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Hospital Topics

Resuscitation teaching room in a district general hospital: concept and practice

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Summary

Practical training in cardiopulmonary resuscitation presents a problem because of the shortage of teacher time and the many potential trainees. A resuscitation teaching room in a district general hospital has been established, equipped with training mannikins and models, together with wall diagrams and cassette recordings. The arrangement enables many trainees to gain training in small groups with minimal demand on teachers. Experience with the room in use has suggested that the concept may have an application in many district general hospitals and possibly also in large industrial concerns.

Introduction

Undoubtedly attempts at resuscitation after cardiac arrest are worthwhile in most cases.¹⁻⁷ This is emphasised by the growth of intensive care units, coronary care units,⁸ and mobile resuscitation units.^{4 9-14} Knowledge of resuscitation techniques, including external cardiac compression and artificial ventilation, is now mandatory for both medical and paramedical staff and many believe that members of the public should also be taught these skills. Resuscitation training has been undertaken in the USA by many medical and lay groups under the guidance of the American Heart Association and the National Academy of Sciences.¹⁵ Similar schemes exist in many countries of the European Economic Community and Scandinavia, where particular use has been made of training aids and mannikins which have been developed over the years. In an increasing number of European countries a test in first aid and resuscitation forms part of the driving licence examination. By comparison,

Britain would appear to be somewhat behind in organised training schemes for both medical and lay groups, although there are several exceptions where excellent tuition is given.

Cardiopulmonary resuscitation is essentially a practical skill, and teaching by lectures to a large audience is only of limited value. The formal lecture can convey the rationale and theory behind resuscitation but cannot in any way transmit the essential practical skills. These may be acquired only by small group learning with a teacher present to give guidance and monitor progress. Teaching at an actual cardiac arrest is necessarily erratic and impracticable and, therefore, training aids are necessary. Because of the many potential trainees in the typical district hospital and the few skilled teachers available, tuition in practice for the majority consists only of attending a formal lecture with perhaps an occasional attempt to practise on a mannikin without a teacher present to guide their efforts.

Concept of the resuscitation teaching room

To overcome these difficulties we decided to allocate a room specially devoted to teaching cardiopulmonary resuscitation. The room is equipped with the following training aids: Recording Resusci Anne (Laerdal/Vickers Medical Ltd), Vitalograph Intubating model (Vitalograph Ltd), Laerdal Intubating model (Laerdal/Vickers Medical Ltd), Arrhythmia Resusci Anne (Laerdal/Vickers Medical Ltd), Oscilloscope (Rigel Ltd), external DC defibrillator (Cardiac Recorders Ltd), Entonox inhalation unit and cylinder (BOC Ltd), cassettes and tape recorder, projector and screen, montage of drugs used in cardiac arrest, and blackboard and chalk. When available, models with built-in self-assessment features were selected. Each model is accompanied by a cassette tape recording explaining how to perform the particular skill. Wall diagrams and slides are also used to reinforce the training aids and the cassettes. Teachers are really essential only when potentially dangerous equipment, such as the defibrillator, is used.

The equipment in the room is designed to be used by a wide variety of staff, ranging from the most basic technique of mouth-to-mouth respiration to recognising cardiac arrhythmias and electrical defibrillation. Using a cassette for each lesson, the student may choose either the entire course or a particular aspect of training which he feels will be most appropriate for his individual need. The room is available for 24 hours a day and consequently the trainees may choose their own most convenient time for study.

Arrangements and equipment

The models and equipment used do not require excessive space. Apart from the life-size mannikin (Recording Resusci Anne), most of

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the equipment will fit comfortably on ordinary bench shelving. The room measures 2.4 m $\times$ 3 m and is equipped with bench shelving (38.1 cm wide) at each end. A bigger room would enable several pieces of equipment to be used concurrently if we had more cassette tape recorders and ear phones. A plan of the room is shown in the figure. The only mains services required are five power points. The room is locked with a key available in the adjacent intensive care unit, where a reservation book recording the use of the room is also kept.

Lay-out of resuscitation teaching room.

As the trainee enters the room large signs immediately draw his attention to the library of pre-recorded cassettes which explain the use of each training aid. An introductory cassette containing instruction on how to use the room best is always left in the recorder by the preceding trainee and the new trainee is instructed to switch on the recorder on entering the room. This cassette describes the equipment available and gives guidance on its best use. A cassette on managing cardiac arrest¹⁶ aimed at senior nursing and junior medical staff guides the student through the entire process of cardiopulmonary resuscitation and he can then choose those aspects of training which he thinks are specially relevant for his needs. All other cassettes consist of a self-contained lesson on a particular aspect of cardiopulmonary resuscitation (external cardiac compression, use of a self-inflating bag, endotracheal intubation, etc). There are built-in pauses in the commentary to allow the trainee to orientate himself during training and suggestions for stopping the tape from time to time to allow for practice. At difficult junctures, the trainee is encouraged to replay the particular section for special emphasis. Each cassette is enhanced by wall diagrams when appropriate.

