CSMEN – Simulation Publications Update Bulletin October 2021 Surgery

Welcome

Welcome to the Simulation Publications Update a service brought to you by CSMEN in partnership with NES Knowledge Network.

The focus for this Simulation bulletin is on how simulation is used in Surgery. The reviews selected include a wide variety of topics including use of VR and AR.

These articles may be of interest or relevance to your current role in NHS Scotland. The articles may also be of use in your research. These articles are from those journals we currently subscribe to. If there are any articles or journals that you would like us to add/consider please let us know.

If you would like to suggest a focus topic or become a reviewer, please email CSMEN.

The plan is to widen this service to focus on topic areas and to monitor its use and effectiveness so feedback would be much appreciated.

This bulletin was developed by Jean Ker former CSMEN Clinical Lead in partnership with Alan Gillies from NES Knowledge Network.

Access to Journals

Different journals have different processes for login so please follow the instructions for accessing the full text of the articles through the links provided.

On your behalf NES Knowledge Network subscribes to some journals direct and others via aggregators (ie. journal collections or full text databases). We use something called a 'link resolver' to link you via the best route using your NHS Scotland OpenAthens password. Some journals can detect that you're logging in from NHS premises, so won't ask for the OpenAthens password, but if you're accessing from home you may have to login. None of the links should require you to set up a separate login – where there are login boxes for personal accounts, look for an OpenAthens or 'institutional login' option as well, which will accept your OpenAthens password.

Focus: Use of Simulation based education in Surgery

[**Virtual reality warm-up before robot-assisted surgery: A randomized controlled trial**](#).
Kelly J.D., et al, The Journal of Surgical Research, Vol 264, 107-116. 2021.

This is an interesting paper from the USA which is a randomised controlled trial of the use of warm up before robotic surgery.

Introduction

The context of surgical errors in the USA is the setting for this study and reviews skill decay in relation to surgeons technical skills after a period of inactivity which should be highly relevant not just between operating lists each week but has probably been more pronounced following the pandemic. The introduction also reviews how to measure surgeons technical skills objectively. The da Vinci skills robotic simulator allows surgeons to practice technical skills

Methods

The study was undertaken in two phases;

Initially four centres were recruited to determine the magnitude of skill decay between two standard assessment intervals and to determine the curriculum content to optimise skill performance.

Once this was identified surgeons were randomised to receive warm up exercises or not on the da Vinci robotic simulator. Data were captured from the operating room and video data reviewed and analysed.

Results

No statistical significant difference in technical skill was observed between the two groups with no evidence of increased surgical readiness in the warm up group.

Discussion

In sports the prefrontal cortex and anterior cingulate cortex which are related to visual imagery and motion processing are in control of the initial phase of motor skill learning and warm up exercises enhances performance. There is a similar process in surgeons but warm-ups only appear to impact on novice surgeons.

Brief warm-ups have also been shown to improve intraoperative performance in laparoscopic procedures.

The results from this study are explored and reasons for finding no difference between the groups shared. These included only recording the first 15 minutes of surgery, the modules used for the virtual reality warm up not stimulating the key areas in the brain.

It is useful to see a study that did not produce expected positive significant results published.

Jean Ker

An indigenous virtual reality-based Simulator—a tool in surgical training, Aspari, A.R., et al, Indian Journal of Surgery, Vol 83, 1, 176-182. 2021.

The high costs associated with acquiring virtual reality (VR) surgical simulators have limited the universal availability of such trainers across institutions in India. This study aims to validate an indigenously designed Indian virtual reality simulation-based trainer as a valuable tool in surgical training. The performance parameters of ten laparoscopic basic surgical skill tasks were analysed. These included deviation from the desired path (error), total distance traversed in performing the task (distance in mm) and total time taken to complete the task (task completion time in seconds). One hundred seventy tasks performed by novices and 100 by experts were included for comparative analyses. The study found that these virtual reality-based simulators are a valid tool in surgical training that offer a wide range of exercises comparable to conventional trainers.

Effect of smartphone laparoscopy simulator on laparoscopic performance in medical students. Awal, W., et al, Journal of Surgical Research, 159-164. 2021.

This study aimed to investigate if a smartphone laparoscopy simulator, SimuSurg, was effective in improving laparoscopic skills in surgically inexperienced medical students. All participants performed three validated exercises in a laparoscopic box trainer and repeated them after 1 week. The intervention group spent the intervening time completing all levels in SimuSurg, whereas the control group refrained from any laparoscopic activity. The total score improved significantly between the two testing sessions for the intervention group but not for the control group. Scores for the nondominant hand improved significantly in the intervention group but not in the control group. There was no improvement in dominant hand scores for either the intervention or control groups. Interest in surgery was positively correlated with the baseline total scores; however, age, sex, and experience with video games were not.

Surgical cognitive simulation improves real-world surgical performance: Randomized study. Cragg J., et al, BJS Open, Vol 5, 3, 07 May 2021. 2021.

