MEDICAL PRACTICE

*Contemporary Themes***A community training scheme in cardiopulmonary resuscitation**

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Abstract

Community instruction in basic life support and resuscitation techniques has been offered in Brighton Health District since 1978. Classes are held frequently for the general public and businesses, schools, and other organisations. First aid care for unconscious patients, the treatment of respiratory obstruction or failure, and the recognition and management of cardiac arrest is taught in a single two hour session. Over 20 000 people have been taught, up to 40 at a time in multiple groups of six to eight, by lay instructors usually supervised by ambulancemen trained to "paramedic" standards. Fifty four incidents have been reported to us in which techniques learnt in the classes have been implemented. Five patients recovered after first aid support but subsequently did not seek medical treatment. Of the 34 patients reviewed in hospital, at least 20 survived to be discharged. We believe that intervention may have been life saving in 16 instances. The benefit of cardiopulmonary resuscitation for victims who may have been asystolic is, however, difficult to quantify because the outcome without intervention cannot be predicted accurately.

Community training in basic life support should be considered in association with ambulances equipped for resuscitation and hospital intensive care and cardiac care units as an integrated service for the victims of sudden circulatory or respiratory emergencies. The

results achieved so far in Brighton and in other more advanced schemes, particularly in the United States of America, may encourage other health authorities to adopt similar programmes.

Introduction

Cardiopulmonary arrest remains the most urgent of all medical emergencies, for death is inevitable unless corrective measures can be taken within minutes. In hospital, where skilled help is readily available, successful resuscitation from ventricular fibrillation can be achieved at best in 50% of patients¹; outside hospital the chances of success are strikingly less. The provision of ambulances equipped for resuscitation makes an important contribution to patient rescue,²⁻⁵ but even when response is fast the unavoidable wait for emergency services frequently precludes a successful outcome. First aid cardiopulmonary support given by bystanders thus assumes a crucial role if patients in the community are to be rescued from circulatory arrest, and if the potential of an ambulance service equipped for resuscitation is to be exploited fully. We describe the organisation of a scheme in the Brighton Health District for community training in cardiopulmonary resuscitation and its impact over the past four years.

The training scheme

An ambulance service equipped for resuscitation and manned only by specially trained ambulance personnel was introduced into the Brighton Health District in 1971.² As an extension of this service a community training scheme in techniques of resuscitation was started early in 1978. Training was offered first to commercial organisations in the Brighton area; later that year a publicity campaign was launched through leaflets, local radio, and press and by displays at community functions to attract members of the public to "open" classes. Since then public classes have been held regularly on two evenings a week, and numerous additional classes have been arranged at the request of commercial, local authority, or private groups.

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Training in cardiopulmonary resuscitation is given in a single two hour session to classes of up to 40 people. After an explanation of the purpose of the scheme and of the principles of resuscitation, students are divided into groups of six to eight. Each group receives teaching from a certified instructor who follows an agreed outline. The instructors are drawn from a pool of 43 intensely trained lay personnel and 10 supervisory instructors, most of whom are members of the ambulance service. The scheme has two coordinators who have been funded by the British Heart Foundation over its initial experimental period.

The groups are taught to recognise four presentations of collapse: conscious patients with coronary attacks, unconscious patients in whom normal heart beat and breathing are preserved, victims of isolated respiratory obstruction or failure, and those with full circulatory arrest. Great emphasis is placed on the recognition of circulatory arrest and its distinction from simple loss of consciousness or fits.

Training is given in methods of airway protection, including use of the recovery position, and in the Heimlich manoeuvre. Mouth to mouth ventilation and external chest compression are carefully explained and demonstrated. Attention is drawn to the modifications in technique required when treating infants or children. Adequate time is given for supervised practice using teaching models ("Anatomic Anne," Laerdal, Stavanger, Norway).

