TEACHING ROUNDS

Teaching procedural skills

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This series provides an update on practical teaching methods for busy clinicians who teach. The series advisers are Peter Cantillon, senior lecturer in the department of general practice at the National University of Ireland, Galway, Ireland; and Yvonne Steinert, professor of family medicine, associate dean for faculty development, and director of the Centre for Medical Education at McGill University, Montreal, Canada

"See one, do one" is not the best way to teach the complex technical procedures needed in many hospital based specialties

For many patients, a successful clinical outcome depends on having a well performed technical procedure. Crucial for surgeons, technical competence is becoming an important element of training for many hospital based specialists: interventional radiologists, cardiologists, gastroenterologists, endovascular therapists, and others. "See one, do one" is no longer appropriate for educating health professionals to perform complex procedures. Graduated independence, the hallmark of the approach to teaching procedural skills, is being challenged by concerns for patients' safety, the skyrocketing complexity of procedures, and a diminishing work week for trainees. Finding the balance between patients' safety and doctors' training will require a more structured approach to our skills curriculum, including continuous assessment of skills, constructive feedback, and provision of opportunities for deliberate practice in the teaching environment.

This paper aims to provide an evidence based algorithm for procedural skills training. It focuses on teaching technical skills, which are just one component of a successful procedure—others are clinical judgment, communication, and team work.

What do we know about current teaching of procedural skills?

Currently, training in technical procedures is often unsystematic and unstructured. Educational tools that have been validated are often underutilised,[1] and evidence is growing that adjunctive methods for procedural teaching, such as the use of virtual reality, have not been translated into clinical practice. Teaching communities worldwide would benefit from standardised validated curriculums that use proved technology for teaching technical competence effectively, minimise wasted time, and focus on the breadth of skills needed for a specific practice.

Pre-patient training

Pretraining for technical skills should involve three major components, which should be done outside the clinical setting:

- The cognitive knowledge surrounding the specific medical conditions, the steps of a procedure, and the function and operation of equipment;
- Instruction in basic, generic enabling skills that will prepare students by giving them the fundamental elements needed to perform specific procedures; and
- An opportunity to perform a procedure in a variety of different platforms, such as virtual reality training, bench model simulations, and cadaver and live animal model surgery.

The educational experience of these simulated models can be enhanced by designing patient focused, realistic scenarios involving simulated patients and team members.[2] During all of these three elements learners must have access to patient, expert teachers who provide ongoing summative and formative evaluation.

This approach would bring to our operating theatres the strategies that have in the literature on learning motor skills, proved efficacious. Instead of learning how to do a cholecystectomy in the operating theatre, trainees would become comfortable with basic laparoscopic psychomotor skills before performing their first live laparoscopic procedure.[3] This can be effective: in a randomised controlled trial of 16 surgical trainees, those who had received virtual reality simulation training for a laparoscopic procedure were faster, made fewer errors, and showed greater economy of motion than those who had not received such training.[4] To this end, we have designed and are currently validating standardised comprehensive "pre-patient" curriculum (fig 1).

Training in a clinical situation

At the completion of a period of "pre-training," learners should be exposed to technical procedures in clinical situations, following validated models for teaching psychomotor skills, such as those of George and Doto and of Walker and Peyton.[5,6] A systematic clinical exposure can be achieved through the steps shown in figure 2.

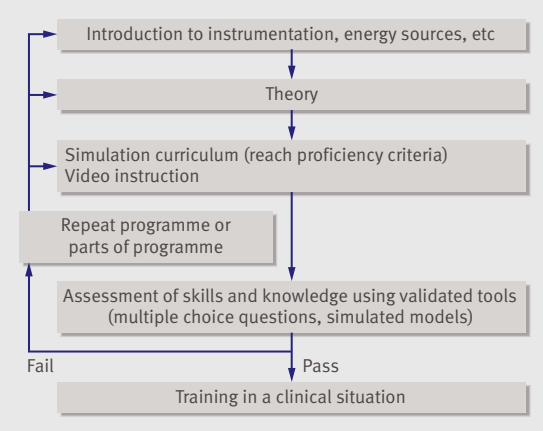

Fig 1 | **Pre-patient training programme**

Practise basic psychomotor skills until proficiency criteria are achieved

Basic skills should generally be practised in the simulation lab. The traditional approach has been based on time spent, but as students learn at different rates we should use a proficiency based system that allows advancement once competence in subordinate skills has been shown.[7]

Acquire knowledge that is specific to the procedure

Knowledge specific to the procedure should include knowledge of the instrumentation, anatomy, indications, and possible complications associated with the procedure, preoperative work-up, and postoperative management, as well as successful completion of an assessment procedure. Once criteria have been met successfully, the learner should be considered competent to start on basic skills procedures.

Demonstration of the procedure

The learner should review a video or a demonstration by an expert of a real procedure on patients.[6] This will allow the student to observe and understand the skills necessary to perform the procedure.

Break the procedure into key steps

The trainer describes the steps while performing the procedure. This will help the learner identify and follow the key steps of the procedure in the correct manner and order. Such deconstruction has established the key procedural steps for common surgical procedures such as laparoscopic cholecystectomy, hernia repair, and Nissen's fundoplication.[8 9]

Comprehension

The trainer demonstrates the steps of the procedure while the learner describes the steps. This aims to ensure that the learner understands the steps clearly.