The application of psychological methods by surgeons to improve surgical performance is sparse. This may reflect the paucity of evidence that would help surgeons to use psychological techniques effectively. There is a need for novel approaches to see how cognitive training might be used to address these challenges. In this study surgical trainees were divided into intervention and control groups. The intervention group received training in surgical cognitive simulation (SCS) and was asked to apply the techniques while working in operating theatres. The authors concluded that the findings show that SCS training has a statistically significant impact in improving surgical performance. Subjective feedback suggests that surgeons are able to apply it in practice.

Evaluation of laparoscopy virtual reality training on the improvement of trainees' surgical skills. Elessawy M., et al, Medicina, Vol 57, 2: 02 Feb 2021.

This study evaluated the benefit of training with virtual reality simulation and sought to describe the short-term skill acquisition obtained by simulation training and to determine the factors affecting its magnitude. 63 participants were divided according to their level of experience into three groups: 16% residents; 46% specialists and 38% consultants. The authors concluded that virtual reality simulation established high ratings for both realism and training capacity, including clinical relevance, critical relevance, and maintaining training enthusiasm.

[**HoloPointer: A virtual augmented reality pointer for laparoscopic surgery training**](#). Heinrich F., et al, International Journal of Computer Assisted Radiology and Surgery, Vol 16, 1, 161-168. 2021.

In laparoscopic surgery training, experts guide novice physicians to desired instrument positions or indicate relevant areas of interest. These instructions are usually given via verbal communication or using physical pointing devices. This study trialled optical see-through augmented reality to visualize an interactive virtual pointer on the laparoscopic. Ten surgical trainees were guided by an experienced trainer during cholecystectomies on a laparoscopic training simulator. All trainees completed a virtual cholecystectomy with and without the interactive virtual pointer in alternating order. Results showed significantly improved economy of movement and error rates, as well as an overall improved user performance and the authors concluded that the proposed HoloPointer is a feasible and applicable tool for laparoscopic surgery training.

[**The role of simulation in training breast surgeons: A systematic review**](#). Kankam, H., et al, Annals of the Royal College of Surgeons of England, 318-323. 2021.

This review investigates the extent to which simulation of breast surgery procedures has been validated as a training tool. Only five articles met the inclusion criteria. The quality of the evidence presented in each article was low. Simulators were designed to train procedures such as breast augmentation, lesion biopsy and excision. Of these, breast biopsy was the most simulated procedure (three studies). The authors conclude that despite the abundance of breast surgery simulators created for trainees, few have been objectively validated and they only cover a narrow range of breast procedures. Although early results are promising, further studies are required before routine use of simulators is considered in breast surgery curricula.

[**Assessment of training and selected factors on speed and quality of performing different tasks on the endoscopic simulator**](#). Kasprzyk M., et al, Wideochirurgia I Inne Techniki Maloinwazyjne, Vol 16, 1. 2021.

This study aimed to determine the influence of selected factors, and examine the shape and the length of the learning curve, in performing simple tasks on an endoscopic simulator. Twenty students took part in 4 training sessions with a one-week break between sessions. They trained for 12 minutes and performed three tasks at each session on the endoscopic simulator. The study found that regardless of activities performed in free time, the shape of the learning curve was logarithmic. Improvement after the fourth session ranged from 50% to 75%. Performing specific activities in free time did not influence the results achieved on the simulator. The authors conclude that the length of the learning curve of performing simple tasks is quite short and the shape is logarithmic, and suggest that more complex exercises should be included in the training programme.

[**Virtual reality warm-up before robot-assisted surgery: A randomized controlled trial**](#). Kelly J.D., et al, The Journal of Surgical Research, Vol 264, 107-116. 2021.

The goals of this research were to identify the optimal virtual reality (VR) warm-up curriculum to prime a surgeon's technical skill and validate benefit in the operating room. The authors concluded that, counter to most existing literature in conventional laparoscopic surgery, performing a VR warm-up curriculum before robot-assisted human surgery does not significantly improve the technical skill of a practicing surgeon.

[Apprenticeship to simulation - the metamorphosis of surgical training](#), Khan, M.R. & Begum, S., JPMA - Journal of the Pakistan Medical Association, Vol 71, Supl 1 S72-S76 2021
This article describes the evolution and transformation of surgical training over time. Surgery is a dynamic specialty and surgical competencies are a combination of both technical and non-technical skills. After the inception of the art of surgery, surgical education and training has undergone incredible evolution. The first model of surgical training was introduced in the 19th century and is known as the 'apprenticeship model', followed by the famous 'Halstedian' model. However, a report by the Institute of Medicine challenged the teaching institutions to formulate alternative methods of surgical education to ensure patients' safety and to reduce the fear among patients of them being practised on. Teaching surgical skills outside the operating room to ensure patient safety has laid the foundation of simulation-based training in surgical education. More recently, the focus of surgical training and residency has shifted to competency and outcome-based models.

