Spinal Anaesthesia: Teaching and Assessment

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Abstract
As performance assessment in medicine moves into a competence-based era there is a need to develop procedure-specific tools for evaluating technical ability. Spinal anaesthesia is one of the fundamental skills of the practicing anaesthetist. Changes in learning opportunities for trainees over the last decade mandates a change in the way practical skills are taught and assessed. In order to optimise the way the practical skill of spinal anaesthesia is acquired by trainee anaesthetists, it will be necessary to combine newer methods (e.g. simulation, structured feedback and assessment) with older techniques (e.g. didactic learning, clinical demonstration). The use of proven concepts from disciplines outside medicine should also be considered.

Keywords: Assessment, Spinal Anaesthesia, Competence, Simulation
In recent years there has been a plea for change in the way practical procedures are taught to trainees in medicine [24]. There is now recognition that the traditional experience-based mode of acquiring technical skills should be replaced by a more structured competence-based method. It is no longer acceptable for trainees to undertake procedures on real patients with minimal experience or supervision [9]. Despite the broad acceptance of the need for change, the wheels of motion are moving slowly. Primarily this is due to a paucity of research on how best to educate and assess medical practitioners in relation to technical procedures.

The safe practice of anaesthesia demands proficiency across a broad range of practical skills. Spinal anaesthesia is one of the first procedures taught to new trainees. The procedure involves inserting a needle through a variety of tissue layers using mainly tactile cues. As such, it is difficult for the trainer to demonstrate the procedure to the learner using the traditional “see one, do one, teach one” approach. The number of spinal anaesthetics attempted by novices before acceptable failure rates can be achieved has been reported between 36-112 procedures [7, 10]. Clearly, there is a need to bridge this gap with valid, reliable competence-based training and assessment [26].

Acquiring technical skills in medicine can be a challenging process. The learning needs of the novice are often overshadowed by limited resources, time pressures and genuine concerns for patient safety [30]. Trainees frequently report there has been inadequate exposure in this regard [12]. In a recent US study of surgical residents, 50% of the graduating residents had not performed even one of 50 of the 121 essential operations. In addition, the number of total cases performed over 5 years per resident varied significantly from 600 to 2785 [3]. The delivery of high quality anaesthesia into the future relies on the provision of practitioners who are not only knowledgeable but competent in the practical procedures relevant to their scope of practice [24]. Medical education is expensive, therefore at the very least it should be effective. Finding the safest, most efficient means of teaching technical procedures requires rigorous research. Factors that influence teaching and learning practical skills need to be explored in detail [8]. Procedure-specific considerations will also need to be taken into account. It is most likely that the ideal approach to acquiring a skill such as spinal anaesthesia is multifaceted. A sound knowledge base, clinical demonstration, observation, the use of simulation, structured feedback, self reflection, supervised practice and competence-based assessment all have a role to play [29].
Knowledge of the relevant indications, contraindications, complications, anatomy, physiology, and pharmacology of spinal anaesthesia can be acquired before undertaking the procedure on a real patient. Books, lectures, videos and the internet are all useful adjuncts yet frequently trainees undertake procedures in the clinical setting with insufficient knowledge [25] or without any formal assessment of the fundamentals required.

The specialty of Anaesthesia has been among the first to embrace simulation as a training and assessment tool in medicine [15]. A 1999 world wide survey of the use of simulators in anaesthetic practice found that in excess of 70% of medical schools used some kind of simulator for teaching anaesthesia skills [22]. Simulation offers the unique opportunity to acquire and practice technical skills without exposing patients to any risk. It also offers the possibility of presenting the learner with rare but critical scenarios which might not ordinarily be encountered in routine practice. In theory it is an ideal bridge between textbook and reality. However the evidence supporting the use of simulators in procedural training has been questioned. Can technical skills learnt in the simulated environment actually result in better outcomes in clinical practice [9, 23]? There is some evidence to date that simulation can improve performance in the areas of laparoscopy [21, 17, 27] and obstetrics [16, 11]. Airlines and other high risk industries have embraced simulation as a means of training. In the current climate where the culture of patient safety prevails, it would seem unnecessary to wait for exhaustive and definitive proof to support the use of simulation as a training tool [14, 19].

