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Teaching acute care: a course for undergraduates

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Abstract

Aim: To describe a course designed for medical undergraduates to help develop the necessary competencies to recognize and manage acutely ill patients.

Materials and methods: Primary description by the authors of the content, development and implementation of a course designed to teach competencies recommended by the Acute Care Undergraduate Teaching (ACUTE) project of the Resuscitation Council (UK) and Intercollegiate Board of Training in Intensive Care Medicine. The course format was designed to balance best teaching methods within the context of limited available teaching time and resources. Various components of the course were rated by 155 final year medical students who attended the course.

Results: A one and a half day integrated acute care course based on self-learning (course manual, CD-ROM, web material), lectures, interactive tutorials, skill stations and formative and summative assessment is described. The course addresses 55/71 (77%) of competencies considered important by the ACUTE project. It was well accepted by medical students and on a scale of 1 (poor) to 5 (excellent) median student ratings of various components of the course ranged from 4-5.

Conclusion: The course offers a method of teaching acute care for medical undergraduates in a pedagogically sound, resource-efficient manner.

Introduction

Care of critically ill patients is often suboptimal^{1,2,3} with clinical deterioration often being undetected or poorly treated by ward staff^{4,5}. Deficiencies often involve simple aspects of acute care of the patient's airway, breathing and circulation, oxygen therapy, fluid balance and monitoring. Lack of knowledge and skills, failure to appreciate the urgency of the situation, failure to seek advice early and poor communication are the principle contributory factors to the suboptimal care commonly delivered by junior medical staff to acutely ill patients⁶.

In the last few years there has been increasing concern about undergraduate training in acute

care^{7,8}. Many new medical graduates feel that they are not competent to perform life saving procedures and report a lack of confidence in their ability to manage acute clinical conditions^{9,10}. Resuscitation and critical care medicine remains poorly represented in the undergraduate curriculum and many students have a poor knowledge of acute care^{11,12}.

The necessity to incorporate acute care in the undergraduate curriculum is now well recognized^{7,8}. The question of what core competencies should be incorporated into the syllabus has been addressed in the ACUTE (Acute Care Undergraduate Teaching) project¹³. We describe a new course (Very BASIC) designed to address the competencies defined as "essential" by the ACUTE project in the context of limited teaching

time and resources. The course material is available free of charge to other medical schools, on application to the authors.

Course Description

The course was developed with the aim of providing high quality teaching in acute care to final year medical students without the need for expensive teaching aids and without an excessive demand on the time of busy clinicians. The course was devised by an international group of acute care specialists with an interest in undergraduate training and experience in course development (see appendix). Most were involved in the development of the Basic Assessment and Support in Intensive Care (BASIC) course, a postgraduate course which has been taught by local faculty in Australia, India, Hong Kong, Malaysia, New Zealand, South Africa, Syria and the United Kingdom (www.aic.cuhk.edu.hk/web8/basic.htm). No external funding was obtained for course development.

The course utilizes a mixture of teaching methods including didactic lectures, experiential learning using manikins, electronic interactive self-learning, small group interactive scenario based teaching, formative assessment, reading of provided course material and guided reading on the Internet to address 55/71 (77%) of "essential" ACUTE competencies (table 1). Those competencies considered to be poorly covered in our existing medical student curriculae, to be of greatest importance and to be appropriately taught in a course format were prioritized.

Students are given a comprehensive course manual, in preparation for the course. They are required to complete a pre-course open book on-line multiple choice questionnaire (MCQ) designed to motivate students to read the manual carefully. They are given immediate feedback on those questions they have answered incorrectly which includes guidance on which chapters of the book to re-read. The students also receive a CD-ROM which contains electronic interactive tutorials, narrated lectures and links to material on the website (www.aic.cuhk.edu.hk/web8/VeryBASIC.htm). The website contains material written specifically for the course as well as external links to other useful material.

Primarily factual topics are taught by a self-learning process using the manual and associated electronic material. Essential concepts are reinforced by lectures, which are largely based around fictional cases and utilize high quality

illustrations to demonstrate how factual knowledge can be applied into clinical practice. Topics requiring motor skill development utilize manikin based skill stations. Interactive tutorials, based on case scenarios, are designed to create a cycle of abstract conceptualization of problems, encourage active participation in providing solutions and allow expertly guided reflection of the consequences of action taken. This process closely mimics the process of experiential learning¹⁴. Students are encouraged to apply their knowledge and make decisions in the initial assessment and management of critically ill patients, in the interpretation of arterial blood gases and metabolic abnormalities as well as in an extended case scenario. The latter involves electrocardiogram (ECG) and chest X-ray interpretation and interactive decision making regarding the management of sepsis, acute coronary syndrome and septic and cardiogenic shock. Each skill station and interactive tutorial involves groups of 4-5 students for 35 minutes.

