Putting the Boot In - intensive simulation based training to prepare surgical trainees for practice

Richard Bamford
Co-author: Mehool Acharya

The National Health Service is changing rapidly with increasing numbers of patients' requiring rapid assessment and decision making. This is coupled with the European Working Time Directive (EWTD) dramatically reducing training time availability. It is important that adequate training time is balanced against the need for service provision.

As a profession, surgeons are becoming more accountable to the public and surgical outcomes are now available in a range of specialties on a yearly basis. All of these factors contribute to the traditional apprenticeship model of training no longer being feasible or educationally acceptable.

Progressing through training from medical student to senior specialist can be a stressful time for trainees as they develop concerns related to their clinical skills, responsibilities and expectations. This is most evident during the August handover period where new graduates start their training and the majority of trainees rotate to new programmes. During this time there is evidence that patient mortality can increase and Hospital efficiency reduce.

Simulation offers one potential answer to the challenges faced in the modern work place. Intensive, simulation rich training programmes or “Boot Camps” have been postulated as a way to develop such skills and may be of benefit to trainees during their handover period.

This article will explore the use of simulation in the development of surgical skills and its use in a Boot Camp environment.

Simulation Training

Simulation training recreates realistic environments to allow for safe, reproducible and effective training of technical and non-technical skills. The use of simulation in medical education is now well established and in surgery, simulation is often seen as a technique to safely improve procedural skill.

The UK Department of Health and The General Medical Council support the use of simulation in medical training. The Joint Committee on Surgical Training (JCST) and the Intercollegiate Surgical Curriculum Programme (ISCP) have incorporated it into their syllabus and simulated work based assessments can be used to evaluate progression. In the United States, the Accreditation Council for Graduate Medical Education requires all training centres to provide a simulation and skills lab and the American Board of Surgery mandate that general surgical residents must complete and pass the Fundamentals in Laparoscopic Surgery Programme to become eligible for Board Certification. Surgical trainees argue that simulation is beneficial.
as an adjuvant to clinical practice and value the skill acquisition it provides[19,20,21].

**Surgical Skills**

Bench models to teach basic surgical skills are commonplace and may use either synthetic or animal tissue (Figure 1). Porcine bench models have been validated for compression plate application and can be argued to be a realistic and cost-effective form of training[22]. Within laparoscopic surgery it has been demonstrated that low and high fidelity models can successfully be used to develop skills that can be transferred to the operating theatre[23] and develop the skills required in arthroscopy[24]. Studies have demonstrated improvements in the psychomotor skills for arthroscopic surgery using simulators[25,26]. Howells et al have shown that these skills can be transferred to the operating theatre[27]. As well as using synthetic models, cadaveric models have been used. While cadaveric bone may be considered less realistic due to the high degree of variability in its biomechanical properties, cadaveric models may be useful for the soft tissue aspect of orthopaedic procedures and have demonstrated improvements in accuracy amongst orthopaedic trainees[27]. High fidelity virtual reality simulators are also available and include The Knee Arthroscopy Surgical Trainer (KAST), supported by ABOS, and The Sheffield Knee Arthroscopy Training System (SKATS) have demonstrated both construct, face and predictive validity[28,29]. Virtual reality simulators have been shown to offer valid, reliable and feasible assessments of a trainee’s skills level[28].

While these simulation models are encouraging tools that can be used to develop and assess surgical trainees, access to simulators alone is not the solution to developing surgical skills. Ericson suggests that successfully learning a new skill requires a mechanism for feedback and repetition of the task[30]. Regular repetition and aiming beyond basic levels of achievement are also important to prevent the deterioration of a skill[31]. This may explain why some studies fail to show sustained improvement in performance after initial simulator training[32], whilst those who offer repetition in learning are more likely to retain the skill[33].

The development of surgical skills using simulation is possible, effective and can transfer skills to the operating room. However, the process must have well defined, specific outcomes and aims and allow for feedback with repeated practice beyond that of the initial training opportunity. Their inclusion in a Boot Camp environment should be encouraged but, to be effective, must not end there and further exposure to practise and simulators must be available.

**Non-Technical Skills**

Technical skills are only one part of surgical training. Clinical judgment, communication, decision-making, patient interaction and teamwork are essential components required in trainee surgeons[34]. The complexities associated with these skills are often the cause of surgical errors. Increased risk of complications and mortality has been demonstrated in teams who do not share information effectively[35]. Communication and team work issues have been identified as the root cause for up to 70% of adverse events and a contributing factor in 24% of malpractice claims[36,37]. These non-technical skills are "the critical cognitive and interpersonal skills that underpin technical proficiency"[38]. A number of assessment tools have been designed and validated to assess team and individual surgeons in these areas[39,40]. It has been argued that these assessment tools should be integrated into the UK surgical trainee work based assessment scheme[41].

Simulation offers the opportunity to train individuals and teams in these skills and does not depend on expensive or complex models to reduced rates of surgical morbidity.

