MEDICAL PRACTICE

Contemporary Themes

Advanced training for ambulance crews: implications from 403 consecutive patients with cardiac arrest managed by crews with simple training

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Abstract

Sixty seven ambulance staff in Nottinghamshire completed a simple extended training programme in managing cardiac arrest and using a defibrillator. This enabled around one third of the ambulance emergency shifts to be manned by such a crew, with a defibrillator as part of their standard equipment. Forty four of 403 consecutive patients who suffered cardiac arrest in the community were managed by these crews and survived to leave hospital.

The training programme does not include endotracheal intubation, intravenous infusion, or drug administration. The new official advanced training course for ambulance crews, which includes these skills, is inappropriate in its methods and may delay widespread introduction of emergency ambulances equipped with defibrillators.

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Introduction

In the late 1970s and early 1980s the Department of Health and Social Security did not encourage advanced training in resuscitation techniques for ambulance staff despite pressure from the Royal College of Physicians and the British Cardiac Society.[1] The department's reluctance was in part based on clinical trials in Nottingham of one of the "mobile coronary care units" that at that time were considered to be the appropriate means of transport for patients with heart attacks.[2-4] The department subsequently, however, recommended advanced training for ambulance crews, and the official training scheme being tried consists of an eight week course (half of it residential) in which the skills of defibrillation, endotracheal intubation, intravenous infusion, and drug administration are taught.[5,6] The Nottingham mobile unit was considered to be insufficiently effective and was taken out of service in 1976. We subsequently developed a simple training scheme, with the aim of making a defibrillator part of the standard equipment in all ambulances handling emergency cases and training their crews in its use. As we now fear that the more complex official training programme will inhibit the development of our simple approach we describe our progress.

Methods

Our training programme has been fully described elsewhere.[7] Of 245 individuals who qualified for accident and emergency work in the Nottinghamshire Ambulance Service, 75 were trained to use a defibrillator and 67 successfully completed the course. Forty five of them were based at the eight ambulance stations primarily serving the city of Nottingham and 22 were based at the four stations serving the countryside and other conurbations in the county of Nottinghamshire.

The data in this report were derived from standard forms completed by the ambulance crews after each resuscitation attempt and apply to 403

consecutive patients who suffered a cardiac arrest out of hospital. The report form records details of the time of calls for the ambulance, the duration of cardiac arrest, whether cardiopulmonary resuscitation had been performed by a bystander, and if so by whom. The outcome of any resuscitation attempts is outlined and recordings made of the cardiac rhythms before and after use of the defibrillator. These forms are returned to the department of medicine, University Hospital, Nottingham, together with the rhythm recordings, and data are subsequently stored on the university's computer. Information from postmortem examinations of patients who are dead on arrival at hospital, or who die after admission, is obtained from the records of the coroner's pathologist. Patients discharged from hospital were followed up by contacting their general practitioner and reviewing the hospital notes.

Results

Figure 1 shows the progressive increase in the number of patients with cardiac arrest dealt with by specially trained crews between June 1983 and April 1987. An average of 2·7 arrests a month were handled by special crews in the first three months, whereas in the final three months the average was 14·3 arrests a month. Four weeks from December 1986 to January 1987 were selected for an assessment of the proportion of emergency ambulance shifts manned by a specially trained crew with a defibrillator in Nottinghamshire as a whole. The shift pattern was complex, different numbers of emergency ambulances being available at different times of the day. All Nottinghamshire ambulance stations had at least one defibrillator that could be issued when a trained crew took over a vehicle for a shift. Those stations with adequate numbers of trained crews and a shift pattern resulting in more than one vehicle at a time being available for accident and emergency duties had at least two defibrillators. Thus the limiting factor to providing the advanced resuscitation service was the number of trained crews rather than the number of defibrillators available. During the months studied a total of 1720 individual emergency ambulance shifts were worked, of which 605 were manned by special crews and the ambulance carried a defibrillator.

Most cardiac arrests managed by these crews were caused by ventricular fibrillation. The table shows the nature of the underlying rhythm disturbance in the whole group and compares various features of patients found to be in ventricular fibrillation with those of patients with other rhythms.

The group with other cardiac rhythms included a wide variety of clinical events associated with apparent cardiac arrest. This is exemplified by considering the survivors in detail. Five patients had primary respiratory problems (three asthma, one chronic bronchitis, and one attempted suicide by drowning), two of whom were in sinus rhythm, two in atrial fibrillation, and one in idioventricular rhythm. One patient with severe heart failure had asystole, one patient with aortic stenosis had sinus bradycardia, and one patient had third degree heart block complicating diabetic ketoacidosis. The remaining patient recovered his pulse after initial cardiopulmonary resuscitation and was then shown to be in sinus rhythm.