Towards the end of the two hour session the entire group reconvenes for a final talk by the supervisory instructor. The key points of resuscitation are re-emphasised and encouragement given to recommend the scheme to others. At the end of the class students receive certificates of attendance and pamphlets or charts to remind them of the essential facts of resuscitation techniques. They are also invited to contribute up to £1 each towards the expenses of the scheme.

Trainees are asked to send to the scheme coordinator details of any incident in which they subsequently find need to use the skills learnt during the session. These are followed up by at least two of the authors to establish as far as possible their nature, the action of the trainee, and the outcome of any interventions made.

Results

COMMUNITY RESPONSE TO THE SCHEME

Figure 1 shows the number of persons trained since the beginning of the scheme. Community interest in resuscitation training, reflected in the attendance at public classes, has been variable; a steady fall in attendance towards the end of 1982 prompted a relaunch of the scheme with extensive publicity and the new designation of those completing the training as "heart guards." The effectiveness of this publicity was seen in a temporary increase in attendance at public classes.

The participation in the training scheme by local authority and commercial organisations has provided a steady number of trainees, exceeding those recruited in the public classes. In 1982, for example, 1834 persons were trained in sessions arranged privately compared with 1312 trained in the "open" sessions. The number of trainees passing through the scheme from 1 January 1978 to 31 March 1983 averaged 290 a month.

INCIDENTS REPORTED BY TRAINEES OF THE SCHEME

Since the inception of the scheme 54 incidents have been reported in which trainees have implemented techniques learnt during their instruction. Ten incidents occurred in holiday locations away from the Brighton district, three outside the United Kingdom. Support given by the trainees included external chest compression on 20 occasions and artificial ventilation on 23 occasions. In most of the 54 incidents active measures were taken to restore or maintain the airway, and the Heimlich manoeuvre was used twice.

Figure 2 and the table summarise the nature and outcome of reported incidents. Five patients were reported to have made a satisfactory recovery after intervention by trainees, but did not thereafter seek medical advice. Ten patients were known to have been beyond effective resuscitation on arrival of the ambulance. Of the 34 patients recorded as arriving at hospital alive, four died shortly after admission to the accident and emergency area and it is known that 20 survived to be discharged. We judged intervention to have been possibly or probably life saving in 16 instances. The final outcome of a total of 11 incidents remains unknown in spite of efforts to trace this information, because of inadequate identification of victims and difficulties in liaising with hospitals abroad.

The following cases illustrate some of the incidents reported. They show that the importance of some interventions is beyond doubt, while the importance of others is conjectural, and that bystanders who have been taught resuscitation may perform commendably well or (rarely) disappointingly badly when confronted with real emergencies.

Case 1—The father of a 16 year old boy who had been trained through the scheme developed chest pain on his return from golf. Because his father's pain was increasing the trainee contacted his local general practitioner and afterwards telephoned the emergency ambulance service. Shortly after the arrival of the general practitioner the

FIG 1—Cumulative number of those trained through scheme since it began. Note inflection in curve after a relaunch of scheme in last quarter of 1982.

FIG 2—Outcome of 54 incidents in which trainees of scheme gave help.

Nature and outcome (where known) of 54 incidents in which trainees of the scheme gave help

Probable cause of emergency	No of incidents	Hospital review	Survival	Intervention	
				Probably lifesaving	Possibly lifesaving
Cardiac ischaemia or arrhythmia	16	13	7	3	2
Respiratory failure or obstruction	6	3	6	5	1
Drowning	6	4	4	4	
Trauma	6	4	4	3	1
Epilepsy	3	3	1		
Miscellaneous or unknown	17	7	3	1	3
Total	54	34	25	16	7

patient collapsed with circulatory arrest. The trainee provided effective mouth to mouth breathing, and the general practitioner gave external chest compression. Subsequently, the ambulance crew found the patient to be in ventricular fibrillation but receiving effective first aid. Defibrillation was successful, and the patient was admitted to the cardiac care unit for treatment of an anterior myocardial infarction. He was discharged home nine days later.

