Paramedics and technicians are equally successful at managing cardiac arrest outside hospital

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Abstract

***Objective*—To examine the effect on survival of treatment by ambulance paramedics and ambulance technicians after cardiac arrest outside hospital.**

***Design*—Prospective study over two years from 1 April 1992 to 31 March 1994.**

***Setting*—Accident and emergency department of university teaching hospital.**

***Subjects*—502 consecutive adult patients with out of hospital cardiopulmonary arrest of cardiac origin.**

***Interventions*—Treatment by ambulance technicians or paramedics both equipped with semi-automatic defibrillators.**

***Main outcome measures*—Rate of return of spontaneous circulation, hospital admission, and survival to hospital discharge.**

***Results*—Rates of return of spontaneous circulation, hospital admission, and survival to hospital discharge were not significantly different for patients treated by paramedics as opposed to ambulance technicians. Paramedics spent significantly longer at the scene of the arrest than technicians ($P < 0{\cdot}0001$).**

***Conclusions*—The response of ambulance paramedics to patients with cardiopulmonary arrest outside hospital does not provide improved outcome when compared with ambulance technicians using basic techniques and equipped with semi-automatic defibrillators.**

Introduction

In 1984 the Department of Health authorised the extended (paramedic) training of ambulance staff by the NHS training authority (now the NHS training directorate). The directorate has recommended that from 1995 every front line ambulance in England and Wales should be staffed by one paramedic and one technician and should be equipped with a defibrillator.[1,2]

A similar approach was followed in Scotland but implemented differently. The Scottish Ambulance Service introduced semi-automatic defibrillators into all front line vehicles and provided limited training for the basic ambulance technicians. The provision of the 407 defibrillators, together with the eight hour training required for the ambulance technicians, was completed by July 1989.[3] The results achieved by these actions have been remarkably successful, and local and national results have been reported.[4,5]

Paramedic training has also taken place in the Scottish Ambulance Service. This entails a 320 hour training course, and the successful candidates are then introduced to front line vehicles. Paramedics may attend patients with cardiac arrest either as a member of the crew of the first responding ambulance or as a secondary response at the request of an ambulance technician crew.

With these innovations it is appropriate to evaluate the relative contributions to patient outcome made by these two groups. We prospectively studied all out of hospital cardiac arrests presenting to this hospital over a two year period to examine how the presence of paramedic crews and the use of their extended skills affect outcome.

Patients and methods

We carried out a prospective study on all cardiac arrests occurring outside hospital that were received and treated in the accident and emergency department over the two years from 1 April 1992 to 31 March 1994. Details of prehospital intervals and interventions were obtained from the Scottish Ambulance Service's patient report form. This form includes the time of receipt of the 999 call, the time of dispatch of the ambulance crew (either technicians or paramedics), the times of arrival at and departure from the scene, and the time of arrival at hospital. These times are noted by the individual crews but are also confirmed by reference to the ambulance dispatch and control unit. The performance of interventions such as tracheal intubation and intravenous access were also obtained from this form. The presenting rhythm for the cardiac arrest episode was determined from the printout from the semi-automatic defibrillator (Laerdal Heartstart 2000 or 3000).

The decision to send an ambulance with technicians or one with paramedics is made by the central ambulance control on the basis of the available clinical information, availability of crew, and proximity. Assistance by paramedics can also be requested by ambulance technicians after evaluation of the patient at the scene.

Patients in whom return of spontaneous circulation occurred and who were admitted to hospital were treated in the coronary care or intensive care units. The rhythm on presentation to the accident and emergency department, any return of spontaneous circulation, survival to admission to hospital, and discharge from hospital were documented from the accident and emergency record sheets and the hospital records.

Patients sustaining cardiac arrest due to a non-cardiac cause (for example, drug overdose, trauma, hypovolaemia, or hypothermia) were excluded from the analysis. Within Edinburgh and the surrounding area some patients are treated by a hospital based medical team (Medic 1), which operates closely in conjunction with the Scottish Ambulance Service.[6,7] These patients were also excluded from analysis.

Data were entered on a database (Microsoft Excel 4.0) with the internationally recognised Utstein template.[8] Data analysis was performed by using χ^2 test with Yates's correction, and differences between groups were assessed by the Mann-Whitney U test.

Results

Over the two years a total of 565 patients were received in the accident and emergency department

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after out of hospital cardiac arrest of cardiac origin and treatment by ambulance technicians or paramedics. Sixty three patients were excluded from analysis: in 46 patients the arrest episode occurred after the arrival of the ambulance crew or during transit to hospital; in 17 cases the available documentation was insufficient to determine whether a paramedic or technician crew had been involved.