---

**Boots Camps**

Surgical Boot Camps are innovative, simulation rich environments that allow the acquisition and development of key technical and non-technical skills. A variety of studies have suggested a benefit to trainees prior to commencing their first clinical rotation[42,43]. National or regional boot camp training programmes for higher specialist trainees in neurosurgery[22,24] and cardiothoracic surgery[25] have shown benefits to their trainees. The Royal College of Surgeons in Ireland run a surgical boot camp for core trainees and have found it to be an effective way to rapidly acquire knowledge, technical skills, and confidence[44]. A similar training programme is available in Scotland[45].

Trainees report boot camps to be a useful adjunct to their training and describe them as relevant to clinical training. Faculty assessments identify improvements in patient assessment, team-working, communication skills, confidence and patient care[46].

Meta-analysis of the effects of post-graduate Boot Camps have highlighted that this relatively new concept consistently demonstrates improvement in clinical skill, knowledge and confidence and may be of benefit during a trainees career transitions[47]. Overall it would appear that Surgical Boot Camps are useful in the acquisition and development of technical and non-technical skills, knowledge and confidence. If placed at an appropriate time in training these skills may be beneficial to patient safety[48].

---

**Figure 1:** Core Trainees using pork belly to develop suturing skills as part of a basic surgical skills workshop.
The development of non-technical skills is essential for surgical trainees. Many trainees will need to develop these skills rapidly and with limited experience while they attempt to simultaneously master technical skills. By introducing these components at an early stage of training and reinforcing their value, trainees will have long lasting tools at their disposal.

Confidence

The relationship between confidence and surgical performance is complex and this is reflected in the limited data available on the subject. Despite this, a wide range of evidence exists demonstrating that simulation training increases confidence in surgical skill, knowledge and non-technical skills.

Cognitive research suggests that increased confidence is associated with a higher level of motivation and that high levels of motivation are required for the development of a skill. This may demonstrate the importance of confidence but is unproven. One study has identified a strong relationship between confidence and competence in medical students after training in basic surgical skills, perhaps suggesting that novices are not yet aware of their skill level.

However, the relationship manifests, surgical trainees need to be confident enough to succeed within a highly competitive and challenging environment. Simulation training has been shown to enhance confidence and the Boot Camp is possibly the safest environment to explore the boundaries associated with it.

Knowledge

The acquisition of knowledge has not traditionally been associated with simulation training, however, an integrated framework of simulation design allows for knowledge to be obtained alongside technical skill. This can take the form of identifying anatomical structures during a simulated procedure or explaining the reason behind choices of surgical equipment and approach. Further knowledge can be derived by the need to justify decisions and explain the physiological or mechanical impact this will have. Web-based pre- and post-simulation assessment and computer based simulated patients allow for trainees to work through their decision making process and understand the impact of their decisions. Van Heest demonstrated this successfully as...
part of an integrated carpal tunnel training programme\textsuperscript{5}. More often, simulation is a tool by which the application and refining of clinical knowledge can be developed\textsuperscript{6,7}.

Expectations and requirements for knowledge will vary amongst trainees according to grade and experience. For simulation to be successful in the acquisition and application of knowledge, it must be aimed at the correct end user. Boot Camps for trainees of the same seniority and during periods of transition between grades therefore seems an appropriate way for this to be accomplished, highlighting the level of knowledge that can be expected in their new role.

Summary

Simulation offers opportunities to develop skills in all the suggested areas of a Surgical Boot Camp. By providing an appropriately timed intensive simulation rich induction course, trainees will quickly develop the core technical and non-technical skills required for safe practice. In doing so patient safety may be improved and there may be a significant reduction in the “August effect”.

Richard Bamford is a Surgical Trainee within the Severn Region and is the inaugural Health Education South West Severn School of Surgery Simulation and Non-Technical Skills Fellow and Honorary Senior Lecturer at the University of Bristol. His main educational areas of interest are in teaching postgraduate trainees, using simulation, virtual patients and technology enhanced learning, to develop technical and non-technical skills.

Correspondence:
Email: richardbamford@doctors.org.uk

References:
References can be found online at www.boa.ac.uk/publications/JTO or by scanning the QR Code.

Britspine 2016
Nottingham Conference Centre
April 5th - 8th 2016
www.britspine.com

The Biennial Scientific Congress of the United Kingdom Spine Societies
Representing:
- The British Association of Spinal Surgeons (BASS)
- The British Scoliosis Society (BSS)
- The Society for Back Pain Research (SBPR)

Tuesday 5th April 2016
PRE-MEETING TRAINEES’ AFTERNOON
Anatomy Teaching Suite, Medical School, Queen’s Medical Centre, Nottingham
SPINE MASTERCLASS, Aimed at experienced fellows and consultants. Early application required due to limited spaces being available. Nottingham Conference Centre, Nottingham

Wednesday April 6th - Friday April 8th 2016
SCIENTIFIC MEETING Nottingham Conference Centre in association with SRS Worldwide

Wednesday 6th April 2016
Welcome Reception - Join us and Industry for a glass of wine or a cocktail!
Thursday 7th April 2016
Conference Dinner - An Asian Fusion Evening with our very own ‘Spinal Chords’!

United Kingdom Spine Societies Board at the British Orthopaedic Association
The Royal College of Surgeons of England, 35-43 Lincoln’s Inn Fields London WC2A 3PE
Tel: 020 7405 6507 | Fax: 020 7831 2676 | Email: ukssb@boa.ac.uk
References