Case 2—As a result of a mid-air collision two hang glider pilots fell about 100 feet (30 metres) to the slope of a hillside below several spectators, one of whom had attended a resuscitation class. The trainee found one of the pilots to be deeply unconscious, apnoeic, pulseless, and grey. He gave a precordial blow, checked for the response, and began external chest compression. He was joined by a second bystander, who knew how to perform mouth to mouth resuscitation, though he was not a trainee of the scheme. After less than a minute of ventilation and chest compression, a palpable pulse returned and the victim began to breathe spontaneously. The trainee placed him in the recovery position, but he remained unconscious for about 10 minutes. An ambulance arrived 20 minutes after the collision, at which time the pilot was able to ask the crew what had been happening. He was admitted to hospital with injuries that included a fractured jaw, but he made an uneventful recovery.

Case 3—A trainee and his wife were disturbed by a young couple who had stopped their car outside the house. The husband asked if he could use the telephone as they had suddenly discovered that their baby seemed very ill. As it was apparent that the 11 month old child had stopped breathing the trainee's wife phoned immediately for an ambulance. The trainee took the baby from its mother observing that it was "like a doll"—completely still and limp, eyes wide open, and unresponsive. He checked for a heart beat and breathing but found neither. After 30 to 60 seconds of gentle chest compression a spontaneous pulse became palpable and breathing returned. The baby remained drowsy, so the trainee placed her prone on the floor. She was reviewed at hospital and subsequently discharged well. The paediatrician was initially unaware of the chain of events leading to the infant's admission, probably because the emergency department staff discounted the apparent gravity of this incident.

Case 4—A lifeguard, who had received training through the scheme, was alerted to the possibility of an animal or child floating in the sea. At first nothing could be seen, but while his colleague was wading out in about four feet (122 cm) of water the submerged body of a young girl bumped against his leg. About 20 minutes had elapsed since the incident was first reported. The lifeguard began resuscitation on the beach while his colleague ran for help. He continued alone for six or seven minutes giving external chest compression and mouth to mouth breathing. Later a second trainee, who had been on the beach with her family, gave help with chest compression. After a further interval an ambulance arrived. Unfortunately, a resuscitation vehicle was not available so the child was brought to the accident and emergency department still receiving full resuscitative measures. At this time there was no sign of life: the pupils were wide and non-reactive, there was no heart beat, and the electrocardiogram showed ventricular fibrillation. Direct current cardioversion resulted in a coordinated rhythm and shortly afterwards feeble attempts at spontaneous ventilation were observed. Artificial ventilation was given in the intensive care unit overnight, and evidence of brain activity returned progressively over several hours. Further treatment in hospital resulted in full recovery and her discharge only a few days later. One of the trainees was awarded the Royal Humane Society's resuscitation certificate as a result of her efforts. This incident has been included in a previous report.⁶

Case 5—The mother in law of a trainee of the scheme swallowed a sweet which "lodged in her throat." Embarrassed, she retired to the kitchen where a few minutes later she was found to be leaning over the sink fighting for breath. Another relative simply patted her on the back but without benefit. The trainee then performed the Heimlich manoeuvre and the sweet "literally shot out," relieving the respiratory obstruction. The trainee noted that her mother in law was "not simply coughing but in distress because of airway obstruction." She herself was impressed with the effectiveness of the manoeuvre which she had learned in a resuscitation class.

Case 6—A neighbour of one of the trainees was found unconscious as a result of a drug overdose, though still breathing. Recognising the seriousness of the situation the trainee called for an ambulance. She kept the patient under careful observation while recording as much information as possible about the nature of the ingested drugs. By the time the ambulance arrived, three to five minutes later, the patient had become apnoeic. The crew of the attending conventional ambulance therefore called for a vehicle equipped for resuscitation. The trainee administered mouth to mouth ventilation while one of the crew applied

chest compression. The patient was admitted to hospital alive but in spite of intensive treatment, including artificial ventilation, deteriorated and died three days later.

