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Teaching daVinci Robot® Surgical System – A New Paradigm

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Das rasche Wachstum des Bereichs Roboterchirurgie hat sich auch auf die akademischen Lehrprogramme ausgewirkt. Die herkömmliche Struktur der chirurgischen Ausbildungs- und Lehrtätigkeiten ist für die Vermittlung der Roboterchirurgie nicht besonders gut geeignet. Materialien und Methoden: Erfahrene Laparoskopie-Chirurgen können sich in speziellen Schulungskursen die Feinheiten der Roboterchirurgie relativ leicht aneignen. Dies gilt nicht für relativ unerfahrene chirurgische Praktikanten, wenngleich den Ausbildungsprogrammen auf jeden Fall die Verantwortung zukommt, auch das Fachgebiet der Robotertechnik zu lehren. Die Richtlinien des Amerikanischen Urologenverbands und des Accreditation Council on Graduate Medical Education werden geprüft und bei den Versuchen zur Bewältigung dieser Probleme herangezogen. Die einzelnen Verfahrensschritte, insbesondere die Prostatektomie, werden aus der Lehrendenperspektive betrachtet. Ergebnisse: Ein Curriculum der Roboterchirurgie kann in das Gesamtausbildungsprogramm erfolgreich integriert werden. Die Konsolenzeit wird auf die Erfahrung als Assistent am Krankenbett abgestimmt, ebenso wie die Entwicklung grundlegender laparoskopischer Fertigkeiten und eines Verständnisses der optischen Anatomie. Die Kompetenz als Klinikassistent ist erforderlich, bevor weitere Fortschritte zu den höheren Stufen der Konsolenbedienung erwogen werden können. Die chirurgischen Schritte werden in logische Fortschritte mit Fertigkeitseinheiten in verschiedenen Segmenten unterteilt, ehe eine Reihe von Segmenten zusammengesetzt werden kann, um signifikante Abschnitte der eigentlichen Operation zu ergeben. Schlußfolgerung: Das Lehren der Roboterchirurgie bringt neue und bislang unbekannte Schwierigkeiten mit sich. Diese neue Art der Chirurgie erfordert neue, innovative Lehrmethoden mit den obersten Zielen Sicherheit und Wirksamkeit. Es wird leichter werden, wenn auf dem Gebiet der Roboterchirurgie insgesamt mehr Erfahrungswerte vorliegen.

The rapid growth of the field of robotic surgery has introduced the new demands on academic teaching programs. The conventional structure of surgical training and teaching activities does not lend itself well to teaching of robotic surgery. Materials and Methods: Experienced laparoscopic surgeons can undertake special training courses to adopt with relative ease to the nuances of robotic surgery. These methodologies do not apply to relatively inexperienced surgical trainees, nevertheless teaching programs have a responsibility to educate in the area of robotics. Guidelines of the American Board of Urology and the Accreditation Council on Graduate Medical Education are reviewed and incorporated into rational attempts to address this issue. The steps of the procedure, especially prostatectomy, is considered from the teaching perspective. Results: A curriculum on robotic surgery can be successfully integrated into the overall training program. The consol time is balanced against the experience as a bedside assistant, and the development of basic laparoscopic skills and understanding of the optical anatomy. Competence as a bedside assistant is required before further advances can be considered to the higher stages of console operation. The surgical steps are broken down to lend themselves as a logical progression of skill sets of individual segments, before a series of segments may be put together to accomplish significant portions of the actual operation. Conclusions: Teaching robotic surgery presents new and previously unencountered difficulties. This novel surgery requires new innovative teaching methods with safety and efficacy as required outcomes. It will become easier as greater overall experience is developed in the field of robotic surgery.
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The demand for urologists skilled in minimally invasive surgery vastly exceeds the supply. More and more open urological procedures are done with the help of endoscopes, laparoscopes and now with the assistance of a robot. It has already captured the public attention. At places where there is a shortage of urologists trained in laparoscopic and robotic surgery, general surgeons with laparoscopic skills have proceeded to the patient's request for urological surgery (e.g. laparoscopic nephrectomy, laparoscopic adrenalectomy). Currently, public demand is driving the need at a very fast pace [1].

The academic centers are facing the challenge to train a whole generation of urologists in laparoscopic and robotic surgery. Currently, there are only 22 approved fellowships in endourology-laparoscopy in the United States. There are only a few residency programs in which laparoscopy and robotic surgery is integrated into the training program.

Teaching Model

In the traditional model of teaching, the mentor has done hundreds of cases. The trainee does 25–50 cases under the supervision of the mentor, e.g. 25–50 cases of transurethral resection of prostate (TURP) or 25–50 cases of radical prostatectomy. In the case of the robot-assisted surgery (RAS), the mentors may have very limited experience themselves. Here, senior student (mentor) is teaching junior student (trainee).

