



Sankar Sinha
Nicholas Cooling

Simulation based education

Models for teaching surgical skills in general practice

Background

Simulation based education is an accepted method of teaching procedural skills in both undergraduate and postgraduate medical education. There is an increasing need for developing authentic simulation models for use in general practice training.

Objective

This article describes the preparation of three simulation models to teach general practice registrars basic surgical skills, including excision of a sebaceous cyst and debridement and escharectomy of chronic wounds.

Discussion

The role of deliberate practise in improving performance of procedural skills with simulation based education is well established. The simulation models described are inexpensive, authentic and can be easily prepared. They have been used in general practice education programs with positive feedback from participants and could potentially be used as in-practice teaching tools by general practitioner supervisors. Importantly, no simulation can exactly replicate the actual clinical situation, especially when complications arise. It is important that registrars are provided with adequate supervision when initially applying these surgical skills to patients.

Keywords

simulation, models; procedural skill; general practice, teaching

Simulation based education (SBE) has been widely incorporated into the curricula of most Australian medical schools and in the Australian Junior Doctors curriculum (<http://curriculum.cpmecc.org.au>). In addition, SBE is used in general practice vocational training and is integrated into the curricula of The Royal Australian College of General Practitioners (RACGP) (www.racgp.org.au/curriculum) and the Australian College of Rural and Remote Medicine (ACRRM) (www.acrrm.org.au/curriculum). Simulation based education is also used in the training of many other health professions, including nursing, physiotherapy, pharmacy and speech therapy. Health Workforce Australia has recognised the current and potential use of SBE in medical training and is now providing financial support for a coordinated national approach.¹

The authors believe that teaching surgical skills to general practice registrars using SBE is a priority because:

- while recent reports indicate an increasing number of conditions requiring surgical intervention in general practice,² there is simultaneous deskilling of general practitioners in performing minor surgical procedures³
- an increase in procedural work has the potential to attract more junior doctors to the specialty of general practice⁴ by improving job satisfaction, range of work and patient satisfaction.⁵

General practitioner supervisors – who play an important role in training general practice registrars to undertake and master practice-based surgical procedures⁶ – need to ensure that registrars are technically and clinically competent and safe. In order to maintain procedural skills, and to increase enthusiasm for such procedures, simulated models are useful as they allow the opportunity for ‘deliberate practise’⁷ in a stress free environment. It has been observed that medical skills laboratories do lead to improvement in procedural skills compared with standard or no training when assessed by simulator performance and immediately post-training.^{8,9}

There are a range of simulation models available for teaching surgical skills and their advantages and disadvantages have been well described.¹⁰ When choosing a teaching model, the ‘functional similarity’ of the model to its real-life counterpart is crucial.¹¹ In recent years, many simulation models have become available commercially, but most of these are expensive, difficult to access, or are poor replicas of the conditions seen in human patients. Sushruta – the father of plastic surgery – has been stated to use simple simulation models such as fruits and animal hides to teach common surgical procedures.¹² In this article we describe three simulation models for teaching surgical skills in general practice following the examples described by Sushruta to teach:¹²

- the excision of a sebaceous cyst (also known as an epidermal cyst)
- debridement
- escharectomy of chronic wounds.

All of these skills are included in the recommended core list of procedural skills in general practice vocational training.¹³

The authors have used the model described here for the excision of a sebaceous cyst since 2004 as part of a course run for General Practice Training in Tasmania. The wound debridement models have been used to teach junior doctors at the clinical school in Hobart, Tasmania, and in wound care workshops for other health professionals. We believe these models have the potential to be useful to others involved in such courses, for in-practice teaching and for teaching junior doctors in the hospital setting.

Model 1. Simulated sebaceous/epidermal cyst

The simulated sebaceous/epidermal cyst model proceeded through a series of prototypes before the authors arrived at the final version. The first prototype was created by cutting the tip of a finger from a glove, filling it with toothpaste and tying it with suture material. This was then inserted into the subcutaneous space created in a pig's trotter using the needle attached to the suture material, which was then cut off leaving the finger tip in the subcutaneous space (Figure 1 and 2). In this model, we found that the cyst was too mobile compared to a real-case scenario where the cyst wall is relatively fixed to the overlying skin at the punctum. To address this issue, after the needle was brought through the skin it was then brought back into the subcutaneous space and a knot was tied beneath the surface of the skin before the suture material was cut. This not only stabilised the cyst but also created what looked like a punctum of the cyst when 3/0 black silk was used to make the knot (Figure 3 and 4). We observed that this still did not resemble a real sebaceous cyst, which often remains adhered to its surrounding tissue and requires careful dissection to avoid rupturing the cyst. So a further modification was made by applying a drop of synthetic glue ('Super Glue') between the simulated cyst wall and the surrounding

tissue. We found this to be a very effective model for teaching the technique (Figure 5) and a close replica of a real sebaceous cyst (Figure 6).

