Study: Simulator Training Improves Resident Performance in Arthroscopy

Better results seen in shoulder procedures compared with classroom training alone

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Orthopaedic surgery residents who trained with a surgical simulator performed better in both knee and shoulder arthroscopy than residents who received traditional training, reported a study presented at the annual meeting of the American Orthopaedic Society for Sports Medicine.

The study, presented by Brian J. Rebolledo, MD, of the Hospital for Special Surgery, involved 14 junior residents at a single institution randomized to receive knee and shoulder arthroscopy training with a surgical simulator (n = 8) or didactic lectures with arthroscopy models (n = 6).

Those who trained with a surgical simulator outperformed the didactic-trained residents in shoulder arthroscopy by time to completion (P = 0.02) and an injury grading index (IGI) (P = 0.01), used to subjectively assess arthroscopy handling. In addition, a trend toward improved performance of knee arthroscopy by the simulator-trained group was found by time to completion (P = 0.09) and IGI (P = 0.08).

According to Dr. Rebolledo, the study found that training with a surgical simulator “translated to improved performance in diagnostic shoulder arthroscopy in junior-level residents. Although the simulator-trained group also showed improved skill in knee arthroscopy, the differences found did not reach significance.”

Simulator versus classroom

In the study, participating residents were randomized to train either on a virtual reality surgical simulator for a total of 2.5 hours or undergo 2 hours of didactic lectures on basic arthroscopy, including the use of models. Following their respective training, the arthroscopic performance of each resident in both shoulder and knee arthroscopy was assessed using a cadaveric model. No resident had simulation training experience prior to the study, and none had a previous rotation that encompassed either shoulder or knee arthroscopy.

Arthroscopy training using the surgical simulator was modeled to replicate the surgical experience. The simulator device had a high-definition monitor with two robotic arms that incorporated force-reflective technology with interactive live feedback to the participant. The camera used in the training modules showed a 30-degree view for both shoulder and knee modules. A “blue sphere” program designated landmarks to be probed as part of the diagnostic arthroscopy modules.

Didactic lectures received by study participants included a slide-show presentation on basic arthroscopy, the use of arthroscopy instruments used in the operating room, steps involved in diagnostic arthroscopy of the shoulder and knee, and instrument models that residents could handle to gain familiarity with them.

After completion of arthroscopy training, a cadaveric model of both shoulder and knee arthroscopy was used to assess arthroscopic performance in both groups. Testing included time required to complete a standardized arthroscopy checklist for both shoulder and knee cadavers, and an IGI to assess dexterity probe collisions and presumed intra-articular injury. Two senior investigators determined each resident’s IGI based on direct observation during cadaver testing. Both instructors were blinded to the type of training each resident had received. Checklists were used to assess performance and time to completion for both the shoulder and knee. Portal landmarks and incisions were made prior to testing so that instruments could be introduced more readily with a diminished effect on timing measurements for each participant.

The simulator-trained group completed the shoulder checklist approximately 3 minutes faster than the traditionally trained group (mean 6.4 minutes versus 9.9 minutes) (Fig. 1). A trend toward improved performance in knee arthroscopy was also noted in the simulator-trained group (mean 5.1 minutes versus 8.0 minutes).

In addition, the simulator-trained group had better IGI scores in both shoulder and knee models than the traditionally trained group.

Change in the training model

Under new requirements for orthopaedic surgery residents, basic arthroscopy training occurs in the first year of training. However, PGY-1 resident training also includes 6 months of structured education on nonorthopaedic rotations.

“arthritis expanding requirements mean that junior orthopaedic surgery residents have a limited time to obtain early surgical training,” said Dr. Rebolledo. This concern is heightened by work-hour restrictions, putting pressure on residency programs to adapt to these parameters while still providing a high-quality educational experience for residents.

According to the authors, arthroscopy simulation training might serve to sustain the quality of the experience, but further exploration of the role of simulated surgery is warranted. “Invariably, the operating room environment could also have an impact on a...”

Bottom Line

- Arthroscopy simulation has the potential to optimize the surgical training experience.
- In this study, junior residents were randomized to arthroscopy simulator training or didactic instruction for diagnostic shoulder and knee arthroscopy procedures and then assessed on cadaver models based on time to completion of a checklist and an injury grading index.
- Residents randomized to arthroscopy simulator training showed significantly better timed performance in diagnostic shoulder procedures compared to the didactic-trained group and demonstrated a trend toward better timed performance in knee procedures.
- The study was limited by being underpowered due to the number of residents at the investigators’ institution.

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