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The Impact of Simulation-Based Training in Endovascular Surgery

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INTRODUCTION

Endovascular surgery has rapidly advanced, offering less invasive options for treating vascular conditions (1). However, mastering these techniques requires rigorous training. Traditional methods like apprenticeships may not fully prepare surgeons for the complexities of endovascular procedures (2,3).

Simulation-based training, using virtual reality or physical models, provides a safe environment for trainees to practice and refine their skills (4). While previous studies have shown the benefits of simulation-based training in other surgical fields (5,6), its specific impact on endovascular surgery is not yet fully understood. Determining its effectiveness is vital for improving surgical education and ensuring high-quality patient care.

AIM

This study aims to evaluate the impact of simulation-based training on the performance of surgical residents in endovascular procedures. By comparing the outcomes of simulation-based training with traditional methods, we seek to ascertain the potential benefits of incorporating simulation into the training curriculum for endovascular surgery. Assessing performance metrics such as objective structured assessment of technical skills (OSATS) scores, number of sessions to proficiency, and skill retention at follow-up will provide valuable insights into the efficacy and durability of simulation-based training. Ultimately, this research endeavors to inform evidence-based strategies for enhancing surgical education and improving patient care in the field of endovascular surgery.

The EndoSim ® VR Simulator

The EndoSim ® VR Simulator is a virtual reality tool used in endovascular surgery training. It provides a simulated environment where trainees can practice various procedures, offering realistic scenarios and feedback.

METHODS

A randomized controlled trial was conducted involving 50 surgical residents. Participants were divided into two groups: one received traditional training, while the other underwent simulation-based training using EndoSim ® VR Simulator. Performance was evaluated using objective structured assessment of technical skills (OSATS) scores, number of sessions to proficiency, and skill retention at 6 months. Independent assessors blinded to training methods evaluated OSATS scores.

The ANGIO Mentor simulator from Surgical Science

A cutting-edge simulator that provided a realistic and immersive environment for our participants to hone their endovascular skills. Its advanced features allowed for effective training, contributing significantly to our research findings.

Image from the Endovascular Basic Skills Module

The Endovascular Basic Skills module is a self-directed simulator environment offers interactive challenges in both non-anatomical and anatomical settings, with cases designed to simulate real-world scenarios. It aims to help physicians new to endovascular procedures learn and gain confidence in fundamental wire-catheter skills. Participants can practice techniques such as bifurcation crossover and stent-graft cannulation in a user-friendly and safe environment. Key objectives include mastering tool manipulation, understanding guidewire and catheter variations, and learning proper imaging techniques for optimal visualization of vessels.

RESULTS

The group that underwent simulation-based training (n=25) demonstrated a significant improvement in their performance. The mean OSATS score for this group was 85.2 ± 6.3, compared to the traditional training group (n=25) which had a mean OSATS score of 72.4 ± 7.1 ($p<0.001$).

Furthermore, the simulation group showed a faster skill acquisition, achieving a mean proficiency after 15.3 ± 2.1 sessions, compared to 25.4 ± 3.2 sessions in the traditional group ($p<0.001$). The simulation group also exhibited higher skill retention rates, with 92% of the participants maintaining their proficiency level at a 6-month follow-up, compared to only 68% in the traditional group.

Performance Comparison of Simulation-Based and Traditional Training Groups

Outcome Measure	Simulation-Based Training Group (n=25)	Traditional Training Group (n=25)
Mean OSATS Score (mean ± SD)	85.2 ± 6.3	72.4 ± 7.1
Sessions to Proficiency (mean ± SD)	15.3 ± 2.1	25.4 ± 3.2
Skill Retention Rate (%)	92%	68%

CONCLUSIONS

Simulation-based training in endovascular surgery significantly improves surgical performance, suggesting its potential as a valuable tool in surgical education. Further research is needed to explore its impact on patient outcomes.

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