Preparing the simulation model

1. Obtain a fresh (not frozen) pig's trotter from a local butcher
2. Cut off a finger tip from a small disposable glove
3. Insert about 2–3 mL of toothpaste into the cut-off glove tip
4. Tie the glove tip with a 3/0 black silk suture or Prolene™ with curved cutting needle to form a cyst, keeping the needle attached (Figure 1)
5. Dissect a tunnel under the skin of the pig's trotter
6. Place two drops of Super Glue on the wall of the cyst
7. Advance the needle, suture and cyst through the tunnel and bring the needle through the skin (Figure 2)
8. Take a small bite of skin with the needle and advance the needle back under the skin and tie it off to form a punctum (or use a black marker-pen dot if using Prolene™, to highlight the punctum) (Figure 3 and 4).

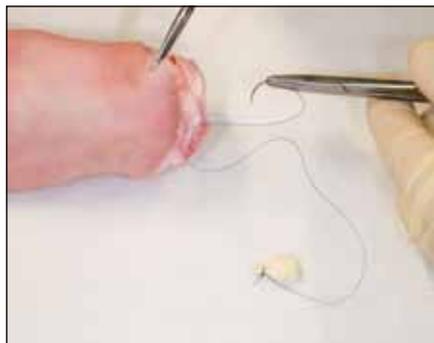


Figure 1. Preparation of cyst

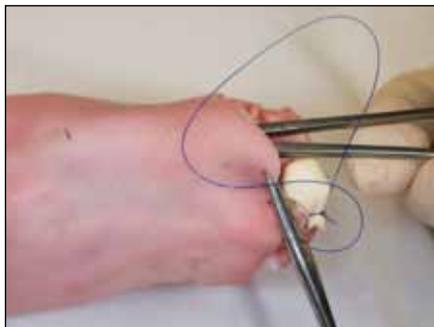


Figure 2. Placement of cyst

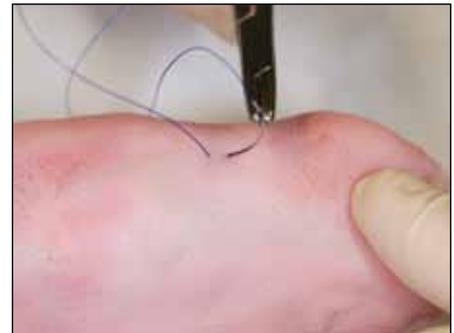


Figure 3. Creation of punctum



Figure 4. Completed sebaceous cyst model



Figure 5. Sebaceous cyst excision on model



Figure 6. Sebaceous cyst on patient

Model 2. Simulated chronic wound for debridement

A simulated chronic wound covered with thick slough, as described by Sinha in 2007,¹⁴ can be created on a pig's trotter by excising an area of skin and applying a layer of hydrocolloid paste (eg. ADAPT™, Hollister) to the denuded area (Figure 7). A layer of toothpaste to simulate eutectic mixture local anaesthetic (EMLA) cream can then be applied. This is then covered with a piece of GladWrap™. A small curette is then used to debride the area (Figure 8) after removing the GladWrap™ and wiping away the layer of toothpaste.

This model simulates the conditions of a chronic wound in a real patient (Figure 9).



Figure 7. Completed chronic wound model



Figure 8. Curettage of sloughy wound



Figure 9. Chronic sloughy wound on patient

Model 3. Simulated wound debridement for escharectomy

An eschar resembling that seen in patients can be created on a pig's trotter skin by marking out an area of skin then coagulating this skin with a diathermy (Figure 10). If diathermy is not available, the area can be painted with black ink to simulate an eschar. Escharectomy is then performed (Figure 11)¹⁵ in a manner similar to that performed on a real patient (Figure 12).



Figure 10. Completed eschar model



Figure 11. Escharectomy on model



Figure 12. Escharectomy on patient

Discussion

Contemporary teaching methods for procedural skills acquisition in general practice and surgical training programs have been well described.^{16,17} Important components of these methods include learning in phases or steps, effective feedback,¹⁸ transitioning from theory to simulation to clinical settings and combining mechanical skills with communication, professional and ethical skills.¹⁹ In order to teach basic surgical skills to junior doctors within the hospital setting, and to trainees in general practice, there is a need to develop inexpensive, safe and authentic simulation models.

Registrars vary in their confidence and competence around surgical procedures and some may benefit from repeated practise with easily available, authentic simulation models. Maran and Glavin⁹ have emphasised the concept of simulator fidelity and the distinction between engineering fidelity and psychological fidelity, of which the latter is of greater importance.