Although teaching practical skills according to the old dogma-”see one, do one, teach one” can no longer be recommended, the role of clinical demonstration and observation cannot be discarded. Many subtleties relating to coordination and movement can be assimilated through observation that may not be acquired through physical practice alone [28]. The effect is magnified when observation is combined with physical practice. Wulf has commented on the opportunity for efficiently teaching trainees in pairs given the effect of alternating observation and practice. Trainees operating in such a manner perform as well despite having only half the physical practice compared to trainees practicing alone [29].

Self reflection is a much under utilised tool in teaching practical skills. Trainees often have a good perception of how they have performed and fare better if they can control some aspects of the learning such as which tasks they would like to practice or whether or not they would like feedback [5].
Bell has proposed a multistep approach to training and assessment of practical skills to surgical trainees. Cognitive assessment, skills training using validated metrics and practice on a simulator should be undertaken before entering the operating room. After clinical exposure the trainee should have access to structured feedback, the opportunity to select aspects to practice again in the skills laboratory and formal competence-based assessment [2].

To date formal assessments in medical training have been weighted more towards cognitive rather than technical skills. In essence this has been due to a lack of a valid, reliable procedure-specific means of assessing practical procedures. A global impression of competence given by a supervising clinician of a trainee’s performance without predefined criteria is no longer sufficient [13]. Logbooks, direct observation, psychometric testing, cusum analysis, checklists of completed tasks, global rating scales, multi-station bench testing, predefined error lists and simulation are amongst the techniques that have been employed [4]. It is likely that some combination of these techniques applied over time would yield the most accurate assessment.

The MedCAP (Medical Competence Assessment Procedure) project is an EU funded project aimed at developing a competence assessment procedure for the performance of spinal anaesthesia (www.medcap.eu). The system comprises a learning management system (LMS) and a simulator for spinal anaesthesia. The LMS facilitates case-based learning by presenting the user with a series of questions and decisions within a given clinical scenario. The simulator is embedded within each scenario such that the user is asked to perform the procedure of spinal anaesthesia at the appropriate time. It uses a force feedback system to replicate the sensations of needle insertion during spinal anaesthesia and stereoscopic vision to provide 3D visualisation [20]. Data from lumbar CT scans of patients typical of those presented in the case scenarios were used to vary the simulator experience according to the relevant anatomy. Thus the sensations can be altered to match the given clinical scenario. A set of metrics for the performance of spinal anaesthesia on the simulator has been defined within the system [6].

The assessment procedure used in MedCAP incorporates the principles of competence-based Knowledge Space Theory (CbKST). This concept has been successfully applied to other educational domains [18]. The theory is built on the concept that mastering a given skill is usually preceded by acquisition of a number of related prerequisite skills. Thus many of the competences necessary to
perform a certain task have surmise relationships to each other. Assessment can be streamlined such that it is only necessary to test certain competences to establish that the prerequisite competences are present. One of the benefits is that on completion of the competence assessment procedure the user does not merely receive a numerical result but instead a detailed output of the individual’s competence state. This result can be used to inform further which competences need detailed renewed attention. In this way assessment drives future learning [13]. Studies to determine the validity of MedCAP against clinical assessment are currently underway.

One of the greatest challenges in the delivery of high quality healthcare to society in the coming years is the reform of medical training and assessment. The solution will require innovative technology to be combined with aspects of traditional methods which have been proven to be effective. It would seem wise to “borrow” established concepts from the educational domain. The specialty of anaesthesia as with other disciplines will need to focus on the development of valid, reliable, procedure-specific mechanisms for teaching and assessing valuable practical skills to the practitioners of the future.

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References


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