MINIMALLY INVASIVE TRAINING IN UROLOGIC ONCOLOGY

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Summary.- Use of minimally invasive surgical (MIS) techniques continues to expand in the field of urologic oncology; however, proficiency in these techniques is subject to a learning curve. Current training paradigms have incorporated MIS, but in a non-standardized fashion. Residency work-hour restrictions and ethical concerns may influence efforts to deliver adequate training during a defined residency period. Post-residency fellowships or mini-courses may help urologists gain proficiency in these skills, but are time-consuming and may not provide adequate exposure. Surgical simulation with dry labs and augmentation with virtual reality are important adjuncts to operative training for MIS. The urologic oncologist must be familiar with open and MIS techniques to effectively treat cancer in the least morbid way possible and adapt to the ever-changing field of MIS with dynamic training paradigms.

Keywords: Minimally invasive surgical procedures. Laparoscopic surgery. Urologic neoplasms.

Resumen.- La utilización de la cirugía mínimamente invasiva (CMI) continúa expandiéndose en el campo de la urología oncológica; sin embargo, el dominio de estas técnicas está sujeto a una curva de aprendizaje. Los modelos de entrenamiento actuales han incorporado la CMI pero de una forma no estándarizada. Las restricciones del horario laboral de los residentes y las preocupaciones éticas pueden influenciar los esfuerzos para ofrecer un entrenamiento adecuado durante un período definido de la residencia. Los “fellowships” o mini cursos después de la residencia pueden ayudar a los urólogos a ganar competencia en estas destrezas, pero consumen tiempo y puede que no faciliten una exposición adecuada. La simulación quirúrgica con “pelvitrainers” y la realidad virtual aumentada son complementos importantes para el entrenamiento de las operaciones en CMI. El urólogo oncológico debe estar familiarizado con las técnicas abiertas y de CMI para tratar efectivamente el cáncer de la manera menos mórbita posible.

Palabras clave: Operaciones quirúrgicas mínimamente invasivas. Cirugía laparoscópica. Neoplasias urológicas.

INTRODUCTION

Minimally invasive surgical approaches for cancer treatment have become a standard of care since the first laparoscopic radical nephrectomy in 1990 (1). Since then, studies have shown that MIS...
approaches to many urologic procedures, including nephrectomy, partial nephrectomy, prostatectomy, and nephroureterectomy improve post-operative outcomes such as pain, length of hospital stay, and recovery to baseline activity compared to open surgical procedures (2-6). With data accumulating that these techniques provide equivalent oncologic outcomes for many procedures, the field of MIS continues to expand. For nephrectomy, oncologic efficacy and improved patient morbidity are well established, and laparoscopic nephrectomy is now considered a standard of care for appropriate patients with renal masses (7). Robotic surgery has also expanded dramatically, particularly in urology. Robot-assisted laparoscopic prostatectomy (RALP) was first reported in 2001 (8). Currently, over 65 percent of prostatectomies performed in the United States are accomplished with robotic systems (9). In 2010, a total of 217,730 new cases of prostate cancer were diagnosed in the U.S. (10). The use of PSA screening has led to an increase in the number of patients diagnosed with prostate cancer and the number of patients who are potentially candidates for RALP.

Even as use of robotic assisted-surgery and laparoscopy has become widespread, techniques such as laparoendoscopic single site surgery (LESS) and natural orifice transluminal endoscopic surgery (NOTES) have emerged as new modalities in MIS (11-13). Thus, the urologic oncologist must be fully aware of the range of surgical approaches to urologic cancers, which includes knowledge of open, laparoscopic, and robotic-assisted techniques, while maintaining flexibility to develop new skills (14). Training paradigms in MIS must respond dynamically to an increasing array of technologies (e.g., radiofrequency ablation, cryoablation, HIFU) and areas of expertise (e.g., radiology, medical oncology) that the urologic oncologist must be able to integrate into a comprehensive multidisciplinary approach for treatment of cancer patients.

Current Training Paradigms for MIS

The Halsted model of surgical education for open surgery (observe, assist, perform) can be adapted for MIS, however, MIS requires a unique skill set, particularly when using the DaVinci robotic system. Residency exposure to these techniques has increased as use of MIS has become more widespread, however, there may still be a lack of experienced surgeons who feel comfortable enough with MIS and robotics to provide an adequate educational experience for trainees. Thus, the amount of training that residents receive may be variable.