Perform single components of a procedure

Time limitation is often an important obstacle for junior doctors wishing to perform procedures in the clinical environment. One option is to split each technical procedure into two or three major steps and to allow learners to do only one step at a time until each has been mastered. This allows the learner initially to do manageable steps, without influencing the flow of patients in a busy schedule. This approach also has the advantage of "setting the educational stage" for the learner, who knows that he or she will be expected to do a specific element of the procedure. This removes the frequently observed adverse psychological fallout of "not being allowed" (often without explanation) to complete the procedure. For example, in lower gastrointestinal endoscopy, the learner may start with retracting the endoscope, which already has been inserted by the teacher. When this has been mastered the learner may introduce the scope through the descending and ascending colon, and finally may try to pass the instrument through more challenging areas such as the sigmoid colon or the splenic and hepatic flexures.

Performing an entire procedure

Once students have mastered each component of the procedure, they should be allowed to perform the whole procedure under supervision.

Assessment and feedback throughout the learning process

To reinforce learning, each operative procedure should be followed by a debriefing session. Video recording the learner's performance of the procedure, followed by a review of this recording by both trainer and learner, could provide structured assessment and constructive feedback. This has been shown to

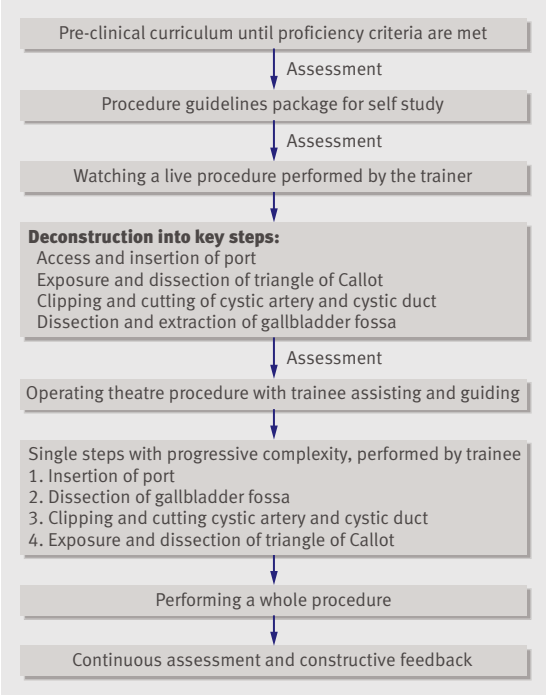

Fig 2 | **Training in a clinical situation: curriculum in basic laparoscopy (laparoscopic cholecystectomy)**

KEY POINTS

- Technical competence is a key element in many surgical and non-surgical specialties
- Basic skills training should take place in the skills lab until proficiency criteria have been met
- Tools for training have been designed and validated
- Putting comprehensive teaching curriculums into clinical practice is the next step
- The impact on quality and speed of skills acquisition remains to be evaluated

contribute to faster acquisition of skills and reduce the learning curves in the operating theatre.[9]

What are the challenges?

Difficulties associated with the system

Often, educational opportunities cannot be utilised because of the pressure for speed and maximum efficiency. This is exacerbated when faculty and staff have to deal with overcrowding and schedules that are running late. A stepwise approach will allow learners to be exposed gradually to tasks they feel comfortable and competent with, and will minimise any "wasted" clinical time.

Exposure to technical procedures is currently diffuse and uneven, based on available opportunity rather than on structured educational objectives. This can lead to inefficient training and prolong the time before competency with each procedure is achieved. A modular curriculum will focus the exposure to procedures and speed up learning.

Many training programmes maintain a hierarchical approach: junior trainees are not taught tasks considered to be in the domain of more senior trainees. This may lead to wasted clinical time early in the career for many competent learners. A structured training curriculum should allow junior doctors to learn procedures once they have shown they have adequate skills and knowledge.

Difficulties associated with the learner

Observational studies have shown that trainees acquire knowledge and skills at different rates, and some find specific types of procedures challenging.[10] A pre-patient training programme will allow only those who show sufficient technical proficiency and knowledge of procedures to continue their training on patients.

Difficulties associated with the trainer

Concerns among attending physicians about the safety of training junior doctors in advanced procedures has often been an obstacle. Observational studies have indicated that these concerns are unjustified and that with appropriate safeguards, early training does not compromise patient safety.[11]

What next?

If the model we have described is to succeed, trainees must be assigned to complete modular based learning objectives and must spend long enough in environments where these can be achieved. Future work should aim at piloting this approach, investigating its impact on acquiring skills, and meeting the need for adequate training in less time.

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Confusing times

Have the people who have devised the "bare below the elbows" policy in hospitals fully considered the impact on the assessment of mental state?

While reviewing a patient on the ward who was confused, I completed the physical examination and drug chart review and naturally turned next to the mini-mental state examination. We passed through the time and place questions, tried and failed to remember three things, and had even managed, after a fashion, to copy interlocking pentagons.

On the home straight, the patient rapidly and correctly identified my pen. I whirled my arm theatrically in the air, bringing my wrist in front of her face to show her my watch. Where was my wristwatch? Of course, along with my shirt sleeves and engagement ring it was removed. Gone, never to be seen in public again for fear of contaminating the hospital. Falteringly, I asked her the question anyway: "What is this?"

Luckily the patient was able to identify my arm. This raises the questions, is it the arm or the wrist the patient should name? Has the test been validated for parts of one's anatomy? What other objects could be used instead?

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