Virtual Simulation Training In A Fully Equipped Hybrid Operating Room

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Endovascular intervention is a treatment modality which has been rapidly embraced by physicians treating vascular disease. The endovascular technology has fundamentally changed the way of working in the operating room which in turn poses considerable perceptual, cognitive and psychomotor demands on the operator.

Invasive procedures are traditionally learned by repeated practice on patients. Trainees under supervision are exposed to a variety of patient cases over a number of years. This experience in dealing with a broad range of approaches and complications will hopefully balance the experience of the trainee with the demands of the clinical procedure.

Today, clinical practice does not offer the same opportunity for beginners to start training endovascular procedures by angiography as non-invasive modalities such as CT, MR and duplex ultrasound are increasingly used before a decision is made to treat a patient. Also, increased demands of productivity and ethical considerations have limited the exposure to in vivo training on patients. Therefore, new training strategies are needed for those specialists that have adopted the technique: vascular surgeons, cardiologists, cardiovascular surgeons and radiologists.

Animal lab training has traditionally provided training opportunities but poses other difficulties. Notwithstanding the ethical issues, animal anatomies vary significantly from the humans. Their response to medications, their metabolism and reactions also sufficiently differ from humans. Furthermore, the costs of such training experiences can be prohibitive. Combined, these circumstances pose considerable challenges to training, even the most basic endovascular skills in a controlled environment.

Training is slowly shifting away from an approach that relied on practice repetition towards simulation which affords the opportunity for the deliberate practice of many interventions without putting the patient at risk. Virtual reality simulation is a promising training method, where residents can train until a specific level of skill level is achieved and verified, outside the operating room (OR). This approach to training means that the early part of the learning curve is experienced and mastered in a simulated setting before they start work on real patients. It is now generally accepted, that training of (technical) skills should start in the skills laboratory.[1-4]

A further training consideration is that modern image-guided doctor performance is, in part, team-dependent. Learning technical skills is just one component of a successful procedure – the others are clinical judgment, communication and teamwork. Errors also occur because of non-technical aspects of performance. For example, communication problems have been found to be causal in 43% of errors made in surgery.[5] This has prompted an approach to training where simulations must reflect the interaction between technical and human elements of complex and dynamic work environments. From an interdisciplinary perspective the creation of an advanced simulation tool for training and assessment in a highly realistic operating environment with hybrid OR functionality is important. Since the complication rate is highest at the beginning of doctors' training, the goal of simulation-based training should be to reduce the patients' exposure to doctors practising at this point of the learning curve. This approach to training enhances patient safety and is also cost-effective.

For the training of complex, full-procedural technical and team skills an appropriate level of realism or fidelity must be attained. Virtual Reality training has been shown to transfer to improve the intra-operative performance in real life, with measures such as reduced time taken and fewer intra-operative errors recorded. Although training an entire procedure makes intuitive sense, its value to performance improvement in clinical environments needs to be proven.[6-14]

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However, technical skills are only one aspect of a procedural performance. A full understanding of complex tasks and decision-making also includes a mapping of the interventionists thought processes. The use of virtual reality in complex surgical and procedural skills training, aims to recreate the physical and psychological fidelity of real work environments which allow the trainee (and team) to rehearse their performance before in vivo operating.[15-18] Training technical skills often discount a significant component of clinical performance, i.e., the residents' ability to communicate effectively with the patient, the operative team and to display essential, appropriate and effective interpersonal skills. In recent years, there has been increased focus on the importance of communication and interpersonal skills in the role of the physician.[15-20]

The time of Virtual Simulation Training in a fully equipped hybrid operating room is already here. Cognitive skills are built up through exposure and training to real-life situations. A fully equipped hybrid operating room offers a unique opportunity to rehearse, improve and evaluate the skills of trainees in a realistic environment without compromising patient safety.

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