[Virtual experience of perioperative patients: Walking in the patients' shoes using virtual reality and blended learning](#). Kim H.Y., et al, International Journal of Environmental Research and Public Health, Vol 18, 12 Article Number: 6457: 02 Jun 2021.
This study examined the significance, nature, and structure of the virtual experience of perioperative patients as undergone by nursing students during their practical training through VR and blended learning. Data were collected through a focus group interview of 21 nursing students. Seven themes were identified: "placed in a passive position," "facing the limits of communication," "thinking of developing and improving competency as a nurse," "recognizing the importance of interacting with their patients", "learning vividly through experience", "engaging in a new type of participatory learning", and "designing nursing knowledge." The authors conclude that patient-centred care can be achieved through "patient experiences" and that empathizing with the "patient experience" is an essential quality.

[Validity and effectiveness of augmented reality in surgical education: A systematic review](#). Kovoor J.G., et al, Surgery. 2021.
The aim of this review was to evaluate the validity and effectiveness of augmented reality in surgical education, and to compare it with other simulation modalities. 24 studies met the eligibility criteria for inclusion, of which 2 were randomized. Overall, the majority, including 2 high-quality randomized controlled trials, demonstrated the validity and effectiveness of augmented reality in surgical education. However, the quality of the (non-randomized) studies was poor with marked heterogeneity. The authors conclude that results are encouraging, but additional high-quality studies, preferably in the real-life environment, are required.

[Arthroscopic simulation: The future of surgical training: A systematic review](#). Lakhani S., et al, JBJS Reviews, Vol 9, 3: 22 Mar 2021.
The aim of this review was to explore the recent research investigating the use of arthroscopy simulators in training and the teaching of surgical skills. 44 relevant studies were identified, involving benchtop or virtually simulated ankle, knee, shoulder, and hip arthroscopy environments. The majority of these studies demonstrated construct and transfer validity; considerably fewer studies demonstrated content and face validity. The authors conclude that further work should focus on the development of a more uniform simulator training course that can be compared with current intraoperative training in large-scale trials with long-term follow-up at tertiary centers.

Training benchmarks based on validated composite scores for the RobotiX robot-assisted surgery simulator on basic tasks. Leijte E., et al, Journal of Robotic Surgery, Vol 15, 1, 69-79. 2021.

The RobotiX robot-assisted virtual reality simulator aims to aid in the training of novice surgeons outside of the operating room. This study aimed to determine the validity evidence on multiple levels of the RobotiX simulator for basic skills. 27 participants were divided in either the novice, laparoscopic or robotic experienced group based on their minimally invasive surgical experience. Two basic tasks were performed: wristed manipulation (Task 1) and vessel energy dissection (Task 2). Content validity evidence was scored positively overall. Statistically significant differences between novices and robotic experienced participants (construct) was found for movements left, movements right, path length left, and time. Composite scores were statistically significantly different between robotic experienced and novice participants for Task 1 and Task 2. Calculated benchmark scores resulted in a minority of novices passing multiple parameters.

Innovations in urologic surgical training. Ma R., et al, Current Urology Reports, Vol 22 4, Article Number: 26. 2021.

This review aimed to summarize innovations in urologic surgical training in the past 5 years. It found that many assessment tools have been developed to objectively evaluate surgical skills and provide structured feedback to urologic trainees. A variety of simulation modalities (i.e., virtual/augmented reality, dry-lab, animal, and cadaver) have been utilized to facilitate the acquisition of surgical skills outside the high-stakes operating room environment. Three-dimensional printing has been used to create high-fidelity, immersive dry-lab models at a reasonable cost. Non-technical skills such as teamwork and decision-making have gained more attention. Structured surgical video review has been shown to improve surgical skills not only for trainees but also for qualified surgeons. The authors suggest that despite these advances, there is still an unfulfilled need for a standardized surgical training program covering both technical and non-technical skills.

Redesigning surgical training curriculum with simulation: Lessons from the OLIMPICS trial (Opinion: Invited Commentary). Mian, S.I., JAMA Ophthalmology, Vol 139, 1, 16-17. 2021.

The author discusses the Ophthalmic Learning and Improvement Initiative in Cataract Surgery (OLIMPICS) Trial, in which Dean et al present results of a randomized clinical study that aimed to assess if the addition of simulation-based surgical education to conventional training can improve cataract surgical competence in trainees. In the trial, the intervention group received a 5-day simulation-based cataract surgical course in addition to standard surgical training. The results suggested that for surgeons similar to the 50 participants in the trial, ophthalmologists receiving a 5-day simulation-based cataract surgical training course in addition to standard surgical training were likely to score between 14 and 19 points higher on a 40-point validated surgical competency assessment outcome compared with a control group of trainees only receiving standard surgical training. The author suggests that the lessons of the OLIMPICS Trial are applicable to all surgical curriculum planning with supplementation of traditional training with simulation-based courses to provide safe, effective, and efficient care for patients globally.