The course is currently taught over 1.5 days to 38-40 final year students at a time. All students receive lectures over the first half day. The following day half the group spend the morning on the electronic material (CD-ROM and web-based) and the afternoon on skill stations and tutorials while the other half does the reverse. Staff requirements are for two lecturers for half a day and five tutors for a whole day. They should all have acute care experience. Equipment needed to run the course includes 1-2 airway training manikins, 2 intravenous access manikins and computers.

Immediately after the completion of the course candidates are assessed using a computer based post course MCQ test. The typical MCQ involves a clinical scenario and often requires the interpretation of investigations (an example is given in appendix 2). Rather than simply testing factual knowledge, the test is designed to require students to make clinical decisions based on acute care scenarios. The students are warned at the beginning of the course what type of MCQ to expect. Questions are displayed one at a time and students are not able to alter their answers once they have selected and confirmed their choice. Candidates who score <50% in the test are given the opportunity to re-sit the MCQ with the next course. Satisfactory completion is a mandatory requirement to successfully complete the year.

COMPETENCIES	ILS	ALERT	Very BASIC			
			M	L	S	E
Describes signs of airway obstruction	√	√	√	√	√	
Demonstrates safe use of simple airway manoeuvres/adjuncts	√	√	√	√	√	
Describes indication & rationale for safe oxygen therapy in the critically ill patient	√	√	√	√		
Describes the principles of controlled oxygen therapy in the patient with COPD		√	√	√		
Demonstrates basic treatment for simulated choking			√			
Demonstrates a systematic clinical assessment of breathing & oxygenation	√	√	√	√	√	
Describes common causes of breathlessness		√	√			
Describes the clinical signs & treatment of a tension pneumothorax	√	√	√			
Demonstrates effective bag-mask ventilation	√	√	√	√	√	
Demonstrates effective mouth-mask-ventilation	√					
Demonstrates effective expired air ventilation without adjuncts	√					
Describes the clinical feature of shock		√	√	√		
Describes the potentially reversible causes of a cardiac arrest	√	√	√			
Demonstrates the immediate management of a simulated witnessed in-hospital cardiac arrest	√		√			
Describes how to recognize & treat common peri-arrest arrhythmias	√		√		√	
Demonstrates effective external chest compressions	√		√			
Describes effective fluid resuscitation		√	√	√		
Describes control of external haemorrhage	√	√	√			
Recognises cardiac arrest rhythms	√		√			
Demonstrates safe & effective use of an automated external defibrillator	√					√
Demonstrates safe & effective use of a manual defibrillator	√					
Describes peripheral venous cannulation including attention to patient comfort and infection control						√
Describes alternatives to peripheral venous access	√					
Describes indications, risks and safe administration of blood products			√			
Describes the common causes of altered consciousness		√	√	√		
Demonstrates a systematic approach to the assessment of acutely ill patients with altered consciousness	√	√	√	√		
Describes how to recognize and initiate treatment of status epilepticus			√	√		
Describes how to recognize & initiate treatment for an acute asthma attack			√			
Describes how to recognize & initiate treatment for diabetic emergencies			√		√	
Describes how to recognize & initiate treatment for an acute heart failure			√			
Describes how to recognize & initiate treatment for an anaphylactic reaction			√			
Describes the causes, presentation & treatment of oliguria		√	√			
Describes the indication & dosages of drugs used in the management of cardiac arrest	√		√			
Describes how to recognize & initiate resuscitation of a patient with an acute abdomen						
Describes how to recognize & initiate treatment for meningococcal septicaemia				√		√
Describes how to recognize & initiate treatment for a pneumonia			√			
Describes how to recognize & initiate treatment for common drug overdoses						
Describes how to recognize & initiate treatment for acute coronary syndromes			√			
Describes how to recognize & initiate treatment for an acute exacerbation of COPD			√			
Describes how to recognize & initiate treatment of life threatening hypo/hypernatraemia and kalaemia			√		√	
Describes normal physiological ranges for basic vital signs		√	√			
Demonstrates a systematic approach to the clinical assessment & timely management of the critically ill patient	√	√	√	√	√	

