Hewlett Packard laser printer.

Dot matrix printers are cheapest, but their print quality is poor and they are very noisy. Dot matrix printers are, however, well suited to printing on tractor feed paper and multipart forms.

All printers can print on to A4 paper, but you should also ask whether the printer you are considering is capable of printing on to acetate sheets for overhead presentations and on to different sizes of paper. Many general practitioners prefer letters printed on A5 rather than A4 paper as A5 fits more easily into standard records. Users of portable computers may wish to consider a compact battery operated printer which allows printing on the move. Before choosing a printer ask to see an example of its print quality and compare this with samples from other makes.

Manufacturer

Manufacturers of computers and printers

Computers

Apple Macintosh	0800 127753
Compaq	0181 332-3888
Compusys	01296 395531
Dan	0181 830-1100
Dell	01344 720000
Elonex	0181 452-4444
Evesham Micros	01386 765500
Gateway	0800 602000
IBM	0800 919929
Taxan Monitors	01344 484646
Viglen	0181 758-7000

Printers

Brother	0800 535100
Cannon	0800 252223
Epson	0800 220456
Hewlett Packard	01344 369222
Star	01494 471111
Kodak	01442 61122

Choosing an established manufacturer is important because many computer companies have gone into liquidation in recent years. Computer equipment is generally very reliable but is eventually likely to need attention. We therefore recommend that you buy from a reputable company. Most manufacturers have showrooms where you can try their computers before purchase. If you decide to use mail order, always purchase with a credit card as this protects you against bankruptcy of the supplier.

The ABC of Medical Computing is edited by Nicholas Lee, consultant ophthalmologist, Western Eye and Hillingdon Hospitals, and Andrew Millman, occupational physician, Gloucestershire Royal Hospital.

When is it futile for ambulance personnel to initiate cardiopulmonary resuscitation?

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Abstract

Objective—To determine whether patients with unexpected prehospital cardiac arrest could be identified in whom ambulance resuscitation attempts would be futile.

Design—Review of ambulance and hospital records; detailed review of automated external defibrillator rhythm strips of patients in whom no shock was advised.

Setting—Scottish Ambulance Service; all cardiopulmonary resuscitation attempts after cardiorespiratory arrest during 1988-94 included in the Heartstart Scotland database.

Subjects—414 cardiorespiratory arrest patients with no pulse or breathing on arrival of ambulance personnel, no bystander cardiopulmonary resuscitation performed, and more than 15 minutes from time of arrest to arrival of ambulance. Patients were stratified into those with "shockable" and "non-shockable" rhythms.

Main outcome measures—Return of spontaneous

circulation, or survival to reach hospital alive, or survival to discharge, or all three.

Results—No patient with a non-shockable rhythm who met the entry criteria for analysis survived a resuscitation attempt. Review of the defibrillator rhythm strips of these patients failed to find any case in which the tracing was deemed compatible with survival.

Conclusions—On the basis that it would be inappropriate to initiate vigorous resuscitation in patients who can be identified as "dead" and beyond help an algorithm was prepared to guide ambulance personnel.

Introduction

The scene is familiar. Ambulance staff respond to an emergency telephone call: "I think my husband has died." They find a pulseless, apnoeic corpse, in their view clearly beyond help. His distressed widow requires professional support and care. But there are

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no definitive signs of death. Thus, because ambulance personnel cannot pronounce "life extinct" (they are not, after all, doctors), the charade must be acted out of instituting full resuscitation measures while removing the victim "from public gaze." Johnson and Maggiore, reporting from New Mexico, found that most emergency medical technicians had at least once in their careers taken a decision to discontinue resuscitation without a direct physician order or protocol guidance and that nearly half were troubled by this decision.¹

Since the introduction of automated external defibrillators with monitoring capability an additional tool—the electrocardiogram monitor—has become available to ambulance crews which might help in diagnosing death. Kellerman *et al* and Bonnin *et al* reported that in the United States paramedics can now identify patients who will not survive resuscitation^{2,3}. Halting futile attempts could redirect about \$1bn worth of resources to other aspects of health care.⁴ We reviewed ambulance resuscitation records in Scotland to see whether patients could be identified in whom resuscitation attempts are clearly futile.

