Endotracheal intubation skills of medical students

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Summary

The ability and confidence of clinical medical students to insert endotracheal tubes correctly and quickly and to recognize oesophageal misplacement was evaluated. Ten (33%) of the medical students intubated the trachea correctly at their first attempt but 14 (47%) incorrectly identified the position of the endotracheal tube. However, recognition improved by their second and third attempts (70% and 80% respectively). Ninety-three percent of students intubated correctly on their third attempt.

Although medical students can obtain better results at correct tube placement with repeated attempts under optimum conditions - a practice effect - and do better at recognizing correct tube placement there is still a persistent failure to recognize endotracheal tube misplacement, ie oesophageal intubation. It is the ability to recognize oesophageal intubation promptly that is a life-saving skill. This essential skill should be taught during the introductory anaesthesia programme through the use of clinical patients.

Introduction

The proficiency of pre-registration doctors in techniques of resuscitation has been criticized both in the UK[1-3] and the USA[4]. Only one in three could pass an endotracheal tube - and took an inordinately long time about it[1]. It is agreed that all medical personnel must be taught to recognize this potential hazard of a misplaced tube at an early stage in their careers. First year medical students can learn the basics of life support in a few hours[3]. The absence of ventilation which can result from accidental oesophageal intubation rapidly produces hypoxia and may result in death if not detected very promptly[5-11]. The basic essential skills in dealing with an apnoeic patient progress from knowing how to ventilate the victim's lungs by expired air resuscitation, progressing to the safe use of a self-filling bag and mask to deliver oxygen and finally, if necessary, to achieve endotracheal intubation with a cuffed tube. The objective of this study was to evaluate the ability of clinical medical students after a standard didactic teaching programme to insert endotracheal tubes correctly and quickly and to recognize oesophageal misplacement.

Methods

Subjects

Ninety healthy patients (ASA grades 1 and 2) of whom 32 were males aged 15-70 years (median 28 years) undergoing elective surgery where orotracheal intubation was required as part of the anaesthetic technique were studied. Median weight was 65.0 kg (range 45-100 kg). Patients with cardiovascular or respiratory pathology, or others at risk of aspiration or for whom intubation was expected to be difficult, were excluded, as were patients with oropharyngeal, tracheal, oesophageal and gastric disease. Patients with loose teeth or crowns were excluded to avoid the potential of dental injury during the study. Informed consent was obtained from all patients.

After approval by the local human research committee, 30 medical students, randomly selected from the anaesthetics course in the first clinical year were tested; none had intubated a patient previously. All had previous didactic instruction in the techniques of orotracheal intubation and the standard methods to determine correct tube placement including direct visualization, observing apical movement of the chest, absence of stomach distension, and auscultation of the chest, axillae, and epigastrium[12]. This instruction was by formal lectures, manikin practice and a demonstration on an anaesthetized patient. Formal classroom instruction on the technique of airway control and tracheal intubation was based on standard textbook descriptions and the guidelines of the Resuscitation Council (UK)[13]. The students had previous instruction in cardiopulmonary resuscitation, airway management in general and basic anatomy and physiology in the pre-clinical course.

Technique and apparatus

After a standard premedication of intramuscular papaveretum 20 mg and scopolamine 0.4 mg one hour previously, anaesthesia was induced with intravenous fentanyl 1 μg/kg followed by thiopentone 4 mg/kg. Muscle relaxation was provided by intravenous suxamethonium 1 mg/kg. After the lungs were routinely inflated with oxygen, tracheal intubation using a Macintosh adult blade laryngoscope to expose the larynx was attempted by the medical student under the direct guidance of the investigator. A maximum period of 45 s from the laryngoscope blade passing the patient's lip was allowed for the student to attempt the intubation using appropriately sized (No. 7-8) polyvinyl chloride cuffed Portex endotracheal tubes; no bougie or director was used.

The student was asked after the first attempt at intubation whether he or she had correctly placed the endotracheal tube (ETT) relying on the previously taught methods of confirming correct placement. The investigator then quickly determined the position of the tube using infra-red capnography (Datex cardiocap monitor), with correct tracheal placement confirmed by the appearance on the capnogram of the typically flat-topped carbon dioxide waveform[14-16]. The medical student was blinded to this information.

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The investigator reintubated the patient if the medical student's attempt at intubation was unsuccessful. The same student was studied during intubations on three separate patients.

The view of the glottis at laryngoscopy was recorded by the investigator after the student's attempt according to a previously published classification[17,18]: grade 1, glottis can be fully exposed; grade 2, glottis can be partly exposed (posterior commissure only); grade 3, glottis cannot be exposed (only epiglottis visualized); grade 4, neither glottis nor epiglottis can be exposed. The patients' lungs were manually ventilated with oxygen, nitrous oxide and isoflurane via a Bain anaesthetic breathing system with a fresh gas flow of 80 ml/kg until the resumption of spontaneous breathing.

The unpaired Student's *t*-test was used for the comparison between patient weight and initial oesophageal misplacement, and the Chi-squared test was used to investigate the relationship between grading and difficulty of intubation.

Results

Ten (33%) of the medical students intubated the trachea correctly at their first attempt. Capnography confirmed correct placement in all cases. Fourteen (47%) of the medical students incorrectly identified the position of the ETT after their first attempt. However, accuracy of judgement improved on their second and third attempts (70% and 80% respectively). Twenty-eight (93%) students intubated correctly on the third attempt. There was no correlation between patient weight and initial oesophageal misplacement ($P=0.5$). Difficulty of intubation grading was highly predictive of misplacement of the endotracheal tube on the first attempt at intubation ($P=0.003$).

Discussion

Medical educators must provide their students ample clinical experience and implement strategies to monitor and assess progress. The time constraints of the curriculum and the ever-increasing amount of information that must be presented, assimilated, and learned by students make the problem all the more difficult. Clinical experience is essential in developing clinical competence, especially in resuscitation.

Since the significance of oesophageal misplacement following intubation is well-recognized as a cause of morbidity often with consequent litigation[19], we feel that this should be particularly emphasized during the introductory clinical programme. Formal training and education should improve recognition of events and the appropriate responses, in addition to prevention. Though the technique of tracheal intubation can be visualized in the form of demonstrations, blackboard pictures, charts, projected slides and videos, clinical 'hands on' practice is the most important aspect of airway management training. Intubation is easier under general anaesthesia than during emergency situations, and so it is not surprising that medical students can obtain consistent results in achieving tracheal intubation. However, even in such optimum conditions their success in recognizing correct tube placement (80%) following their third attempt is poor. Since even after the third attempt at intubation oesophageal misplacement is likely to occur 7% of the time, and as the students are failing to recognize this fact 20% of the time, then at least 1.4% of patients will suffer major complications as a result. The need for sufficient time and opportunity to learn these skills in the undergraduate curriculum must be emphasized. This study does not address the problem of skill deterioration over time; however, yearly recertification in airway management as a component of advanced cardiac life support skills should be considered and frequent manikin and clinical sessions encouraged for doctors[20].

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