A total of 502 patients fulfilled the study criteria. These patients had sustained a cardiac arrest before arrival of the ambulance; their treatment was performed and documented by an ambulance paramedic or technician.

Two hundred and fifty nine patients (175 men, 84 women) received treatment from paramedics. The median age of these patients was 69 (range 29-94) years. Two hundred and forty three patients (181 men, 62 women) with a median age of 69 (30-92) years were treated by technicians.

There was no significant difference between the two groups in relation to the presenting rhythm, the proportion of patients whose cardiac arrests were witnessed, or those who received any bystander attempt at cardiopulmonary resuscitation (table I). Call response and transport intervals were identical for the two groups. The length of time spent at the scene of the arrest was significantly longer for patients treated by a paramedic ($P<0.0001$), and the length of time between the 999 call and arrival at hospital was also significantly longer ($P<0.0001$) (table II). Table III shows the interventions performed by the paramedics and their influence on these time intervals.

There was no significant difference in any outcome variable between the two groups. This included the proportion of patients in whom spontaneous circulation was achieved, those admitted to hospital, and those discharged alive from hospital (table IV). The proportion of patients discharged alive from hospital was greater in the group treated only by ambulance technicians (9·5% *v* 5·4%), but this did not reach significance ($P=0.087$).

A total of 234 patients had ventricular fibrillation as their primary rhythm. For this group, 32 were subsequently discharged alive from hospital. One hundred and eleven patients with ventricular fibrillation were treated by technicians, with 18 (16%) survivors to hospital discharge. One hundred and twenty three were treated by paramedics, with 14 (11%) surviving to discharge. For episodes of ventricular fibrillation which had been witnessed by bystanders, the figures were 17/85 (20%) for ambulance technicians and 11/103 (11%) for paramedics.

TABLE I—*Details of out of hospital cardiac arrests treated by paramedics or ambulance technicians*

Detail	Paramedic (n=259)	Technician (n=243)
Presenting rhythm:		
Ventricular fibrillation	123	111
Asystole	106	105
Electromechanical dissociation	29	23
Not known	1	4
Witnessed arrest	173	151
Bystander cardiopulmonary resuscitation	90	70

TABLE II—*Median (range) time intervals (minutes) for each stage of response according to treatment by paramedics or ambulance technicians*

Stage	Paramedic	Technician	P value
Call to response	8 (1-18)	8 (0-23)	NS
At scene	23 (2-55)	15 (4-42)	<0·001
Scene to hospital	9 (1-50)	9 (1-30)	NS
Call to hospital	42 (18-83)	35 (11-65)	<0·0001

TABLE III—*Interventions used and effect on median (range) time intervals (minutes) for each stage of response in out of hospital cardiac arrests attended by paremedics*

Stage	Tracheal intubation only (n=156)	Intravenous access only (n=2)	Tracheal intubation plus intravenous access (n=81)	Nil (n=13)	Not known (n=7)
Call to response	8 (1-18)	9 (6-12)	8 (2-17)	8 (2-17)	7 (4-9)
At scene	22 (2-49)	31 (26-37)	26 (7-55)	23 (12-23)	26 (10-36)
Scene to hospital	9 (1-50)	9 (5-13)	8 (4-20)	7 (5-14)	7 (4-17)
Call to hospital	40 (18-83)	50 (50-51)	42 (23-82)	42 (26-56)	46 (18-62)

TABLE IV—*Outcome in patients suffering out of hospital cardiac arrest according to treatment by paramedic or ambulance technician*

Detail	Paramedic (n=259)	Technician (n=243)	P value
Return of spontaneous circulation	78	73	1·0
Admitted	49	48	0·9
Discharged	14	23	0·087

Discussion

The pioneering work of Pantridge and Geddes showed the efficacy of management of out of hospital cardiac arrest by doctors using a mobile intensive care unit.[9] Subsequently, attention has focused on the optimal method of delivering this type of care in the community.