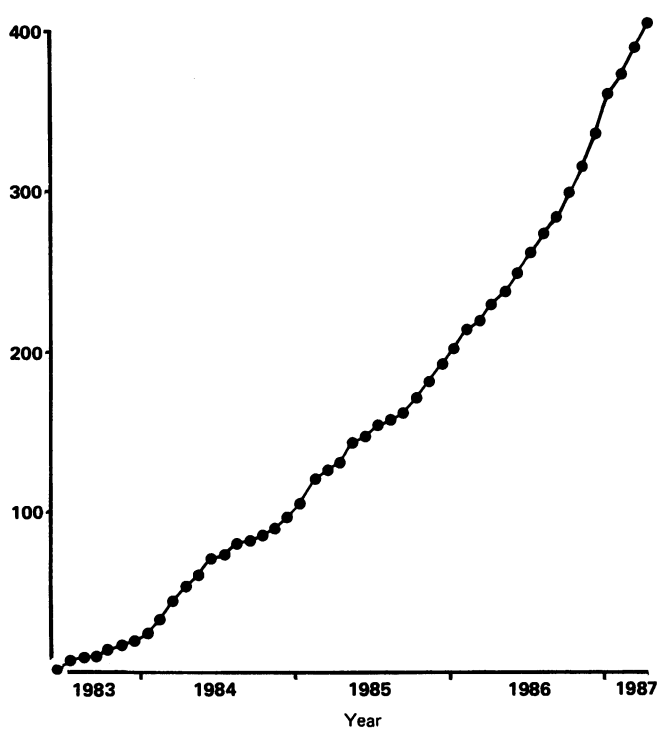

FIG 1—Number of attempted resuscitations from cardiac arrest outside hospital by ambulance staff.

Comparison of patients in ventricular fibrillation with patients in other cardiac rhythms, for all attempts at out of hospital resuscitation

	Ventricular fibrillation	Other rhythms
No	253	150
No (%) men	209 (83)	99 (66)
Mean age (range) (years)	62·4 (15-90)	62·7 (1-92)
No (%) conscious on arrival of crew	22 (9)	23 (9)
No (%) collapsing:		
At home	149 (59)	111 (74)
Elsewhere	103 (41)	35 (23)
Unknown	1 (0·4)	4 (3)
No (%) admitted to hospital	56 (22)	17 (11)
No (%) discharged from hospital	35 (14)	9 (6)
No (%) given cardiopulmonary resuscitation by bystander	134 (53)	46 (31)
No (%) given "professional" cardiopulmonary resuscitation	71 (28)	19 (13)

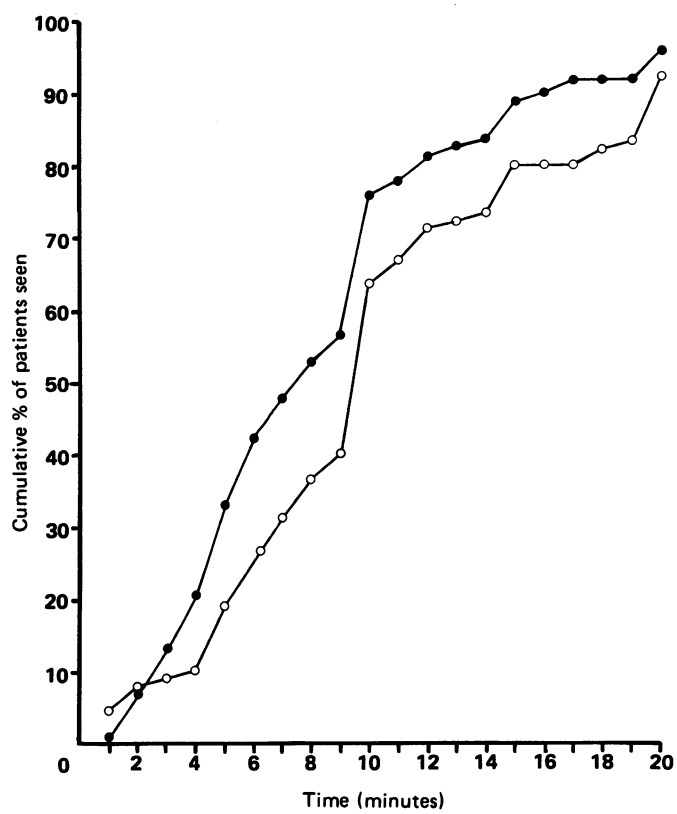

FIG 2—Duration of collapse in cases of cardiac arrest outside hospital. ●——●=Ventricular fibrillation. ○——○=Other cardiac rhythms.

