Improving Rhinology Skills with Simulation

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KEY POINTS

- The use of surgical simulators in teaching residents the basic technical foundation and skills necessary to be proficient in rhinological surgery before operating on the live patient is discussed.
- An overview is given of both high-fidelity and low-fidelity rhinological simulators, and the keys to development of novel and validated simulators are highlighted.
- The importance of the combination of high-fidelity and low-fidelity simulators on maximizing resident education and training in rhinological surgery is clarified.

INTRODUCTION

With the advent of work-restriction hours and limited time availability for training surgical residents in light of increased scrutiny in providing excellent patient care with reduced risk, it's become increasingly important to find novel and efficient ways of improving the surgical knowledge and skill of residents. Surgical simulation allows trainees the opportunity to hone their skills in a standardized and monitored environment before applying the skills on a patient. Simulation has many benefits including (Brandon Hall Research News, 2005)

- It provides a safe environment for the trainee to make mistakes
- It significantly reduces training time by creating the most efficient path to solving specific problems
- The student may practice procedures such as flying in hazardous conditions
- Creation of simulations leads to improvements in the process and can help streamline the processes being taught
- There is significant retention of the simulation procedures

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- The modeling of expert behaviors during simulation training helps transfer expert thinking to the trainee
- Cost efficiency of simulations allows the user the ability to practice without risk of damaging or pulling expensive equipment offline.

Medical-simulation validation studies have shown that the skills learned by trainees using a simulator have significant improved student's performances by decreasing operating times, decreasing errors, and improving efficiency, ultimately reducing the time to proficiency and improving overall patient safety.[1] High-fidelity medical simulations that allow surgeons to perform procedures before doing the same procedure on a patient have shown to have great impact on skills training and learning.[2] The resident is allowed to make mistakes and learn from them in a simulated environment without compromising patient safety.

Surgical rhinology, which is predominately performed endoscopically, lends itself to a variety of innovative and creative ways to teach residents outside of the operating room. One such way is through virtual reality, which has been shown to be an important tool for medical and surgical training and education in a variety of fields.[3–7] It has provided residents an introduction to a wide breadth of laparoscopic, gastrointestinal, plastic, ophthalmologic, dermatologic, urologic, and laryngological procedures.[8–15]

Rhinological simulation not only allows students to practice and learn the procedure and anatomy[15,16] but can also help train and reinforce trainees comfort level with, technique, and various rhinological instruments and their correct application. Overall, this increases the resident's proficiency in performing simple to complex rhinological procedures before patient care.[17]

HISTORY OF SIMULATION IN RHINOLOGY

The practice of simulation has been around for centuries, particularly in the military field in which simulation has been used to practice skills, problem solving, and judgment.[18] It was not until the twentieth century that human patient simulation helped to evolve medical learning and practice,[18] and increased the intensity of medical training through simulation, similar to other fields such as aviation and the military.[19]

Given the advent of endoscopic techniques and its effectiveness in nasal and paranasal sinus surgery, the need for training surgeons capable of operating with the endoscope and surgical tools in a complex anatomic environment was of utmost importance.[20] From 1995 to 1998, collaboration between multiple institutions and The Lockheed Martin Corporation produced the first virtual reality simulator in endoscopic sinus surgery, the endoscopic sinus surgery simulator (ES3).[21] The ES3 established simulation training in endoscopic sinus surgery and set the trend for the development of future rhinological simulators.

VALIDATION

The validation of surgical simulators plays a vital role in their acceptance as effective training tools. Though the process of validation has been extensively discussed elsewhere,[22] numerous validation benchmarks are currently used with the most subjective validation benchmarks being used in the initial phases of test construction. The various validation benchmarks include

- Face validity and content validity: rely on input of experts to determine whether the contents of the test are appropriate and cohesive
- Concurrent validity: compare existing training curriculums or current gold standard assessments to those of the simulator