In North America paramedics routinely use advanced life support techniques, which include defibrillation, tracheal intubation, intravenous techniques, and drug administration.[10] The training includes classroom and field experience and may last from 1000 to 3000 hours.[10]

In the United Kingdom, Department of Health recommendations aim to provide at least one trained paramedic in the crew of every emergency ambulance by the end of 1995.[2] This policy has not, however, been based on objective evidence as to the efficacy of such interventions as compared with simpler, less expensive, and less time consuming approaches. The ability of basic life saving skills and defibrillation alone to achieve good results has been considered.[11-13] Even in North America the need for full paramedic skills as opposed to ambulance crew using defibrillators alone has been challenged.[14,15]

The nature of the primary electrocardiographic rhythm for such patients is the single most important determinant of a successful outcome.[10,16] Malignant ventricular tachyarrhythmias, of which ventricular fibrillation is by far the most common, are found in most patients experiencing sudden cardiac arrest.[17-19] With the passage of time, coarse ventricular fibrillation progressively decreases in amplitude and is associated with a reduction in the probability of successful defibrillation.[20] The other electrocardiographic rhythms associated with cardiac arrest—asystole and electromechanical dissociation—are accompanied by dismal outcomes irrespective of treatment given.[3,5,7,10,12,18] Furthermore, defibrillation as a treatment will not influence survival in this group.[21,22] For these reasons it is apparent that nearly all patients in whom a successful outcome could be anticipated are those with a primary rhythm of ventricular fibrillation and in whom defibrillating shocks can be administered with a minimal delay.

DRUG TREATMENT

For the duration of the study paramedics were permitted to perform intravenous cannulation and tracheal intubation but did not administer specific cardioactive drugs. Although it might be argued that this distorts our conclusions, it is increasingly recognised that the administration of drugs has at best a marginal role in improving survival after cardiac arrest.

In studies on animals and humans, vasopressors such as adrenaline have been shown to have beneficial effects in relation to the haemodynamic profiles achieved during cardiopulmonary resuscitation.[23] Human studies which have assessed improvement in survival to hospital discharge, however, have yielded disappointing results even with high dose regimens.[24 25]

The role of buffers in treating the metabolic acidosis associated with cardiac arrest has also been questioned.[26] The first large double blind, randomised placebo study of the use of buffers in prehospital cardiac arrest was unable to show any benefit either in restoration of spontaneous circulation, admission to hospital, or hospital discharge rates.[27]

Finally, in relation to drug treatment, the ability of antiarrhythmic agents such as lignocaine or bretylium to improve outcomes remains at best not proved.[28-31]

COMPARISON OF AMBULANCE STAFF

The overall results achieved by ambulance service staff in our study compare favourably with other systems in the United Kingdom, Europe, and North America. The overall rate of survival to hospital discharge of 14·9% for patients with witnessed cardiac arrest and a primary rhythm of ventricular fibrillation is higher than the national figure[3-4] and is similar to values from other well established programmes.[10]

We have not shown any improvement in outcome with the presence of a paramedic after cardiac arrest occurring out of hospital. There were small non-significant differences between the two groups in the proportion of patients who presented in ventricular fibrillation, whose arrests were witnessed, and who received bystander cardiopulmonary resuscitation. For all of these variables, however, the group treated by paramedics contained a higher proportion of patients who would be expected to have had a better prognosis.

The length of time at the scene of the arrest was significantly longer for patients treated by a paramedic. This is probably because of the time needed for tracheal intubation and intravenous cannulation, together with any additional time spent waiting for the paramedics to arrive when they were called as a secondary response. This additional time does not result in an improved outcome.

The challenge remains to see whether other or complementary approaches may lead to even better results. There is substantial evidence that basic life support (cardiopulmonary resuscitation) performed by bystanders before the arrival of the ambulance can positively influence the outcome.[32 33] The primary reason for this improvement relates to the fact that, while cardiopulmonary resuscitation cannot itself reverse the processes occurring during cardiac arrest, it increases the proportion of patients who are still in ventricular fibrillation when the first responding ambulance team arrives.[32 34 35]

Hospital based teams led by physicians who are able to provide immediate support to ambulance crews is one solution which has been shown to be effective in Edinburgh[6 7] and Belfast.[36] More radical solutions, such as providing automatic defibrillators at public places for use by lay persons or those with minimal training, still have to obtain widespread acceptance and need to be shown to be safe and efficacious.

The results of this study do not downgrade or diminish the role of paramedics. These people are highly motivated, enthusiastic, and professional. Rather, we have shown the overwhelming need to provide rapid defibrillation for victims of sudden cardiac arrest. At present this is best achieved by ambulance technicians using basic life support skills and semi-automatic defibrillators.