MANNIKIN

A life size mannikin, Recording Resusci Anne, occupies a central position in the room, lying on an ordinary outpatient examination couch. A board is placed beneath the mannikin's chest to "stiffen" the underlying surface and also to remind trainees of the importance of working on a firm surface. Resusci Anne is used for teaching external cardiac compression, mouth-to-mouth or mouth-to-nose ventilation and the use of the self-inflating bag. It is also used to show the clear airway position. The model features a series of lights which flash when a particular manoeuvre has been executed correctly. Cardiac compression and lung inflation is also recorded on a paper trace which emerges from the side of the mannikin. This also aids in self-assessment. When used in conjunction with a teacher, simulated carotid pulses and pupillary reactions are available by hand-held squeeze bulbs. The cassette (20 minutes) takes the trainee through the technique of primary resuscitation, describing airway control and maintenance, artificial ventilation, and external cardiac compression. The trainee monitors his own performance by observing the visual signals, chest movement, and paper recording.

A further cassette, assisted by wall diagrams, describes the use of the laryngoscope, laryngoscopy, and endotracheal intubation. Two intubating models have been used—the Vitalograph¹⁷ and the Laerdal.

ARRHYTHMIAS

When connected to a conventional oscilloscope, Arrhythmia Resusci Anne can generate a programme of electronically simulated electrocardiograph (ECG) traces of the most common arrhythmias. These are normal sinus rhythm, atrial and ventricular extrasystoles, first, second, and third degree heart block, atrial fibrillation and flutter, ventricular tachycardia and fibrillation, and asystole. The teaching commentary is enhanced by wall diagrams and guides the trainee through the normal ECG and describes the arrhythmias, their recognition and significance and cause. The treatment is outlined but not detailed. Used in conjunction with a teacher, a programme of abnormal ECGs may be set up for trainee recognition.

Arrhythmia Anne also may be used for training in defibrillation in the presence of a teacher in conjunction with Resusci Anne (fitted with a special breast cover) and an external DC defibrillator. A pair of wire mesh electrodes are placed on Resusci Anne's chest and, with correct teacher programming, simulated ventricular fibrillation can be converted to normal sinus rhythm. A charge of more than 60 joules is required for conversion. The portable external DC defibrillator in the room is accompanied by strict instructions, in the form of no fewer than three notices, both on the machine itself and on adjacent wall surfaces, that the machine should on no account be used unless a trained teacher is present. Both the introductory cassette and the cassette accompanying the machine also refer to this. The cassette describes the principle of defibrillation and the operation of the apparatus and lays special emphasis on the dangers and safety requirements.

A further cassette describes the detailed arrangements of the cardiac arrest service for our own particular hospital group. This is considered most important since these details will obviously vary from centre to centre but the success of failure of each resuscitation attempt depends very much on all staff being familiar with arrangements in force in their own hospital.⁶

Two cassettes, accompanied by slides, are also available for teaching the use of Entonox by ambulancemen¹⁸ and by nursing and physiotherapy staff,¹⁹ emphasising the value of pain relief in immediate care.

Results of use and assessment of equipment

A suggestion box is included in the room but, in addition, many of the comments have been made directly to us. After the initial enthusiasm and novelty use of the room has now settled down to two to three hours a day, by a wide variety of staff—medical, paramedical, and lay. The table shows a breakdown of use at the Bristol Royal Infirmary, but it has in fact been used more intensively, since several tutors have their own keys and use the room without booking. A similar room at Frenchay Hospital has been used in the same way with emphasis on ambulance men's training.¹⁴ The room has virtually not been used at the weekends, although otherwise it has been used at all times of the day and night. Use of the room is again increasing with publicity, after the initial enthusiasm wore off. In addition to hospital staff outside

Staff using resuscitation teaching room

	No (%) of hours used (90 days)
Nurses	38 + (28.2)
Physiotherapists	19 + (14.1)
Clinical teachers (accompanied by students)	25 + (18.6)
Medical students	18½ + (13.9)
Doctors	10½ + (7.8)
Others (ward clerks, maids, etc)	23½ + (17.4)

organisations have arranged for their staff to come to the room for training on several occasions.

