

An advanced resuscitation training course for preregistration house officers

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ABSTRACT – Preregistration house officers need to be able to manage the first 5–10 minutes of a cardiac arrest. A course has been designed based on the recommendations of the Resuscitation Council UK 1984 and the format of the American Heart Association advanced cardiac life support course. Fifty-nine newly qualified doctors from the same medical school class were studied in two consecutive groups: Group 1 ($n = 31$) were commencing their first post and Group 2 ($n = 28$), whose first preregistration post had been at other hospitals without practical resuscitation training, were commencing their second post. They were pretested and taught in three 2-hour sessions. Five months later they were tested to measure retention of knowledge and skills. Before training there was no difference in knowledge between the two groups but Group 1 were more skilled. The knowledge and skills of both groups immediately after training were significantly improved and at 5 months skills were subject to modest decay only. Experience of managing cardiac arrests was not a substitute for formal practical training.

Preregistration house officers need to be able to manage the first 5–10 minutes of resuscitation following a cardiac arrest and to function effectively as resuscitation team members. Previous studies have documented the poor resuscitation skills of house officers in the United Kingdom [1,2].

Most hospitals do not have formal instruction for doctors in either basic or advanced resuscitation. Most medical schools in the UK teach only basic life sup-

port. Although some medical schools offer advanced resuscitation training, few include practical training and none includes practical testing [3].

A report of the Royal College of Physicians [4] on the training and organisation of resuscitation recommends that all qualified doctors should be able to perform basic life support, use airway adjuncts and defibrillate safely. Medical schools and hospitals should ensure that medical students and house officers are taught these skills.

We designed a 6-hour course for preregistration house officers with emphasis on the acquisition of practical skills. This course was based on the recommendations of the Resuscitation Council UK [5] and the format of the American Heart Association advanced cardiac life support course [6,7]. The purpose of this paper is to describe the course and to present the results of training.

Methods

Subjects

Fifty-nine preregistration house officers who had received practical basic resuscitation training in their third clinical year of medical school took part in the study. None had received any advanced resuscitation training. These house officers who had graduated in July 1986 from the Royal Free Hospital school of medicine were studied in two groups.

Group 1 consisted of 31 doctors who completed their first 6-month post as preregistration house officers at the Royal Free Hospital. Group 2, consisting of 28 doctors, had spent the first 6-month post as prereg-

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istration house officers at other UK hospitals and had returned to the Royal Free Hospital for their second 6-month post. During their first post, seven doctors in Group 2 had attended a 1-hour lecture on advanced resuscitation, but none had received practical training. About half of each group were in medical posts, the others in surgical posts.

Course outline

The course emphasised practical skills, including assembly and operation of equipment: basic resuscitation, management of the airway and ventilation, recognition of arrhythmia, defibrillation, drugs, post-resuscitation care, the role of the team leader, and working as a team in managing simulated cardiac arrests (see Table 1). Teaching took place during practical sessions rather than by tutorials.

Study design

During their first 2 weeks in post at the Royal Free Hospital both groups were tested for knowledge and skills prior to the course being taught and tested again for knowledge and skills immediately after the course. Five months later they were tested once more to assess how much of the instruction they had retained.

Training and testing

The 6-hour course was taught in three 2-hour sessions, each on a different day. The number of doctors for each session was restricted to 10, since the number of instructors and the amount of equipment were limited.

Session 1. A multiple choice questionnaire and an arrhythmia recognition and treatment test were used to evaluate the doctors' knowledge. Each doctor was individually assessed in a separate room, in the skills of one-rescuer basic resuscitation and bag-mask ventilation using a recording manikin and a checklist. All of them then practised rescuer resuscitation by one and by two persons, bag-mask ventilation alone and bag-mask ventilation with two-rescuer resuscitation. Their skills as team leaders during a simulated cardiac arrest were evaluated using a checklist for the management of ventricular fibrillation [8] (see Table 2).

Session 2. The multiple choice and arrhythmia pre-tests were reviewed. A lecture was given on the recognition of life-threatening arrhythmias and their treatment. The doctors then practised recognition of arrhythmias, defibrillation and once again bag-mask ventilation.

Session 3. After brief lectures on the role of the team leader and the principles and priorities of resuscitation [9] the doctors participated in the team practice (simulated cardiac arrest [10]). Subsequently multiple choice and arrhythmia tests were administered differing from but comparable to the tests before the course. Practical skill testing, using the same checklists

Table 1. Outline of the advanced resuscitation course.