Fifty six (22%) of the 253 patients in ventricular fibrillation were admitted to hospital compared with only 17 (11%) of 150 patients with other cardiac rhythms. Although the success rate in terms of admission was fairly low, those who were admitted did well in that 35 (63%) of the 56 patients who had been in ventricular fibrillation were discharged, as were nine (60%) of those who had been admitted after an arrest with other rhythms. Thus of all patients with cardiac arrest managed by the specially trained crews, 44 of 403 (11%) were discharged from hospital; no patients survived with any neurological deficit.

Forty five of the 403 patients were conscious when the ambulance arrived but required resuscitation during transfer to the vehicle or during the journey to hospital. Of these, 22 patients required defibrillation, and in this group 13 (59%) were admitted to hospital and 11 were discharged home. Of the remaining 23 patients who had a cardiac arrest due to rhythms other than ventricular fibrillation in the presence of the ambulance crew, only five were admitted and three of these were discharged home.

A higher proportion of patients found to be in ventricular fibrillation was receiving bystander cardiopulmonary resuscitation (134 of 253, 53·0%)

compared with those found in other cardiac rhythms (46 of 150, 30·7%). Ninety of the 180 patients who received such resuscitation were attended by individuals who had some professional knowledge of resuscitation techniques, 31 of these being ambulance staff who had not undertaken the extended training programme but who called for a vehicle equipped with a defibrillator rather than transport the patient to hospital themselves.

Figure 2 shows the duration of collapse before treatment by the ambulance crews, and also the difficulty in obtaining accurate time intervals under such circumstances. The crews preferred to express intervals in multiples of five minutes when asked to estimate them from information available to them on their arrival.

The median time taken to transport patients from the site of the collapse to hospital was nine minutes. This time was calculated from a sample of 129 patients transported in the last year of the study.

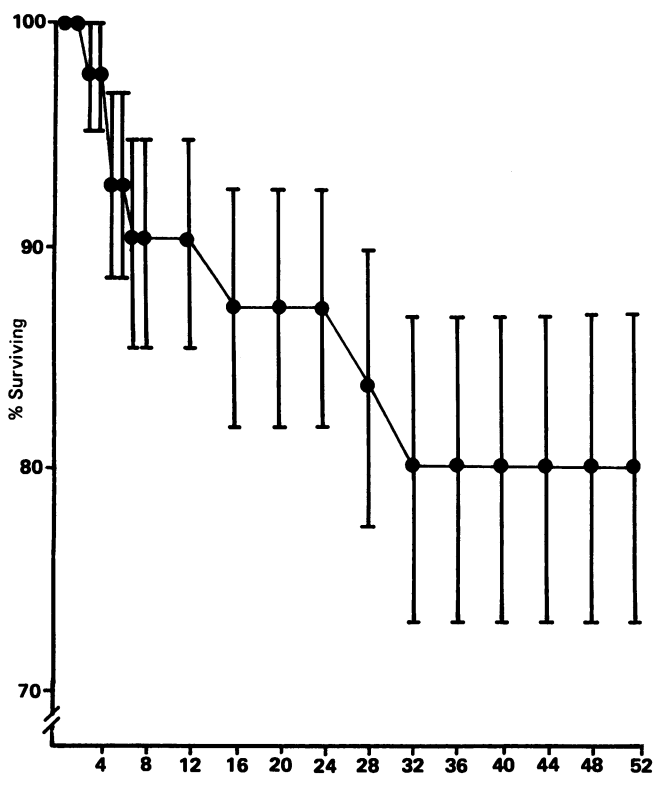

FIG 3—Life table analysis of survival to one year for patients discharged from hospital after successful resuscitation. (Values are means (SE).)

Figure 3 shows the results of life table analysis of survival for the 44 patients who survived to be discharged from hospital; 80% of them are calculated to have survived one year (standard error 7%). There were insufficient numbers to attempt a meaningful analysis of the differences in survival between groups of patients in whom ventricular fibrillation was a primary phenomenon rather than a result of myocardial infarction.

Discussion

With 67 ambulance staff successfully trained to use a defibrillator roughly one third of emergency ambulance shifts in Nottinghamshire are appropriately manned and equipped for managing cardiac arrests outside hospital. Although it may prove impracticable for every emergency vehicle to be so manned in every shift, room for improvement exists and we aim to double the number of specially trained crews over the next three years.