			Very BASIC			
Demonstrates safe handling & disposal of sharps & clinical waste			√		√	
Demonstrates a systematic approach to 3 and 12 lead ECG interpretation, recognizing common & important abnormalities	√				√	√
Demonstrates a systematic approach to chest radiograph interpretation recognizing common & life threatening abnormalities					√	√
Measure arterial blood pressure correctly using a manual method						
Describes the importance of repeated & timely assessment of the acutely ill patient	√	√	√	√	√	√
Demonstrates/ Describes how to obtain arterial blood gases						
Describes a systematic approach to arterial blood gas analysis		√	√		√	√
Describes the principles & limitations of pulse oximetry			√	√		
Demonstrates the rationale use of common laboratory tests & investigations in the critically ill patient						
Describes/ Demonstrates how to recognize one's own limitations & when to call for help	√	√				
Describes/ Demonstrates the principles of breaking bad news		√				√
Describes how to deal with the personal emotional issues surrounding critical incidents, breaking bad news, post incident stress etc						
Describes/ Demonstrates the principles of good communication skills	√	√	√	√		
Demonstrates the ability to work as part of a multi-professional team	√	√				
Demonstrates the ability to extract & critically appraise literature						√
Describes the importance of & methods for achieving adequate pain control		√	√			
Demonstrates respect for patients dignity						
Describes key aspects of in-patient safety						
Describes the ethical & legal implications of attempting/not attempting resuscitation	√	√	√			√
Describes the principles of consent in the acutely ill patient		√				√
Describes the principles of recognition & initial management of patients with suspected spinal injuries			√			
Describes or demonstrates a systematic approach to the assessment & immediate treatment of the victim of trauma			√			
Demonstrates how to correctly set up an intravenous infusion						√
Demonstrates how to correctly prepare & give an intravenous drug						
Demonstrates how to correctly set up and administer high flow & controlled oxygen therapy		√	√	√		
Demonstrates how to correctly set up and use an oxygen/air driven nebuliser & describes indications for use of either device						
Adheres to the basic principles of infection control measures including hand washing			√		√	√
Describes the recognition & immediate resuscitation of a patient with sepsis			√	√	√	
Describes a rational approach to antibiotic prescribing in the patient with sepsis			√	√		

Table 1. Essential competencies addressed by Resuscitation Council Immediate Life Support Course (ILS), University of Portsmouth Acute Life threatening Emergencies Recognition & Treatment (ALERT) and our course (Very BASIC).

For our course details of how the competency is addressed are indicated: L=lecture, M=course manual E=electronic material, S=skill stations or interactive tutorials

Student performance

The mean score (\pm standard deviation) in first attempts at the post-course test (n=155) was 76% (\pm 13%). One student failed on the first attempt, passing on the second.

Course Assessment

Students were asked to anonymously rate aspects of the course on a scale of 1-5 where 5 indicated excellence. Median rating for all aspects was 4. They were also asked to rate various statements

on Likert scale where 1= totally disagree and 5=totally agree. Feedback from the students indicates that they thought that the course material was relevant, well presented, neither too easy nor too difficult and did not contain too much or too little information (table 2).

Discussion

Acutely ill patients are complex, requiring immediate attention and rapid correction of physiological abnormalities. Therefore, the window of opportunity for meaningful student contact and involvement with the acutely ill patient is limited. Furthermore the attention of the clinician is usually directed at patient care rather than teaching at this time. As a result, experiential learning is compromised. The problem is compounded by insufficient dedicated time allocated to teaching, excessive clinical workload, insufficient staffing and funding¹². Our course aims to address some of these issues. By providing the course manual, slides (with speaker's notes), scenarios for skill stations and tutorials (with teacher's notes), on-line pre- and post-course MCQ tests we believe our course will greatly reduce the requirement for preparatory work and marking, allowing teachers to devote more of their time to direct student contact. We estimate that an experienced teacher will require less than 2 hours preparation to give a lecture for the first time and considerably less on subsequent occasions and less than 1 hour for initial preparation to teach a skill station or tutorial. The course uses little in the way of specialized teaching equipment except airway and intravenous cannulation manikins and all course materials are provided free of charge to minimize resource requirements. In addition the tutorials are designed to mimic experiential learning.

Surveys have recommended a minimum of 20 hours contact time is necessary for undergraduate training in critical care medicine¹². Currently the course runs over only 12 hours excluding breaks for lunch and refreshments but despite this, the students performed well in the post-course MCQ test. However, such an assessment can only test the knowledge component of competencies and the test has not been validated. It is possible, but unlikely, that students would have performed well without attending the course: students evaluated the course as challenging and useful. We do not have data to assess the impact of the course on clinical care.