I. Basic resuscitation (CPR); one and two rescuers

A. One-rescuer resuscitation (mouth-to-mouth)

B. Two-rescuer resuscitation with bag-mask ventilation

II. Airway and ventilation

A. Turning on an oxygen cylinder and adjusting the flow rate

B. Insertion of an oropharyngeal airway

C. Ventilation using a bag-mask unit

D. Use of suction devices

III. Arrhythmia recognition on an oscilloscope and paper strips

A. How to get an ECG

1. How to operate the monitor or machine
2. Use of the quick-look paddles, chest or limb leads

B. Recognition

1. Sinus rhythm
2. Ventricular fibrillation
3. Ventricular tachycardia
4. Asystole
5. Electromechanical dissociation; any pulseless rhythm
6. Premature ventricular complexes
7. Bradycardias; any slow rhythm

C. Management, with emphasis on the arrested patient

1. Defibrillation
 - a. Description of the defibrillator
 - b. How to operate the defibrillator
 - c. Technique of defibrillation
2. Drugs
 - a. Access or route
 - i. Venous, peripheral or central
 - ii. Endotracheal
 - b. How to assemble prefilled syringes
 - c. How to prepare infusions
 - d. Specific drugs with emphasis on dosage and route of administration (oxygen, adrenaline, lignocaine, bretylium, atropine, isoprenaline, sodium bicarbonate, calcium chloride, dopamine, dobutamine)

IV. Post-resuscitation care immediately after the restoration of a spontaneous pulse

A. Ventilation and oxygenation

B. Support of rhythm and circulation

V. Putting it all together

A. Principles, priorities and algorithms for advanced resuscitation

B. Description of the resuscitation team

C. Team member role-playing during several cardiac arrest scenarios (Mega Code); learning to work as a team and practising the role of the team leader

for evaluation, was conducted in the same manner as pre-testing (see Table 2).

Retention testing

Retention testing took place in one 2-hour session. As with initial training, the session was limited to 10 doctors and was offered three times for each group. The same instruments and procedures as in the initial

Table 2. Scores for skill testing.

Skill	Points
One-rescuer resuscitation	
Ventilation	6
Compression	6
Bag-mask ventilation	
Assembly of equipment	4
Technique	5
Adequacy	4
Mini Code	
Assessment	10
Use of equipment	4
Arrhythmia recognition	3
Defibrillation	6
Drug therapy	1
Total skills score	49

Table 3. Scores on knowledge and skills assessment for Groups 1 and 2 before training (pre-test), immediately after training (post-test) and 5 months after training (retention)

Scores	Group 1 mean (SD)	Group 2 mean (SD)	1 v 2
Knowledge (0-70) (Multiple choice quiz, arrhythmia recognition and treatment test)			
Pre-test	35.5 (6.8)	38.2 (6.6)	n. s.
Post-test	52.8 (7.1)	55.7 (5.9)	n. s.
Retention	49.6 (9.0)	52.5 (6.8)	n. s.
Pre v Post	$p < 0.001$	$p < 0.001$	
Post v Ret	n. s.	n. s.	
Pre v Ret	$p < 0.001$	$p < 0.001$	
Skills (0-49) (Basic resuscitation, bag-mask ventilation, management of ventricular fibrillation)			
Pre-test	25.4 (6.5)	19.9 (4.8)	$p < 0.001$
Post-test	40.2 (3.6)	37.4 (4.8)	$p < 0.05$
Retention	37.1 (4.1)	34.0 (5.1)	$p < 0.05$
Pre v Post	$p < 0.001$	$p < 0.001$	
Post v Ret	$p < 0.001$	$p < 0.01$	
Pre v Ret	$p < 0.001$	$p < 0.0$	

training were used for knowledge and skill testing (see Table 2). Immediately after practical testing of each subject, additional time was devoted for refresher training as required. When knowledge and skill testing of all the doctors in the session was completed, the multiple choice and arrhythmia tests were reviewed.

Statistical analysis

All scores in Table 3 are reported as means (± 1 standard deviation). To compare mean scores, Student's *t*-tests were used for paired data within groups and unpaired data between groups. All calculated *p* values are two-tailed. Statistical significance was defined as a *p* value less than 0.05.