Case 7—An unusually fit 83 year old man had taken his usual swim in a public indoor pool when he felt dizzy and lay down. A trainee of the scheme noticed that his face was turning increasingly mauve, that his breathing was becoming laboured, and that his eyes had begun to roll upward. She relieved his respiratory obstruction by simple neck extension; his breathing improved, but then faded as he suddenly became limp and pale. The trainee began mouth to mouth breathing and, after confirming an absent pulse, a second bystander gave external chest compression. After about 12 inflations the patient began to show signs of spontaneous ventilation and there was an abrupt and dramatic return of the peripheral pulse. The airway was protected by use of the recovery position but the victim improved sufficiently rapidly to be talking to his rescuers within seven minutes of his initial collapse. The ambulance arrived some five minutes later and after a further 10 minutes the patient was able to walk out to board the vehicle. On review in hospital little abnormal was found and the seriousness of the incident was discounted. He was allowed home from the accident and emergency department. He died abruptly two days later at home.

Case 8—A child was seen immobile at the bottom of an Olympic sized swimming pool in Austria. He was brought to the surface but was found to be unconscious and grey blue in colour. A holidaymaker from Sussex who had attended the heart guard programme intervened when he saw that the boy showed no signs of life and did not respond to shaking. He began cardiopulmonary resuscitation single handed as no one at the pool seemed competent to help. After what he described as "an eternity" (but which was untimed) the boy began to make respiratory efforts and to cough. His colour improved, and he was found then to have a pulse. When ambulance attendants arrived they kept the boy on his back but subsequently accepted the suggestion of the recovery position offered by the visitor. The boy was driven across the nearby border into a hospital in Germany. We have since received a report that he subsequently made a full recovery.

Case 9—A local newsagent collapsed outside his shop. When the resuscitation ambulance arrived there was a crowd of people around, none of whom was doing anything to help. Attempts at resuscitation were unsuccessful. It was later learnt that one of the bystanders had taken the resuscitation course but he said he felt unable to "get involved."

Case 10—On the evening of Yom Kippur a worshipper collapsed on arrival at a local synagogue. A bystander who had attended the training programme correctly identified a cardiac arrest, sent someone to call an ambulance, and began cardiopulmonary resuscitation immediately. She was helped by a general practitioner who was also in the synagogue. After a few inflations the patient vomited; the trainee cleared the airway and continued ventilation. On arrival of the ambulance the patient was found to be in ventricular fibrillation. Defibrillation resulted in asystole, and chest compression was continued. Later an episode of ventricular tachycardia reverted into sinus tachycardia. Soon afterwards the patient began to breathe spontaneously. The number of people present created inevitable problems, and at one time the patient fell while being lifted onto the stretcher, but no harm was caused. On arrival at hospital the patient had a good cardiac output and was awake, though confused. Subsequently he made an uneventful recovery from the inferior myocardial infarction which had caused his collapse and was discharged home six days after admission.

Discussion

A resuscitation service is founded on the principle that respiratory or circulatory collapse may not prove fatal if life support can be given until the underlying condition is resolved. But medical or paramedical personnel cannot always respond with the urgency required. Cardiopulmonary resuscitation initiated by bystanders and given within the critical few minutes after collapse may then be crucial.

The results in the table summarise the evidence that lives have been saved because of the community training within Brighton Health District; a crucial contribution was made in at least 16 instances. Help from bystanders has been shown in previous studies to have an important and beneficial impact. For example, of 316 consecutive patients treated out of hospital for ventricular fibrillation in Seattle,⁷ 109 received cardiopulmonary resuscitation initiated by a bystander and 43% were discharged

home; this was twice the rate of success observed in the remainder, who had no first aid until the arrival of personnel from the fire department. Similar findings have been reported from neighbouring King County,⁸ from Birmingham Alabama,⁹ and from Oslo.¹⁰

