Editorial

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Current status of simulation-based training and assessment in urological robot-assisted surgery

There has been a steady, almost exponential increase in the number of robot-assisted surgeries (RAS) during the past few decades, and this increase has brought about the need to develop simulation-enhanced training [1]. Surgical education has been vastly influenced by the military and aviation industries, which excessively depend on simulation training before real-life exposure [2]. Through the use of simulation, a huge part of the procedure-learning curve can be gained using training models; thus, these simulators are considered a cost-effective answer of the procurement of basic technical skills, especially in RAS to enhance practice in the operating room. As a result, surgical simulation has advanced rapidly, and has become an established and valid approach of training [3].

Simulators available on the market are categorized as low-fidelity, high-fidelity, augmented-reality (AR), and virtual reality (VR) [4]. Low-fidelity simulators, such as the dry laparoscopic box trainer, are cheap and movable, but they are not able to recreate real surgical circumstances. High-fidelity simulators contain cadaveric and animal models, which furnish more realistic training but are not as easily usable for several reasons, such as costs, ethical issues, and so on. AR simulators furnish highly realistic surgical circumstances, containing surgical cases such as anatomical illustrations, narrative instructions, guided movements, radical prostatectomy, and so on [5]. VR simulators use a computer-derived virtual surgical area with tactile feedback and are considered a probable answer for learning of basic techniques in RAS. Currently there are 5 VR simulators available on the market: the Surgical Education Platform (SimSurgery, Oslo, Norway), the Robotic Surgical System (Simulated Surgical Systems, San Jose, CA, USA), the dV-Trainer (Mimic, Seattle, WA, USA), the da Vinci Skills Simulator (Intuitive Surgical, Sunnyvale, CA, USA), and the recently introduced RobotiX Mentor (3D Systems, Simbionix Products, Cleveland, OH, USA). However, there is a demand to validate VR training exercises that are to be performed and standardized in a surgical curriculum and to diminish costs. Additionally, because there is a lack of researches comparing the different VR simulators, recent evidence cannot certify the most effective simulator for training. More importantly, there is a cardinal demand to identify whether there is a correlation between the robotic VR training and surgical complication rates. It is clear that appropriate evaluation of these issues will be crucial in establishing the aim of VR training [1]. Furthermore, patient-specific simulations, in the form of VR and 3-dimensional (3D)-printed bench model, have become more liberally accessible in current years [6]. A recently advanced laparoscopic renal VR simulator that utilizes abdominal computed tomography (CT) scans to make examples from patient-specific data has been advanced to make surgeons to prepare preoperatively. Similarly, an increasing number of models are now being created by 3D printing technology. Although 3D printing might be so expensive for use in all patients, these concepts can be beneficial in unusual and complex cases. At the developed stage of training, a library of such cases could make many of surgeons to prepare for complex operations [2].

Team training is a significant notion that has been absolutely neglected in the literature. This concept is especially important in RAS as the surgeon is at the console away from the patient and, thus, depends on assistants for the safety of patient. The Xperience Team Trainer was created to exercise the surgeon and the assistant. Although it is currently used alongside universal techniques modules, it is expected that procedure specific modules will also be created [7].

Many studies have identified that learning curve for a beginner urologic surgeon appears to be better with simulator training, especially in endourology and simulation-based urological training has made marked developments.

Furthermore, a number of procedure-specific curricula have been reported and validated. The European Association of Urology Robotic Urology Section has promoted a 12-week training curriculum for robot-assisted radical prostatectomy [7].

However, few studies have compared the available models to evaluate their strengths and weaknesses. Most studies identify face and content validity, which are subjective means of validation, as opposed to more objective means including concurrent and predictive validity in training and assessment. Moreover there is no described evidence of skill transfer from simulation to clinical surgery on actual patients.

For this reason, large-scale, multicenter, randomized controlled studies are needed to resolve this problem. Efforts should continue to utilize the recently available simulators in a curricular approach, including the nontechnical skills training. In aspect of the current evidence, the suggested universal and supplementary simulation curricula for urological RAS training should help to enhance operating-room experience and diminish many of its associated complications.

CONFLICTS OF INTEREST

The author has nothing to disclose.

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