Methods

Since 1988-9 the Scottish Ambulance Service has been equipped with automated external defibrillators on all front line ambulances. Details of the defibrillation protocol and outcomes of resuscitation have been reported.^{5,6} Ambulance personnel complete a report after each attempted resuscitation, which includes time of cardiac arrest (if known), time of the 999 call, time of arrival on the scene, and time of defibrillation. The printout from the defibrillator (Laerdal Heartstart 2000 or 3000) allows assessment of the presenting rhythm, documentation of the cardiac rhythm before and after defibrillation (when delivered), and the final rhythm achieved. Analysis of the algorithm used within the automated external defibrillator disclosed a sensitivity of 90.3% to 94.4% in identifying a "shockable" rhythm (ventricular fibrillation or rapid ventricular tachycardia) and a specificity of 99.0% to 99.7% in excluding "non-shockable" rhythms.⁷

The resuscitation database was examined for patients who met the following criteria: (a) more than 15 minutes between collapse and arrival of the ambulance; (b) no bystander cardiopulmonary resuscitation performed; (c) no pulse or breathing on arrival of ambulance personnel. These criteria were based on the findings of Aprahamian *et al*, who hypothesised that survival would be unexpected in cases of unwitnessed cardiac arrest when the onset of symptoms occurred more than 15 minutes before the arrival of the ambulance and asystole was the presenting trace on the electrocardiogram.⁸

At the time of this study ambulance personnel were authorised to withhold resuscitation if there were definitive signs of death such as putrefaction, decapitation, rigor mortis, or postmortem staining. They were also authorised not to initiate resuscitation in patients with known terminal diseases when the doctor responsible for the patient had given written instructions or recorded verbal instructions with ambulance control not to resuscitate. Otherwise, ambulance personnel had no discretion to withhold resuscitation. All patients fulfilling the above criteria underwent a full resuscitation attempt.

Results

At the time of analysis details of resuscitation and ultimate outcome (death or discharge alive from hospital) were available for 8337 patients in the Heartstart Scotland database. Of these patients, 414 met the study criteria.

Table I gives the outcome of the resuscitation attempt in the 414 patients according to whether defibrillation was performed. Only one patient was discharged alive. This patient had sustained a witnessed cardiac arrest, the ambulance had arrived 15 minutes later, and a shockable rhythm was present on first rhythm analysis. The time from arrest to first shock was 19 minutes and cardiopulmonary resuscitation was supported by adrenaline given by a doctor. Five other patients with a shockable rhythm were admitted alive to hospital but died after admission. There were no survivors among the 240 patients not given a defibrillator shock.

TABLE I—Outcome of resuscitation by ambulance personnel among 414 patients who met study criteria

	Total	No admitted to hospital	No discharged alive
Shocked	169	6	1
Not shocked	240	2	0
Unknown	5	0	0
Total	414	8	1

In order to consider whether the automated external defibrillator might have failed to identify a potentially treatable rhythm in the non-shocked group we carried out a detailed analysis of the rhythm strips of patients in this group (table II). Electrocardiogram printouts were retrieved for 193 (80%) of the 240 patients. Asystole was confirmed in 100 cases (52%). A possible diagnosis of ventricular fibrillation was tenable in eight patients (4%), though in all of these the amplitude was fine or definitive analysis of the rhythm was rendered impossible by artefact from ongoing cardiopulmonary resuscitation.

There were no survivors among patients who met the conditions of the hypothesis, so that the omission of treatment in these patients would not have influenced survival. We propose an algorithm (figure) to govern the actions of ambulance staff confronted with a patient in whom attempts at resuscitation may be futile.