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Robot Assistance

In RAS, surgery is performed while looking at a monitor. There is a lack of heptic feedback. The surgeon cannot feel the texture of the tissue upon which he is working. The counterintuitive movement of the instrument and hand-eye coordination take more time to learn compared to open surgery [2].

In contrast with general surgery, urology lacks simple procedures to gain experience from. In expanding reconstructive laparoscopic procedures, high levels of dexterity and suturing skills are needed. The new phenomenon has already started. Many urologists-in training are learning minimally invasive surgery without performing the procedure in a conventional way (e.g. pyeloplasty, urethro-vesical suturing during laparoscopic radical prostatectomy). Therefore, there is a need to develop an integrated program to improve robot-assisted laparoscopic competence during residency training [2].

It has been hypothesized that the robot system enhances surgical dexterity by removing the tremor and adding motion scale. The daVinci Robot® Surgical System has been proven to decrease the time of in-vitro performance of different drills [3, 4]. It allows for a more rapid achievement in dexterity and suturing skills. The features of tremor filtration and motion scale were studied in a medical student population. There was no difference in tremor filtration after robotic assistance or unassisted laparoscopy, but moderate and fine motion scale improved accuracy significantly over traditional laparoscopy. It made the operator equally effective with dominant and non-dominant hand [5]. At present, no definite studies over the added real-life surgery and training value of the robot exist.

Clinical Competence

Surgical competence is a complex quality that goes beyond surgical skills. The Accreditation Council on Graduate Medical Education (ACGME) has defined domains in which competence can be measured: provision of patient care, medical knowledge, practice-based learning and improvement, interpersonal communication skills and system-based practice. The currently available tests assess only motor skills (dexterity) in laparoscopy training. The evaluation only assesses a given moment in a surgeon's career.

Training Phase

For the trainee, didactic and videotape sessions are informational in nature. Watching live surgery at courses and in the operating room is also helpful. Non-clinical hands-on experience is achieved via pelvic trainers, animal laboratories/cadaver dissection and a Robot Intuitive® course. In the clinical training phase, surgical skills are acquired under the direct guidance of a surgeon-mentor. Initially working as bedside assistance, the trainee develops basic laparoscopic skills, understanding of the optical anatomy, positioning of the patient and access. Thorough understanding of the robot function is also a critical pre-requisite. Once the required skills are acquired, then the trainee can work on the console for the selected task of operation. The surgical steps are broken down to lend themselves as a logical progression of skill sets of individual segments, before a series of segments may be put together to accomplish a significant portion of the actual operation.

The steps of the prostatectomy are considered here from perspective of sequence.

1. Establish access (mobilize the adhesions, mobilize the bladder)
2. Lymph node dissection
3. De-fat prostate
4. Clean/open endopelvic fascia
5. Puboprostatic ligament
6. Dorsal vein stitch
7. Anterior bladder neck
8. Posterior bladder neck
9. Seminal vesicles
10. Pedicles
11. Denonviller's fascia
12. Nerve sparing
13. Apical dissection
14. Anastomosis

The above steps are broken down to lend themselves as logical progression of skill sets for trainee.

Tasks

1. Learn 1st assistant role
2. Establish access
3. De-fat the prostate
4. Clean/open endopelvic fascia
5. Intraperitoneal mobilization of bladder
6. Dissection of seminal vesicles
7. Anterior bladder neck
8. Lymph node dissection
9. Dorsal vein stitch
10. Posterior bladder neck
11. Pedicle control
12. Nerve sparing
13. Anastomosis

Credentialing

After completing structured training in a residency/fellowship program, the trainee can be prepared for robot assisted laparoscopic surgery. At present, we believe that 4 proctored cases in RAP with less than 4 hours consol time should be the minimum requirement. At our institute, the credential committee uses these criteria as one of the guidelines to grant privileges for robot assisted prostate surgery.

Future of Training Program

In the future, training for robotic surgery will be done on simulators. Only after mastering a series of skills and procedural exercises, the trainee will assist in robotic surgery. The program with built-in "stressor" will monitor each individual's response to 'unexpected' circumstances, e.g. bowel injury, vascular injury etc. These hand-on exercises will become part of the postgraduate examination. It will help in effective and safe transfer of new skills [6]. Until we use a simulator for robotic surgical training, our approach of training will go a long way in teaching robotic urological procedures in urology programs.

Conclusions

Teaching robotic surgery presents new and previously unencountered difficulties. This novel surgery requires new innovative teaching methods with safety and efficacy as required outcomes. However, teaching the procedure remains an important educational goal, which will become easier as greater overall experience is developed in the field of robotic surgery.

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