Airway Management: skill-specific instructional design.

Expertise in airway management is of great clinical importance and high clinical consequence. It is a defining skill set of the specialist anaesthetist.

Clinical expertise requires clinical experience. Clinical opportunity may be plentiful (BMV and CPAP, SGAs, DL, VL, bougies and stylets), uncommon (AFOI), or rare (CICO). Skill specific training is influenced by clinical opportunity, patient risk, and perceived importance. The relative contributions of human factor, cognitive and psychomotor skill components, influence the need for skill-specific instructional design. Psychomotor complexity varies with different skills and psychomotor aptitude varies with different individuals. This is the underlying problem with certification on the basis of volume of practice rather than demonstrated proficiency. Defining proficiency, assessing performance and supporting the individual practice requirements of people with different skill aptitudes are integral to the application of mastery learning. These methods have been shown to be superior to non-mastery methods for skill development, but they take more time and effort. They may be particularly suitable for skills of high consequence for which there is limited clinical opportunity. Effective skill-specific instructional design should be the consequence of understanding and meeting these challenges.

Bronchoscopic dexterity is an example of a moderately complex psychomotor skill. Proficiency in this skill is an essential component of competent FOI which remains the gold standard technique for many difficult airway situations. It is a technique of high consequence that is only performed sporadically and reluctance to perform the technique when indicated is still reported in airway morbidity and mortality statistics. Widespread proficiency in this skill results from effective application of the principles of mastery learning.

Previous work using a non-anatomic dexterity training system, Dexter (www.dexterendoscopy.com), an anatomic manikin and a proficiency-centric global rating scale has shown that 100% of novices can achieve a proficient standard of bronchoscopic manipulation within 5 hours of distributed structured practice (85% within 3 hours) with clinical skill transfer in 93%. This high clinical transference is a compelling argument for validity. Supporting the concept of individual practice requirement, only 24% of novices achieved a proficient standard in a non-mastery workshop with 1.5 hrs of similar hands-on practice. Of interest the level of skill acquired in the workshop was unchanged after 5 months, regardless of subsequent exposure to bronchoscopy.

In Wellington, a bronchoscopic drivers licence is required before trainees perform clinical bronchoscopy. To achieve their licence, the trainee must achieve a proficient GRS score on an anatomic manikin, demonstrate accurate rotatory and fine manipulation skills on Dexter and show anatomic awareness within a bronchial tree. They are then encouraged to perform asleep FOBI on anaesthetised patients before moving on to AFOI.

Concepts regarding the selective use of anatomic, non-anatomic, “low-fidelity” and “high-fidelity” training systems are well advanced in relation to bronchoscopic training in both the respiratory medicine and anaesthesia literature. A recent meta-analysis concludes that low fidelity part-task trainers are more effective than virtual reality simulators for bronchoscopic psychomotor skill
development. This may relate to a more specific focus on the psychomotor component of the skill when using the part task trainers.

The concept of model “infidelity” is also being critically considered. This refers to potential hazards associated with training on a variety of simulators due to deficiencies in physical, functional or psychological fidelity. Examples include developing a manikin-effective technique for intubation that is potentially harmful to a patient, and developing or testing airway devices in manikins rather than people. Virtual reality bronchoscopy simulators may encourage flawed technique because the tip of the surrogate endoscope is always supported in the simulator aperture. An anatomic manikin is useful for developing the skill of tip control in a large unsupported space, as required for bronchoscopy via the oral route. However other important aspects of dexterity may remain undeveloped. A video-bronchoscope with slight tip flexion can be passed repeatedly from nose to carina of an anatomic manikin with the camera off! The path is essentially a straight line but reaching the carina with this method is meaningless in terms of psychomotor skill development.

The concept of model infidelity is particularly important if clinical application of the skill in question is rare. This may be particularly important in techniques for managing CICO crises. Low fidelity part task trainers provide a platform for awareness of the mechanical tasks but lack tissue feel, blood and physiological response. The lack of tissue fidelity is so marked that the wisdom of junior doctors being taught these techniques prior to demonstrating expertise in the fundamentals of airway management could be considered dangerous. Anaesthetised animal models provide a much higher fidelity training model and opportunity to train with them should be sought. A combination of bench model training, human factor training and real time hands-on participation with an anesthetized animal model provides a powerful experience. The time critical nature of CICO, the rarity of the event, the pitfalls of bench models, and the potential for patient harm, pose particular challenges for CICO training. A sense of optimal preparedness might be more appropriate than the concept of mastery for these techniques. This might be best achieved by periodic training with anaesthetized animals, especially for senior doctors.

The evidence base for effective skill-specific teaching tools and learning methods is starting to take shape. Proficiency based performance measurement is integral to the successful acquisition of complex skills in a population of trainees with different individual aptitudes. The effectiveness of technologically advanced simulators needs to be studied on a skill specific basis to avoid succumbing to “info-tainment” as a surrogate for clinically transferable developed skills.

With regard to bronchoscopy, the challenge is to encourage local ‘airway champions’ to establish the logistical requirements for dedicated practice in their own anaesthesia departments. For CICO techniques, local bench practice needs to be periodically supplemented by participation in training at centres with animal facilities.

References