Discussion

Studies of the apparent futility of cardiopulmonary resuscitation given certain criteria^{2,3} have examined only the effect of discontinuing full advanced cardiac life support performed as routine. Most reports are from North America, where full advanced life support paramedic teams begin resuscitation routinely in all cases and thereafter use protocols for discontinuation. Our study differs by addressing whether to start resuscitation given the criteria of an unwitnessed arrest of more than 15 minutes' duration and a flat trace on the monitor.

The defibrillators used in the Heartstart Scotland project are automated. Concern might be expressed that patients with a flat trace in whom no shock is advised by the automated external defibrillators may be in fine ventricular fibrillation. Weaver *et al*, however, showed that when the amplitude of ventricular fibrillation is less than 0.1 mV full resuscitation, including defibrillation, is rarely associated with survival (only 23 (5.8%) of 394 cases).⁹ We identified eight patients with possible ventricular fibrillation in the non-shocked group; none had truly "flat line" asystole, and with our algorithm a resuscitation attempt would have been initiated routinely.

Several safeguards have been built into the algorithm.

(1) If at any time during the attendance there is doubt about the viability of the patient the ambulance

TABLE II—Presenting rhythm in non-shocked patients

	No (%) of patients
Asystole	100 (51.8)
Agonal rhythm (<20 beats/min)	53 (27.5)
Bradycardia (20-60 beats/min)	32 (16.6)
?Ventricular fibrillation	8 (4.1)
Total	193 (100.0)

crew must begin and continue a sustained resuscitation attempt, invoking advanced cardiac life support as soon as possible.

(2) If a shock is advised or it is not known for certain that the patient has not received cardiopulmonary resuscitation within 15 minutes, then the patient should actively be resuscitated.

(3) Resuscitation should be carried out in all such cases in which survival after prolonged cardiac arrest has been reported.¹⁰ These include circumstances of drowning, hypothermia, and accidental exposure and cases of depression of cerebral activity induced by poisoning or overdose.

(4) For ethical and practical reasons ambulance staff should always initiate resuscitation in children. After cardiac arrest in pregnancy resuscitation should be aggressive to support the possibility of fetal survival.

(5) Even then, to offer the very slim chance of survival to the remaining patients whose asystole may have a hypoxic origin staff are required to give cardiopulmonary resuscitation for one minute (10 cycles).

(6) Only after this, when further checks confirm pulselessness, apnoea, and a non-shockable rhythm and a flat trace has been observed on the oscilloscope for 10 seconds, should resuscitation attempts be abandoned.

Only a doctor may confirm death, and arrangements should be made for a doctor to attend or for the patient to be transported to hospital as quickly as feasible.

The proposed algorithm relates only to unexpected

Algorithm for use by ambulance personnel faced with patient in whom attempts at resuscitation may be futile

Key messages

- Ambulance staff in Britain are expected to initiate vigorous resuscitation attempts in all cases of unexpected cardiac arrest unless there are blatant signs of death
- Commentators have expressed the futility of this approach when patients are discovered with no signs of life, no attempted cardiopulmonary resuscitation by bystanders, and a long time between collapse and the ambulance call
- Identifying asystole with the electrocardiograph and defibrillator with monitoring capability carried by ambulance personnel can aid in decision making in the field
- Review of the Heartstart Scotland database confirms that patients with an unwitnessed arrest, no bystander resuscitation performed, a collapse to arrival time exceeding 15 minutes, and a non-shockable rhythm on an automated external defibrillator will not be expected to survive
- Guidelines have been prepared in the form of an algorithm to help ambulance personnel in decision making at the scene of an unexpected "death"

deaths. There will be circumstances in which death is expected—for example, in the case of terminally ill patients being transported by ambulance from home to hospital or vice versa. Our current "do not resuscitate" orders in the event of expected deaths will continue.

We recognise that this issue is controversial and sensitive. Vigorous resuscitation should be undertaken whenever there is a chance of survival, however slim. Nevertheless, futile efforts at resuscitation are distressing both for staff and for relatives and realistic guidelines are needed. We welcome discussion about the most appropriate form of guidance to ambulance staff and would appreciate data from other emergency medical systems.

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