Each particular piece of equipment has advantages and disadvantages, some immediately obvious and others which have come to light as a result of our experience.

RECORDING RESUSCI ANNE

The Recording Resusci Anne is robust and has stood up well to wear and tear. It comes complete with spare rolls of recording paper and "lungs." The latter must be replaced about twice a year, depending on use. This is not difficult. After mouth-to-mouth ventilation the face can easily be disinfected with a suitable chemical solution. The face does not stain easily but certain types of lipstick are virtually impossible to remove.

External cardiac compression requires considerable effort (41 kg pressure to move the chest 2.5-3.75 cm) to score an orange light on correct application, and several experienced workers have stated that they believe that such force would be likely to lead to trauma to the rib cage. All, however, agree that the precision of the hand position during massage required to score an orange light serves a useful purpose to remind the trainee that the object of the exercise is to squeeze the heart between the back of the sternum and vertebral column.

Many complaints have arisen from the difficulty of positioning the head for a clear airway during ventilation. While extension of the head on the neck is easy, lifting the mandible forward into the prognathic position is difficult, even for the skilled operator. In the model a clear airway is achieved only by hyperextending the neck and the head, whereas in man, a clear airway is best achieved by modest flexion of the neck using a small pillow and extending the head only at the atlanto-occipital joint. We have referred to this in the accompanying cassette. Mouth-to-mouth ventilation is easily performed while mouth-to-nose ventilation is more difficult because of air leakage through the mannikin's lips which are hard to close effectively.

Using a self-inflating bag and mask for ventilation makes securing an airtight seal between the mask and the face difficult. A good seal can often be obtained only by flexing the neck somewhat, which tends to obstruct the airway. A Guedel airway, however, can be inserted and partially overcomes the difficulty. Unfortunately, the light signal only acknowledges ventilation when the tidal volume exceeds 800 ml, although the chest is seen to move with smaller volumes with lifelike expansion. When squeezed with one hand, the available self-inflating bags rarely transfer more than 800 ml and so, even with modest leakage, the beginner is rather discouraged unless he looks for chest movement. He is reminded of this on the cassette accompanying the mannikin.

INTUBATION MODELS

The *Vitalograph intubation model* is well designed but is less robust. The skin, made from a rubber compound, is easily marked and perishes quickly. We have been told by the manufacturers, however, that the skin material has been changed and is now made from a plastic compound which should overcome this defect. On the whole, the model is well designed and reasonably life-like but there are some details which require comment. The mouth remains in the open position throughout and the oropharynx requires lubrication during laryngoscopy and intubation. The tongue itself is not very representative of a human organ. The laryngeal position may be adjusted by a turn screw underneath the model to make intubation easy or difficult. The easy position allows effortless intubation while the most difficult position enabled the model to defeat even the most skilful anaesthetist, which is perhaps an advantage. During intubation the trainee is warned

of excessive pressure on the upper gums or teeth by a buzzer (battery operated). Various sets of teeth are supplied with the model, enabling increasing grades of difficulty to be encountered. The model is accompanied by excellent wall charts and a guidance booklet based on the Royal Free Hospital intubation training scheme.¹⁷

The *Laerdal (Vickers) intubation model* is more robust and the skin does not appear to deteriorate with time and use. The tongue and epiglottis are cosmetically more life-like and intubation by the nasal route is also possible. There is a warning buzzer (battery operated) to indicate pressure on the upper teeth. Nevertheless, most candidates, including experienced anaesthetists, found the model more difficult to use and commented that the "feel" was less like intubating a human being.

Both intubation models may be described as very helpful but in need of detailed modifications to improve them.

ARRHYTHMIA RESUSCI ANNE

Arrhythmia Anne, when used with an oscilloscope and wall-mounted ECG records, presents the trainee with the general waveform of the major heart blocks and atrial and ventricular arrhythmias. Much information is generated by the machine, and this presented difficulties when making the cassette to accompany it, since many different grades of trainee have to be considered. The cassette content is aimed at the medical student, house surgeon, and State-registered nurse working in an acute unit. It has also proved valuable, however, for senior student nurses, operating department assistants, and ambulancemen undergoing special higher training for service in a mobile resuscitation unit,¹⁴ but, with a few exceptions, too simple for grades such as senior house officer or registrar.

When used with a defibrillator and Recording Resusci Anne, the machine can provide valuable teaching on what to do when faced with a serious ventricular arrhythmia. Used with a teacher, considerable realism may be brought to an exercise in managing the "patient," changing from one arrhythmia to another, and requiring maintenance by external cardiac compression and artificial ventilation. Used in this way, Arrhythmia Anne has an advantage over other ECG training aids which cannot be defibrillated in conjunction with a mannikin.