The course is unique in that it is specifically designed for undergraduates, it addresses most "essential" ACUTE competencies and all the

course material is available free of charge to other medical schools (on application to the authors). A MEDLINE search using the terms "education, medical, undergraduate" AND either "critical illness" OR "acute care" did not reveal any similar course specifically aimed at undergraduates. Acute Life-threatening Events-Recognition and Treatment (ALERT™) and Immediate Life Support (ILS) courses are used by some medical schools^{6,15} but address fewer "essential" ACUTE competencies (table 1) and require payment of a license fee. In addition the ALERT™ course was not designed specifically for medical students and does not incorporate formal assessment. We believe that this component is important because a substantial motivation for medical students to learn and an important determinant of what they learn is the desire to perform well in examinations. All three courses utilize lectures, small group teaching, skill stations and course manuals.

The course has limitations. The pre and post course MCQs have not been formally validated and by their nature can only measure some aspects of competence, however they were primarily designed as motivational tools. The course cannot, on its own, train students to an adequate level to achieve all "essential" ACUTE competencies. Indeed, not all "essential" competencies are currently addressed. Our choice of which competencies to address first or in greater detail was based on our desire to address deficiencies in the curriculae at our universities and on our perception of which competencies could be most effectively addressed by this type of course. The course is currently being expanded to cover additional competencies including cardiopulmonary resuscitation and patient safety, at the cost of additional teaching time. Despite its limitations we believe the course provides a useful framework on which students can build, using contact with acutely ill patients in other components of their training to fully develop these competencies. Although an argument might, therefore, be made for holding the course earlier in the student curriculum, the course relies on the student having a reasonably extensive medical knowledge base, on which acute care principles and approaches are built. An inadequate knowledge base would result in the need to teach many of the topics from scratch with resultant time implications.

Component	Content	Median rating (IQR)	Overall ratings	
			Statement	Median agreement (IQR)
Course manual	Assessment of the seriously ill patient, Respiratory failure, Airway management, Chronic obstructive pulmonary disease and asthma, Pneumonia, Haemodynamic monitoring, Shock, Anaphylaxis, Cardiopulmonary resuscitation, Acute coronary syndrome, Heart failure, Life threatening arrhythmias, Renal failure, Sepsis and septic shock, Trauma, Neurological emergencies, Arterial blood gases, Electrolyte disturbances, Blood products, Acute pain management, Infection control, Occupational safety and health, Ethics	4 (4-5)	The course material is relevant	5 (4-5)
			The course is well presented	5 (4-5)
			The course is too difficult	3 (2-4)
			The course is too easy	2 (1-3)
			There is too much information	3 (2-4)
Lectures	Assessment of critically ill, Airway management, Respiratory failure, Haemodynamic monitoring, Shock, Sepsis, Neurological emergencies, Communication	4 (4-5)	There is too little information	2 (1-3)
CD-ROM	Interactive tutorials: Recognition and management of arrhythmias, Arterial blood gas interpretation	4 (3-5)		
	Narrated lectures: Acute respiratory failure, Hand cleansing	4 (3-4)		
Website	Acute coronary syndrome, Meningococcal disease Intravenous cannulation, Chest X-ray interpretation, Oxygen administration, Priming an intravenous administration set Pre-course formative assessment Links to Internet resources covering breaking bad news, informed consent, ECG interpretation, use automated defibrillator, ethical and legal implications of do not attempt resuscitation, evidence based medicine	4 (3-4)		
Skill stations	Intravenous cannulation, Airway management, Hand washing	5 (4-5)		
Small group tutorial	Assessment of critically ill, Extended case scenario, Arterial blood gas and biochemistry interpretation			

Table 2. Summary of student feedback. (1=no value/totally disagree, 5=excellent/totally agree).

Conclusion

We describe a new course designed to teach medical undergraduates acute care. It uses a variety of resource-efficient teaching methods to address 77% of “essential” ACUTE competencies. Student feedback suggests that the course is challenging and very useful. Future course development will incorporate additional competencies.

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Appendix 1

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Appendix 2

Example of a typical post course MCQ question

A 70 kg patient being treated for acute cholecystitis develops acute confusion. His mean arterial pressure is 75 mmHg, CVP 5 cmH₂O,

heart rate 100/min, pH 7.34, PaCO₂ 3.9(29 mmHg), PaO₂ 13.2 (99 mmHg), urine output 20 ml/h. The most appropriate haemodynamic intervention is:

- a) None required
- b) Low dose dopamine infusion
- c) Bolus of 300 ml of colloid
- d) Dobutamine infusion
- e) Frusemide