Key messages

- Ambulance technicians treat cardiac arrest occuring out of hospital with basic life support and defibrillation
- Ambulance paramedics undergo extensive further training in resuscitation techniques
- No improvement in overall outcome was seen when paramedics attended the patients
- The government plans to have at least one paramedic in every front line ambulance by the end of 1995
- The outcome of patients treated by technicians *v* paramedics does not justify the government's plans

We thank the technicians and paramedics of the Scottish Ambulance Service for their diligence in treating the patients under their care and completing the patient report forms.

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Stopping drinking and risk of oesophageal cancer

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Abstract

***Objective*—To examine the effect of stopping drinking on the risk of oesophageal cancer.**

***Design*—Hospital based case-control study.**

***Setting*—Surgical departments of four district general hospitals and general practices in Hong Kong.**

***Subjects*—Cases were 400 consecutive admissions of patients with histologically confirmed diagnosis of oesophageal cancer during a 21 month period in 1989-90 (87% response rate). Controls were 1598 patients selected from the same surgical departments as the cases and from the general practices from which the cases were originally referred (95% response rate).**

***Main outcome measure*—Relative risk of developing oesophageal cancer after stopping drinking (adjusted for age, education, place of birth, smoking, and diet).**

***Results*—Current light drinking (<200 g ethanol/week) was not associated with significant increase in risk. Among former drinkers risk fell more quickly in moderate (200-599 g/week) than heavy (≥600 g/week) drinkers. Even among heavy drinkers, however, risk had dropped substantially after five to nine years of not drinking. The results suggest that the time taken for risk to return to that in subjects who never drink was 10-14 years for moderate drinkers and 15 years or more, if ever, for heavy drinkers.**

***Conclusion*—Risk of oesophageal cancer decreases fairly rapidly with time after abstaining from drinking. This new finding could be used in health promotion to encourage behavioural changes, especially in heavy drinkers, who have a very high risk of developing oesophageal cancer. It also suggests that alcoholic beverages have a strong effect on the late stage of carcinogenesis.**

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Introduction

Alcoholic beverages have been shown by many epidemiological studies to increase the risk of oesophageal cancer.[1] Largely on the basis of epidemiological findings, a working group of the International Agency for Research on Cancer concluded that alcoholic beverages are carcinogenic to humans and causally related to cancers of the oral cavity, pharynx, larynx, oesophagus, and liver.[2] One factor, however, which previous studies have not studied in detail is the effect of stopping drinking on the risk of developing cancer. This will be important for several reasons. Firstly, although several different carcinogenic mechanisms of alcoholic beverages have been proposed, their relative importance is still unclear. Laboratory experiments might have been expected to be illuminating, but the evidence of the carcinogenicity of ethanol and alcoholic beverages on experimental animals is much less strong than the epidemiological findings in humans and was judged to be inadequate by the working group.[2] Information on how risk changes after the removal of exposure should shed some light on this issue. Secondly, demonstrating a reduction in risk when someone stops drinking will be useful for the purpose of prevention and health promotion. Lastly, evidence of a decrease in risk on cessation will provide further evidence on the causal role of alcohol.

A recent case-control study on oesophageal cancer in Hong Kong Chinese has shown a very strong effect of drinking alcoholic beverages.[3] The large sample and the number of former drinkers allowed us to examine the effect of stopping drinking.

Patients and methods

The study was a hospital based case-control study conducted during the period between March 1989 and December 1990. Eligible cases were consecutive admissions of patients with histologically confirmed diagnoses of oesophageal cancer to surgical departments of four general hospitals in Hong Kong. For each case, two controls were selected from patients admitted to the same departments and a further two controls were recruited in the general practice from which the case was originally referred to the care of surgical specialists. Both types of controls were matched by age and sex (within 5 years) to the case. Patients with diabetes mellitus and cancers of the trachea, bronchus and lung, oral cavity, pharynx, larynx, stomach, pancreas, liver, kidney, and bladder, all of which could be related to tobacco and alcohol intake, were excluded. Details of the methods have been reported elsewhere.[3]

A structured questionnaire was used by trained interviewers to interview subjects in hospital (cases and hospital controls) or general practice. Information was sought on patient characteristics, personal and family medical history, smoking and drinking habits, and diet. On alcohol drinking, details were asked about age at starting to drink, usual amount consumed, duration of drinking different types of beverages, and date of stopping for former drinkers. Using this information we calculated the average weekly amount of alcohol consumed as the mean quantity of ethanol consumed during the entire period of drinking.

Data were analysed by using conditional logistic regression, producing odds ratios and deviance χ^2 tests for effects.[4] We analysed hospital and general practice controls separately but as findings were similar we have reported results on the combination of the two series of controls.