2 clinical scenarios requiring OC were randomly simulated: a cardiac arrest or a massive bleeding from a renal artery that surgeons were not skillful enough to clamp immediately.

Theoretical Training

The coordinator presented a formal training lesson about the essential role of simulation in surgical education. Then, major historical surgical errors reported in the existing literature were reviewed. A motivational and team building section was then organized. Possible errors in OC during RAPN and room layout were evaluated by the group. Discussion and team building were encouraged. Clinical scenarios that could or could not require an OC were examined and discussed. Theoretical training took as much time as needed to allow all the participants to be involved in the discussion.

Surgical Room Setup and Human Simulation Model Preparation

The simulation took place in a 5 × 7 m operating room. The furniture disposition in the surgery room is depicted in supplementary Figure S2. The human simulation model was placed in a lateral right decubitus position as for standard RAPN procedure and the trocars were secured to the simulation model. The Da Vinci robot SI was docked to the trocars. Three endowrist instruments and a camera were introduced into the trocar in direct contact with the simulation model.

Data Evaluation and Statistical Analysis

At the end of all the simulations, 2 independent physicians of the same department reviewed the videos. Errors were categorized as robot movement errors (yes vs no), space conflict between operators (yes vs no), communication errors between operators (yes vs no), lack of leadership (yes vs no), lack of tasks sequence (yes vs no), loss of sterility (yes vs no), accidental fall of surgical devices (yes vs no). The classification of errors during the video analysis (Supplementary Table S1) was based on the experience collected in our previous publication.[11] One point was assigned for every error made by each member of the team during the 20 simulations. Inconsistent findings between the 2 readers were discussed and agreed upon consensus.

Frequencies and ratios were reported for categorical variable, whereas medians and interquartile ranges were used for continues variable. Wilcoxon signed-rank test and chi-square test were used to compare, respectively, continuous and categorical variable. A linear correlation analysis was performed to assess the relationship between the number of previous conversion attempts and total number of errors and between total number of conversion attempts and the TC. The data were analyzed with the Statistical Package JMP 12 (SAS). All statistical tests were 2-sided with an alpha level of 0.05.

RESULTS

General characteristics of each group are described in Supplementary Table S2. No differences were found between the pre-simulation groups' characteristics.