Each arrhythmia is generated by a push button which is labelled with the name of that arrhythmia. We have covered up this information with a code letter to provide more of a challenge for the student. A key is provided for the code so that the trainee may assess his own performance in identifying each arrhythmia. This has proved to be a valuable modification.

The apparatus is easy to set up and manipulate if the simple instructions are followed carefully. It has proved to be robust and fault-free in use.

DEFIBRILLATOR

The defibrillator presents a problem in the resuscitation teaching room as it is potentially dangerous. At the outset a rule was made that the apparatus should not be used at all unless a teacher trained in its use was present. Abundant notices to this effect are placed on the walls of the room and on the apparatus itself. The accompanying cassette was planned with extreme care and was made exceedingly simple and straightforward. No problems have been encountered in practice.

Discussion

Above all, efficient cardiopulmonary resuscitation requires practical training, and this presents considerable logistic difficulties. The concept of a room devoted entirely to teaching the practical aspects of resuscitation using training mannikins and models together with audiovisual aids enables many staff to be trained, in small groups in their own time and at their own pace, with minimal teacher time. For the best results, the model should be able to indicate to the trainee whether his performance is correct or not—for instance, by a warning buzzer, flashing light, or paper record. Once established, the resuscitation teaching room can act as a useful test bed for new equipment in this field.

The training mannikins and models are not human beings and cannot replace clinical experience. We believe, however, that they form a very useful bridge, particularly for the uninitiated. A medical student or nurse is much more likely to pass an endotracheal tube satisfactorily in the anaesthetic room if he has practised with an intubating model.

The production of the cassette for each lesson is not easy—as the teachers, who are familiar with the apparatus, tend to take short cuts that are obvious to them but not to the novice. This was noticed in our prototype cassettes which were tested with trainees and then revised in the light of experience.

The market for such a teaching arrangement is wide and the equipment and cassettes may be varied to suit all grades, from lay staff to senior doctors. Possibly the idea will appeal to many district general hospitals who have a responsibility to teach resuscitation.²⁰ Once established, the facilities of the room may be offered to local general practitioners; district nurses and health visitors; and members of the emergency services. Large industrial concerns may also wish to apply the concept for training basic resuscitation to selected employees. In the district general hospital it may well be decided to locate the room in the post-graduate centre, and it may even be possible to teach other practical skills outside resuscitation using the combination of self-assessment models with audiovisual aids.

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Problems of Childhood

Diarrhoea

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The practice of treating diarrhoea in babies and children with a blunderbuss combination of kaolin and an antibiotic is not acceptable to doctors who are familiar with children's diseases. The urge to prescribe medicine should be resisted. The only urgent requirement is to maintain hydration, and the younger the patient the more important this is. Other treatment should usually be delayed until the cause of the diarrhoea is identified. Except for the relatively rare colonic causes of diarrhoea, loose frequent stools are due to a shortened transit time of intestinal contents through the bowel, most commonly due to infection from faeco-oral contamination of food or to malabsorption.

Non-infective diarrhoea

Often mothers say that their infants and children have diarrhoea when the stools are normal. Inspection of a specimen is essential. Even if the stools are loose, simple questioning about the amount of sugar added to the feed, giving

orange juice or oral iron supplements, or, in older children, about indulgence in nuts or fruit-cake may provide the explanation. Frequent small, green, but formed motions in a young baby who is not gaining weight but who is otherwise well (hunger stools) are characteristic of underfeeding. The total daily milk intake should be checked whether the child is being fed on the breast or by bottle. One clinically distinct condition occurs in the newborn baby who is breast-fed. Fluid, orange-coloured motions are relatively common in the first few weeks of life. The gastrocolic reflex produces an explosive stool after each feed. The baby thrives and gains weight satisfactorily. Without treatment the stools become less fluid, presumably as the child's intake of milk is adjusted to his needs.

Soiling of the pants with small, fluid, dark-brown stools suggests strongly that the diarrhoea is spurious, being caused by the leakage of bowel contents, often loose as a result of laxatives, which escape past a firm faecal reservoir partially obstructing the sigmoid colon and rectum. This diagnosis is confirmed by abdominal and rectal examination. Although the possibility of Hirschsprung's disease should always be considered, constipation with or without a behaviour problem is nearly always the cause.

Infective diarrhoea

Although it has long been assumed that gastroenteritis is caused by bacteria, those who culture the stools in this disease

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