

The role of simulation in burns education

ABSTRACT

Burns are devastating injuries which represent a significant global health burden. In the UK alone, it is estimated that 175 000 people suffer from burns injuries requiring hospital attention every year. The global treatment of burns can be improved through a more systematic team-based approach, which can be achieved through simulation training. Simulation has an increasingly important role in medical education, not only allowing practitioners to apply their knowledge in a controlled and safe environment, but also allowing them to gain technical and non-technical skills. This article explores the role of simulation as an important and effective tool for burns education worldwide.

It is estimated that 175 000 people suffer burns injuries in the UK every year requiring hospital attention, and 10% of these patients sustain injuries severe enough to warrant admission (NHS Commissioning Board, 2013). Globally, the World Health Organization Global Burden of Disease estimated that an average of 11 million people suffer burns-related injuries every year (Stylianou et al, 2015).

Burns injuries often involve compound life-threatening injuries such as fractures, traumatic brain injury and inhalation injuries. It is vital that patients with burns are rapidly identified, and have their injuries assessed in a thorough and systematic manner. The high-acuity nature of burns injuries makes simulation training an ideal method to improve practice and clinical outcomes.

Simulation is defined as the recreation of 'real-world' experiences and processes within a controlled environment to allow learners to explore strategies and approaches in clinical situations (Sadideen et al, 2014). Over recent years, simulation training has evolved to become one of the core pillars of medical education. It allows the use of realistic clinical situations, in which clinicians can practice their skills, while staying within ethical limits.

Simulation has been used since the 16th century where mannequins or 'phantoms' were developed to

teach obstetric skills to reduce maternal and infant mortality rates (Ziv et al, 2003). Today, a wide number of simulation methodologies has been developed. These range from simple clinical 'role-play' scenarios, suture practice on animal tissue, and high-fidelity simulators that provide immediate and realistic feedback, to virtual reality constructs that give users a fully immersive experience.

Simulation training should be easily reproducible. It poses no risk to the patient, and allows better integration of learned theory into the applied clinical environment.

Burns education

Burns are frequently under-represented in undergraduate studies. The centralisation of burns services nationally limits the number of students who have the opportunity to rotate through the burns unit. A survey of 31 UK medical schools found that burns were not explicitly mentioned in any of the core curricula (Egro and Estela, 2014). Opportunities to rotate through the specialty are mostly offered as elective modules, which means that only a fraction of students learn about the assessment and management of the multiply-injured patient with burns (Doumouras et al, 2014; Tevlin et al, 2017). There is a role for simulation teaching in burns to be introduced to undergraduate curricula in UK medical schools. Through simulation, trainees will be able to better appreciate the technical and non-technical aspects of the initial management of a patient with burns, thus producing safer future clinicians.

As for physicians, there are two standardised programmes that offer specialised burn management education: the emergency management of severe burns and advanced burn life support. These courses focus on training physicians to be able to confidently approach and begin basic management for a patient with burns, through the use of simulation (Tevlin et al, 2017).

The role of simulation in burns

Simulation fidelity describes the degree of realism or authenticity, which lies on a spectrum from being completely artificial to an actual real-life situation (Munshi et al, 2015). The appropriate level of fidelity is dependent on the intended learning goals and cost. The Advanced Trauma Life Support course has been at the forefront of simulation training for many years. For more than 40 years, the Advanced Trauma Life Support course has used a variety of simulation modalities to streamline and improve trauma care worldwide. A study in the Netherlands by van Olden

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et al reported improved trauma patient outcomes following the introduction of Advanced Trauma Life Support. Widely disseminated Advanced Trauma Life Support training has a positive impact on the survival of trauma and burns victims (van Olden et al, 2004a, b).

A study by Pywell et al (2016) found that the use of moulage to simulate burns injuries contributed positively to the overall training experience. Moulage is a technique which uses makeup to simulate burns injuries on a simulated patient or a mannequin, and is used widely in emergency management of severe burns and advanced burn life support. The use of moulage encouraged participants to treat standardised patients as real burns victims and was shown to have a superior validity when compared to existing non-professional techniques. The materials are easily available, low in cost and can be easily reproduced in simulation education in other settings. Participants reported that the use of professional moulage to simulate burns injuries contributed positively to the training experience.

The Burns Suite was introduced in the UK in 2014 as an experimental simulation tool to improve the delivery of burns education. The Burns Suite is a low cost yet immersive simulated clinical environment, consisting of an inflatable shell, with simplified representations of the surgical environment, such as lighting, banners and audio stimuli. The suite was used to conduct contextualised paediatric burns resuscitation simulation scenarios. This low-cost, high-fidelity and portable simulation environment has been designed based on the advanced trauma life support and emergency management of severe burns principles. The realism has been further refined using expert opinion realism props, briefed nurses and simulated patients (Sadideen et al, 2014). The Burns Suite has a strong face and content validity, and provided an authentic burns resuscitation experience, as assessed by both novice and expert clinicians (Sadideen et al, 2014, 2016a).

In the United States of America, high-fidelity human patient simulation has been incorporated into the advanced burns life support course. This involved the use of a computerised mannequin and screens to display parameters like vital signs and cardiac monitoring trace. The measurements can be adjusted on a remote computer program to replicate a real clinical scenario. The use of mannequins also means that technical skills can be performed (for example gaining intravenous access or performing endotracheal intubation) (*Figure 1*). The success of this method is reflected in the improved post-exam scores and strong participant self-reported confidence levels and satisfaction (Reeves et al, 2018).

