The Royal College of Radiologists

Radiology

Intuition is not evidence: A position statement from The Royal College of Radiologists on the use of simulation in invasive image-guided procedures

Medical simulation offers great potential for training and assessment in image-guided procedures such as those used in interventional radiology (IR). Traditional 'apprenticeship' training is under threat and may no longer be fit for purpose due to mandatory restrictions on in-hospital work hours for resident trainees and the breadth of case material to which the individual trainee has to be exposed in five years. At the same time, advances in non-invasive diagnostic imaging have reduced trainee exposure to invasive procedures such as catheter angiography. Thus, today's resident/trainee has limited opportunity to acquire the basic gateway skills upon which more advanced interventional skills are based.

Medical simulators engineered for IR training have the potential to address these gaps. IR simulators introduce a novel potential capability not only to train, but also to establish objective evidence of technical competence during and after training. While there is growing evidence for their effectiveness, few medical procedural simulations have demonstrated predictive validity. In other words, in very few instances has proficiency with a medical procedural simulator been proven to transfer to the clinical situation. While this transfer of trained skills to patients has now been shown for simulations of laparoscopic surgery, colonoscopy and anaesthesia, at this time robust evidence is still being sought for endovascular simulators.

Although it may be intuitive that skills learned on simulators should effectively transfer to the clinical IR environment, intuition is not evidence. Further development of IR procedural simulations must be completed before truly satisfactory outcomes can be expected from validation. To correctly emulate the real world cues and fine motor actions when performing a challenging IR task requires detailed understanding of the task itself, its context, and the properties of tissues, pathology and instruments used. Such data is being sought by a number of academic groups, worldwide.

Current research and international guidelines

At this time the major UK research group in this field are the CRaIVE (Collaborators in Radiological Interventional Virtual Environments) consortium comprising of clinicians, physicists, computer scientists, clinical engineers and psychologists. Their aim is to implement and validate sophisticated virtual environments designed for use in the training of radiological interventional procedures. The British Society of Interventional Radiology (BSIR), The Cardiovascular and Interventional Radiological Society of Europe (CIRSE), the Society of Interventional Radiology (SIR) and the Radiological Society of North America (RSNA) have established individual medical simulation task forces and a joint task force with the objective of advising on the use of simulators for training in IR, including standards for test development, certification and validation of simulator models. Their joint recommendations are:

1. Current generation simulator models appear suitable for gaining certain aspects of procedural experience, such as learning the correct sequence of procedural steps and selection of appropriate tools. Such cognitive learning relies heavily on the presence and input of a mentor, and may well be beneficial prior to performing procedures on patients. While there is growing evidence for their effectiveness in some areas, the utility of simulators for other aspects of training is currently unproven. In particular, there is no existing, robust evidence that catheter manipulation skills acquired on the simulator are transferable to actual clinical practice. Therefore, experience on a simulator cannot yet be regarded as equivalent to training involving performance of actual endovascular procedures in patients. Moreover, it should be self-evident that even a valid simulation that predicts transfer of a specific skill to the procedural setting has limits. It cannot supplant the experience, judgement, and wisdom gained by managing real patients with serious conditions through their diagnoses, treatments, and longitudinal follow-up. Therefore, we should remember that as training hours shorten, diagnostic work-ups become increasingly non-invasive, and trainees are exposed to dwindling numbers of actual clinical cases, we still must resist the temptation to consider procedural simulations and clinical experiences interchangeable. They are not. Simulation training may become part of a prerequisite for certification or credentialing, but it can never be a sufficient condition for either.

2. Training and assessment methods which use simulation should be developed and validated in close association with the statutory authorities responsible for certification.
    - Procedural tasks that require simulation should be carefully analysed by psychologists working with acknowledged subject matter experts in order to define metrics and critical performance indicators. The statutory bodies will ensure that these are relevant to their curricula and practice. These data should be made freely available as open source.
    - Training and test validation should include content, face, construct, concurrent, and predictive validation with the objective of demonstrating transfer of trained skills to procedures in patients.
    - As the advancement in technology has the potential to outpace the validation effort, validation may have to be performed in a staggered parallel fashion. There is the potential for simulation to provide robust, high-quality training and objective assessment

of competence. Patients will be reassured that interventional radiologists and other practitioners have demonstrated a defined level of experience and that they will be spared the early learning curve of novices.

- The use of simulation as a component of objective certification of skills by statutory bodies is a laudable and achievable objective. It will require collaboration between the statutory organisations, academic groups and the simulation industry.

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