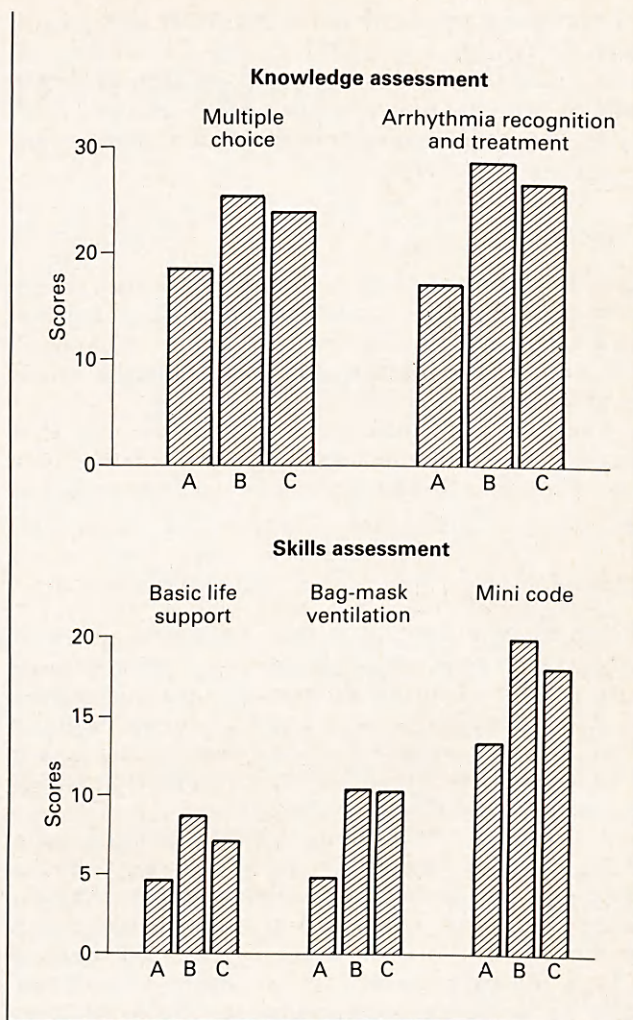


Fig. 1. Mean scores on knowledge and skills assessment for all the house officers (A) before training (pre-test), (B) immediately after training (post-test), and (C) 5 months after training (retention test), indicating learning and retention.

Results

Knowledge

There was no difference in mean pre-test knowledge scores between Groups 1 and 2 (Table 3). For both groups, mean post-test knowledge scores were significantly greater immediately after the course than before it ($p < 0.001$). Five months after the training sessions knowledge scores had not decreased in either group. Figure 1 illustrates the initial learning and retention of knowledge for both groups.

Skills

Group 1 had significantly higher mean pre-test skill scores compared with Group 2 ($p < 0.001$) (Table 3). For both groups, mean post-test skill scores were significantly greater immediately after the course than before it ($p < 0.001$). Five months after training, skill

scores showed a small but statistically significant decrease (Group 1 $p < 0.001$, Group 2 $p < 0.01$). For both groups the scores were still significantly better than their pre-training levels ($p < 0.001$). Figure 1 illustrates the initial learning and retention of skills for the two groups together.

Experience

Experience measured by the number of cardiac arrests attended during the first 6-month post was not associated with increasing competence either in Group 1 five months after initial training or in Group 2 before initial training.

There were no differences in knowledge or skill scores between the doctors in Group 2 whether they had spent their first 6 months on a medical or surgical firm.

Discussion

The pre-training scores of the preregistration house officers were poor and comparable to the poor resuscitation skills of junior doctors and trained nurses [1,2,11]. Group 2, who received no formal training but had experience of attending real cardiac arrests during their first 6-month post, had not acquired the necessary practical skills of resuscitation.

The preregistration house officers' level of knowledge and skills was much improved following the training course and declined only a little after 5 months.

Formal practical training in both basic and advanced resuscitation needs to begin in medical school and continue throughout clinical posts. There must be regular practical training sessions to reinforce the skills taught in the initial training course. This study demonstrates that 5 months after the training session the house officers' practical skills had already started to deteriorate, and experience of attending cardiac arrests did not improve or aid retention of resuscitation skills [12]. Reading, exposure to posters containing essential information of resuscitation, and experience improve knowledge but not psychomotor skills. Hands-on practical experience appears to be the best method to reinforce psychomotor skills following initial training [13-15]. This can be achieved by regular simulated cardiac arrests supervised by an instructor (Mega Code [10]).

This course may be adapted to meet the needs of other groups, eg medical students, junior and senior medical staff and specialist nurses, by modifying the class size, number of instructors, amount of equipment, course content and the time allocated for training.

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