Abdelshehid et al, showed that urologists were more likely to practice laparoscopy if they had received training during residency (14). Prior surveys indicated that less than one third of urology residents felt they would utilize robotic surgery post-residency, and less than 40 percent felt that they had received adequate training during residency in laparoscopic procedures (15). Guru, et al, reported results of an international survey of 44 countries in 2008 that showed that although 78 percent of recipients felt that robotic surgical proficiency was adequate for providing optimal patient care, only 20 percent of respondents were performing RALP (16). In 2005, an AUA survey indicated that 47 percent of academic centers were performing greater than 100 laparoscopic cases per year and 54 percent of programs were performing robotic surgery. However, only 39 percent of chief residents felt that they had average or acceptable experience with laparoscopy, although this was improved compared to 15 percent from a 2003 survey in the Midwest (15,17). Although laparoscopy and robotics are expanding rapidly in academic centers, there may not be adequate volume for residents such that they are comfortable performing these procedures post-residency without additional specialty training.

The need for expanded training in MIS is further complicated by continuing restrictions of residency work hours as well as ethical and potential medicolegal concerns regarding patient safety. Although surgical outcomes are not affected by residency training programs, the existence of a learning curve to obtain acceptable results, especially with complex procedures such as RALP, highlights the challenge of acquiring adequate MIS exposure during residency. The current learning curve for RALP has been reported to be between 150 to 250 cases to achieve results in continence, potency, and positive margin rates routinely reported by experienced surgeons (18). Furthermore, as technical advances are made in the fields of robotics and laparoscopy and new techniques are introduced, urologic training must adapt to train residents in fields that attending surgeons are often learning themselves. Grover et al, proposed a training paradigm for RALP where residents start by learning technical aspects of robot docking and function, followed by observing an experienced bedside assistant, then performing the bedside assistant role, and finally advancing to the console (19). Division of the procedure into consecutive tasks and requiring competency with one before progressing to the next has also been shown to improve resident operative times (20). In order to obtain adequate training, residents and established urologists who are not familiar with MIS techniques have several options to learn these skills following residency.
Post-Residency Training

MIS approaches were originally taught primarily in endourologic fellowships with oncology programs subsequently engaging in MIS training as an essential curricular component. Currently, endourology or oncology-based fellowships are the two main pathways for post-residency training in MIS. Accredited fellowships in urologic oncology require 12 months of clinical training, which includes MIS. Formal fellowship training is a significant time commitment, and may not be practical for urologists already in clinical practice, thus courses and “mini-residencies” have been developed.

Courses are typically three to seven days in length and involve inanimate tasks, animal/wet labs, and operating room experience for practicing urologists. The program at the University of California at Irvine reported that after a mini-course, 95 percent of attendees subsequently went on to perform RALP (21). Clearly, proficiency and progression through a learning curve cannot be achieved in a short mini-course thus some programs offer extended proctoring opportunities; however, there is concern that short courses do not provide adequate surgical volume or training to enable novice MIS surgeons to perform procedures independently with acceptable results. Courses may be more appropriate for urologists who already have some MIS training and are seeking to further improve their skills. Mini-residencies range on the order of months and aim to provide a concentrated experience with adequate surgical volume. Despite the popularity of these short training programs, studies have shown that urologists trained in formal fellowships compared to mini-courses are more likely to have a sustained commitment to MIS, and also have lower complication rates (22).

The Role for Surgical Simulation

Learning MIS skills in the operating room can be time consuming and requires adequate surgical volume to achieve proficiency, but advances in surgical simulation can augment learning and enable surgeons to master skills outside the operating room. Use of simulators has been shown to improve both inanimate skills as well as subjective intraoperative performance. Studies have also shown that an offline DaVinci robotic simulator can teach skills similar to a dry lab with the robot, and can be used to discriminate between expert and novice robot users (23). Lerner et al reported on the Mimic dV-Trainer, a simulation interface with foot pedals, endowrists, and a stereoscopic display that can be used for inanimate training tasks, or with a virtual anatomy simulator. They found similar improvement in inanimate skills with the Mimic trainer compared to the DaVinci simulator, except for knot tying and string-running (24). Further refinement of these types of simulators could help offset the expense and inconvenience of using the DaVinci robot as a trainer. Similar trainers have also been developed for laparoscopy (25).

Simulation allows acquisition and practice of skills in a low stress environment without affecting patient safety. Addition of virtual reality can provide more realistic environments for training. Although animal models are more realistic than inanimate or virtual reality simulators, their use is hampered by cost and access to veterinary facilities. The costs of simulation are borne upfront, but over time may be more cost-effective than training in the operating room alone. The cost of the RALP learning curve has been estimated at $217,034 (USD) when training and operative time are taken into account (15). As work-hour restrictions potentially reduce available operative time for residents, simulation can help augment MIS skill learning by trainees.

CONCLUSIONS

Urologic oncologists must adapt to the ever-changing field of MIS with dynamic training paradigms. To do so, we must standardize laparoscopic and robotic training during residency, invest in surgical simulation to augment education, and encourage specialization in the form of fellowship training. Although MIS training is associated with significant cost, the potential benefits of providing optimal clinical outcomes while reducing morbidity require that we continue to utilize and critically evaluate MIS techniques.

REFERENCES AND RECOMMENDED READINGS

(*of special interest, **of outstanding interest)

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