Although the data for improved survival from ventricular fibrillation can be compelling, cardiopulmonary first aid may provide similar benefits in rescues from asystole—but these are much more difficult to quantify. Trauma affecting the nasopharynx, respiratory obstruction, and drowning are examples of events which initiate severe bradycardia or asystole by reflex mechanisms¹¹; these can be perpetuated by hypoxia to a fatal conclusion. In such cases external chest compression alone or associated with artificial ventilation may break the vicious circle without the need for sophisticated treatment such as defibrillation. The evidence in many of our cases suggests to us that intervention was indeed crucial; examples are provided in cases 2 and 3 of our case histories. We accept that we have no proof that spontaneous recovery would not have occurred, yet the circumstances in these and similar cases argue against it. The impossibility of providing conclusive evidence for the outcome for the treatment of asystole poses an insuperable problem in evaluating schemes such as ours.

The possibility of adverse effects of community training must be weighed against the evidence for benefits. The balance so far seems reassuring. We are aware of no harm from injudicious resuscitation over our four year experience, and no appreciable dangers have been reported by any centre with a major community programme. We are concerned, however, by a tendency to failure by omission rather than by commission, for fear and uncertainty can inhibit a would-be rescuer when the need for intervention is clear. This may have contributed to the tragic outcome of case 9 and we suspect others may have occurred but not been reported.

Public education provides other benefits that are impossible to quantify. The trained bystander may make a valuable contribution in an emergency by reducing panic or bewilderment and by ensuring that rescue services are called without delay. In the opening remarks at the classes we take the opportunity to outline the usual symptoms of coronary heart attacks and to emphasise the need for urgent medical referral; the correct use of the 999 (emergency telephone) system is also discussed. The advantages of reducing delay before admission to hospital are well recognised,^{4 12} and we know that our instruction has been influential in achieving this goal in many individual cases. We have not yet observed any appreciable effects on median delays to the time of admission to the cardiac care unit but these are influenced by many complex factors. The numbers who have attended our heart guard classes remain at present too small a percentage of the community for a major impact to be expected.

We have drawn attention previously to the value of ambulances equipped for resuscitation.^{2 5 13} Reports from Seattle and other American cities convinced us that the full potential of resuscitation services could not be realised until large numbers of the community are trained in cardiopulmonary first aid. At first sight logistics appeared insuperable and the costs prohibitive. The problems were overcome in part by using the "paramedic" ambulance service as a foundation on which to build community participation. The local press and radio have helped to make the possibility of resuscitation well known, and we have been able to draw on the generosity and good will of members of the public who have volunteered to be trained as instructors under the supervision of skilled ambulancemen. Once the framework had been established no burden fell on the hospital services. The experimental nature of the scheme enabled us to attract invaluable support from the British Heart Foundation, while Brighton Health Authority accepted responsibility for office facilities. We do not believe that the modest costs entailed should deter other authorities from adopting similar schemes.

The evidence in favour of community training was the subject of recent editorials in the *Lancet*¹⁴ and in the *BMJ*.¹⁵ The potential role of organisations which might participate in

Britain was summarised by Baskett.¹⁶ The Resuscitation Advisory Council, which is composed of representatives of most professional bodies with a legitimate interest in resuscitation, has produced a simple illustrated guide for lay people¹⁷ intended as an adjunct to rather than a substitute for teaching by skilled instructors.

We believe that resuscitation within a health district should be an integrated service comprising, ideally, a cardiac care unit, ambulances equipped for resuscitation, and a community training scheme. The primary training base should usually be the cardiac care unit within the district general hospital. The influence of a successful unit should extend throughout the hospital so that prospects for resuscitation are similar in all areas.¹ Ambulancemen can be trained within their own service and within cardiac care and intensive care units to extend the reach of emergency resuscitation outside the boundaries of the hospital. But the first aid needed within the first five minutes of any emergency must come from members of the community instructed in basic life support. The performance of our integrated services in Brighton remains far short of the ideal, but the results achieved so far encourage us to continue our efforts. They may also encourage others to adopt similar schemes which will reflect local needs and aspirations.

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