The three simulation models described here encourage the reproduction of the motor skills or 'engineering fidelity', required in the real patient situation. The models described here replicate the physical characteristics of the respective clinical conditions, as well as the psychological or functional fidelity, ie. the simulated task capturing the skills required in the real task.⁹

A model of sebaceous cyst made with synthetic material is available commercially (Limbs & Things²⁰). However, it has drawbacks in regards to cost (\$69 per item) and fidelity (the model has no punctum and no adherence to surrounding tissue). The sebaceous cyst model described here is easy to prepare, is more life-like and is inexpensive. Written evaluation collected by the authors from general practice registrars using the sebaceous cyst model at skin surgery workshops held by General Practice Training in Tasmania, indicated that the model highly resembled the clinical situation and increased their confidence in the cyst excision. However, the simulation models described here do not exactly replicate the actual clinical situation, especially when complications arise such as with a challenging patient or difficult pathology (eg. a very adherent or multilobulated sebaceous/epidermal cyst). This underlies the importance of providing registrars with adequate supervision (onsite, visiting or at a specialised centre), especially when initially applying these surgical skills to patients.

Authors

Sankar Sinha MEd, BSc, MBBS, MS, MNAMS, FRACS, FACS, is Professor of Wound Care, School of Medicine, University of Tasmania, Hobart and Professor and Head of Anatomy, University of Notre Dame Australia, School of Medicine, Sydney, New South Wales

Nicholas Cooling BSc(Hons), DipNutDiet, BMBS, FRACGP, DRACOG, GradCertT&L, is Director of Electives and Internationalisation, Senior Lecturer in Medical Practice, School of Medicine, University of Tasmania and a general practitioner, Hobart, Tasmania. nick.cooling@utas.edu.au.

Conflict of interest: none declared.

Acknowledgement

Thanks to Jo Hanuszewicz from the University of Tasmania for taking many of the clinical photographs, and staff at GPTT for assistance with the development of these models.

References

1. Weller JM, Nestel D, Marshall SD, et al. Simulation in clinical teaching and learning. *Med J Aust* 2012;196:594.
2. Green T. Rural general practitioner surgeons in Australia. *ANZ Journal of Surgery* 2007;77:924.
3. Wilson R. Multispecialty surgical conditions in general practice. *Med J Aust* 2005;182:337–9.
4. Sivey P, Scott A, Witt J, et al. Why junior doctors don't want to become general practitioners: a discrete choice experiment from MABEL longitudinal study of doctors. Melbourne Institute Working Paper No 17/10, 2010.
5. Sturmberg J. Learning relevant procedural skills. Are supervisors providing opportunities? *Aust Fam Physician* 1995;26:1163–5.
6. Wilkinson D, Dick M-L B, Askew DA. General practitioners with special interests: risk of a good thing becoming bad? *Med J Aust* 2005;183:84–6.
7. Ericsson KA, Krampe WC, Tesch-Romer C. The role of deliberate practice in the acquisition of expert performance. *Psychol Rev* 1993;100:363–406.
8. Lynagh M, Burton R, Rob Sanson-Fisher R. A systematic review of medical skills laboratory training: where to from here? *Med Educ* 2007;41:879–87.
9. Maran NJ, Glavin RJ. Low- to high-fidelity simulation – a continuum of medical education? *Med Educ* 2003; 37(Suppl 1):22–8.
10. Reznick RK, MacRae H. Teaching surgical skills: changes in the wind. *N Engl J Med* 2006;355:2664–9.
11. Kneebone R, Simon D. Surgical skills training: simulation and multimedia combined. *Med Educ* 2001;35:909–15.
12. Rutkow IM. *Surgery – An illustrated history*. St Louis: Mosby 1993; p. 67–8.
13. Magin P, Sweeney K, Morgan S, Henderson K. Procedural skills in general practice vocational training. *Aust Fam Physician* 2011;40:50–4.
14. Sinha SN. Wound debridement: doing and teaching. *Primary Intention* 2007;15:162–4.
15. Sinha SN. The art of escharectomy. *Primary Intention* 2000;8:104–5.
16. Wearne S. Teaching procedural skills in general practice. *Aust Fam Physician* 2011;40:63–7.
17. Sachdeva AK, Buyske J, Dunnington GL, et al. A new paradigm for surgical procedural training. *Curr Probl Surg* 2011;48:12:854–968.
18. Boyle E, Al-Akash M, Gallagher AG, et al. Optimising surgical training: use of feedback to reduce errors during a simulated surgical procedure. *Postgrad Med* 2011;87:524–8.
19. Mcleod PJ, Steinert Y, Trudel J, et al. Seven principles for teaching procedural and technical skills. *Acad Med* 2001;76:1080.
20. Limbs and things catalogue. Available at www.limb-sandthings.com/au/products/category/minor-surgery [Accessed 1 June 2012].

correspondence afp@racgp.org.au