Detailed information about patients with cardiac arrest who are handled by crews with standard training is not available, but the results in the 403 consecutive patients managed by specially trained crews were reasonable, with 44 (11%) surviving to leave hospital and 80% of these living for a year. This is not as good a result as has been obtained in Seattle,[8] but it does compare with results from other centres in the United States.[9] In particular, a comparatively low proportion of our patients survived to reach hospital but a comparatively high proportion of those who reached hospital alive survived to be discharged. There were no instances of long term neurological damage in those who survived resuscitation, so overall our simple training scheme seems reasonably effective.

We have confirmed previous findings that the results of resuscitation from ventricular fibrillation are better than of resuscitation from other rhythms.[10,11] The association between ventricular fibrillation, resuscitation by bystanders, and improved survival has also been reported previously.[12] It is still unclear, however, whether cardiopulmonary resuscitation maintains a patient in ventricular fibrillation from which resuscitation is easier or whether resuscitation is effective because it tends to be performed on patients who are seen to collapse and thus who suffer cardiac arrest for only a short time. Clearly, most resuscitation by bystanders in Nottingham is done by people who have had training in cardiopulmonary resuscitation rather than by the lay public.

In a study of 396 patients who did not survive admission to the resuscitation rooms of three large Scottish hospitals during one year Anderson *et al* identified 54 patients who might have been helped had the ambulance crew been specially trained.[13] Of these, 50 had a cardiac arrest. Thus it seems unlikely that training in endotracheal intubation, intravenous infusion, and drug administration will have any dramatic effect in patients other than those who have cardiac arrest. The important question is whether our results would have been better if our crews had received the new official advanced training course rather than the simple one that we use.

Although a few more of our patients might have been saved, we believe that there would have been a poor return for the extra training necessary. In urban areas the journey time to hospital is short and attempts at intubation, intravenous infusion, and drug administration would prolong this and might well be counterproductive. More importantly, however, we consider that if we were to follow the official training scheme we would have far fewer crews available who could use defibrillators, for the official scheme is long (and may well have to be lengthened further if its aims are to be fulfilled) so fewer crews could be released to attend it. In its present form the demands of the course are probably too great for many of the crews who can manage ours perfectly well. In short, the introduction of the new training course seems to be an example of the excellent being the enemy of the good. We believe that a simple course will provide a greater overall benefit to patients suffering cardiac arrest outside hospital.

We thank the nursing staff of the coronary care unit at University Hospital, Nottingham, who helped in training and assessing the ambulance staff, and the Department of Health and Social Security, which has supported the Nottingham heart attack register.

References

1 Joint Working Party of the Royal College of Physicians of London and the British Cardiac Society. The care of the patient with coronary heart disease. *J R Coll Physicians Lond* 1975;10:5-46.
2 Hampton JR. Importance of patient selection in evaluating a cardiac ambulance service. *Br Med J* 1976;i:201-3.
3 Hampton JR, Dowling M, Nicholas C. Comparison of results from a cardiac ambulance manned by medical or non-medical personnel. *Lancet* 1977;i:526-9.
4 Hampton JR, Nicholas C. Randomised trial of a mobile coronary care unit for emergency calls. *Br Med J* 1978;i:1118-21.
5 Department of Health and Social Security. NHS ambulance service: extended training for ambulance staff. London: DHSS, 1984. (DA(84)12.)
6 Ambulance Staff Training Committee. Extended training in ambulance aid. Bristol: NHS Training Authority, 1987.
7 Rowley JM, Garner C, Handy M, Hampton JR. Simple training programme for ambulance personnel in the management of cardiac arrest in the community. *Br Med J* 1985;291:1099-101.
8 Cobb LA, Hallstrom AP, Thompson RG, Mandel LP, Copass MK. Community cardiopulmonary resuscitation. *Annu Rev Med* 1980;31:453-62.
9 Stults KR, Brown DR, Schug VL, Bean JA. Prehospital defibrillation performed by emergency medical technicians in rural communities. *N Engl J Med* 1984;310:219-23.
10 Eisenberg MS, Bergner L, Hallstrom A. Out-of-hospital cardiac arrest: Improved survival with paramedic services. *Lancet* 1980;i:812-5.
11 Roth R, Stewart RD, Rogers K, Cannon GM. Out-of-hospital cardiac arrest: Factors associated with survival. *Ann Emerg Med* 1984;13:237-43.
12 Thompson RG, Hallstrom AP, Cobb LA. Bystander initiated cardiopulmonary resuscitation in the management of ventricular fibrillation. *Ann Intern Med* 1979;90:737-40.
13 Anderson IWR, Black RJ, Ledingham IMcA, Little K, Robertson CE, Urquhart JD. Early emergency care study: the potential and benefits of advanced pre-hospital care. *Br Med J* 1987;294:228-31.

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