Simulation is also used to enhance technical and procedural skills, such as escharotomy. The acute nature of the injury and the multiply-compromised patient makes it a difficult skill to be taught for the first time on a real patient. Innovative training models have been designed to simulate the release of dermal bands during escharotomy



Figure 1. Hospital emergency care simulation. Medical personnel at a hospital training in emergency procedures using a simulation mannequin (SimMan) to practice treating severe burns to the face and head.

(Varas et al, 2012). Other technical procedural skills such as performing a cricothyroidectomy have also been taught successfully using low-fidelity surgical airway models (Parsons et al, 2015).

Non-technical aspects

The high-acuity nature of burns injuries creates a stressful environment, emphasizing the importance of having a skillful, communicative and well-coordinated team. In fact, many adverse events in burns and trauma care arise from issues relating to non-technical skills, such as communication, leadership and teamwork. Simulation has proven to be a powerful modality to advance surgical training in non-technical skills (Sadideen et al, 2016b).

Crisis resource management is a programme which was initially developed for the aviation industry. The programme highlighted that the majority of airline mishaps were the result of human error instead of issues relating to knowledge or skills. Similarly, most errors in the care of trauma patients are not technical in nature, but rather arise from improper assessment, poor leadership and failure to recognize evolving pathology (Rall and Dieckmann, 2005). In 2018, crisis resource management was first incorporated into burns education through a high-fidelity simulation course SIMBurns (D'Asta et al, 2019). The course uses crisis resource management as its foundation, is focused on the management of burns injuries, and has been successfully executed several times. Participants report that the course developed their ability to interact with other team members, improved crisis resource management, helped emphasize the clarity of role and helped develop their communication skills. Since the introduction of the course in 2013, nine courses have been conducted with a total of 101 participants, and the success of the course indicated by the high overall participant-reported satisfaction rate of 4.8 out of 5 (D'Asta et al, 2019).

KEY POINTS

- Burns education is an important subject that is not explicitly mentioned in the curriculum of 31 medical schools in the UK.
- Assessment and management of the burns patient and interprofessional skills can be taught effectively using simulation training.
- Simulation training allows learners to gain concrete experience which can be incorporated into real life practice and is proven to help learners retain knowledge better.

Understanding leadership behaviours of different team members through simulation can help identify and encourage important behaviours. Simulation scenarios can be recorded on camera, allowing learners to identify key qualities of leadership and reflect on methods by which they could improve as a team leader in these scenarios. Mapping these behaviours onto leadership models will help to further the understanding of leadership theory. Collectively this can aid the development of refined simulation scenarios, which could be applied to other areas of simulation-based team training and interprofessional education (George and Quatrara, 2018).

A study in a surgical trauma burn intensive care unit showed that team members who took part in inter-professional simulation training demonstrated increased knowledge scores and changes in perception of teamwork following simulation training. Participants' scores remained significantly elevated 1 month post-training, which highlighted the efficacy of interprofessional simulation in the retention of information and teamwork skills learned (Capella et al, 2010; George and Quatrara, 2018). Recreating the working environment where multidisciplinary teams interact can provide a powerful learning experience for trainees, allowing them to examine their roles within a team and increase motivation levels in team members (Kolb, 1984; Cherry and Ali, 2008).

Discussion

Kolb's theory of adult learning states that learning is a continuous cycle between concrete experience, reflective observation, abstract conceptualisation and active experimentation. Simulation provides opportunities for learners to gain concrete experience, then consolidate the material into the learner's own conceptual framework (Merriam, 2001). Adult learners are also primarily problem-centred, self-directed and interested in immediate application of knowledge (Nanji et al, 2013). The increased use of simulation training is expected to shift medical education from the traditional didactic teaching style towards a more interactive experiential learning experience for the adult learner (Li et al, 2012). Studies on sepsis management have shown that simulation training is more effective than didactic lectures (Ur et al, 2016).

Simulation has long been used in general surgery training, especially in laparoscopic surgery. A study by Varas et al (2012) demonstrated that following a 14-session

advanced laparoscopic training programme, trainee surgeons can obtain similar surgical outcomes to expert surgeons. It was found that complications in laparoscopic surgery were highest during the early part of the learning curve. Psychomotor skills need to be acquired in a safe environment, out of the operating room. The advances in computer graphics and haptic or tactile feedback in laparoscopic simulators make it possible for learners to contextualise their learning experiences, shown to shorten the initial phase of the learning curve. Using simulation in surgical training will help create a generation of safer and more skillful operators (Larsen et al, 2009).

Simulation training has many benefits in enhancing technical skills and inter-professional teamwork, but it can require a significant investment of time, effort and financial resources. It is challenged by shortcomings such as realism and authenticity. With rapid technological advancements in immersive virtual reality, it is hoped that these shortcomings could be reduced in the future (Foot et al, 2008).

The future

Simulation in burns education is of paramount importance to improve outcomes and decrease the global burden of burns. Following the implementation of the recommendations of the National Burn Care Review in 2001, there has been an observed decrease in mortality from burns in England and Wales, as a result of the centralisation of the management of complex burns injuries into regional specialist burns units (NHS Commissioning Board, 2013).

However, with shifting paradigms of terrorism and increased frequency of mass casualty and disaster events, there is an increasingly pressing need for services to be able to prepare for such large-scale events. Simulation-scene training for major-scale surge events can help shape the delivery of emergency services during critical times. An objective for the future care of patients with burns is to incorporate successful educational adjuncts such as simulation training and disseminate it widely, which would in turn empower practitioners to continually improve their practice. It is time to build on current educational strategies to transform the care of patients with burns worldwide. **BJHM**

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