

Editorial

Out-of-hospital resuscitation: room for improvement

Since the first report of survival from out-of-hospital ventricular fibrillation¹ there have been many attempts to reduce the delay to defibrillation. In the 1980s it was demonstrated that fire fighters equipped with defibrillators could administer a DC shock on average five minutes earlier than the existing paramedic service.² Cummins *et al* reviewed five controlled trials where emergency medical technicians were taught to defibrillate and found odds ratios for improved survival ranging from 3.3 to 6.9.³ Leslie *et al* reported a much less impressive reduction in mortality following the introduction of defibrillators to ambulance crews in the City of Glasgow, north of Clyde region.⁴ They attribute this finding to failure to rapidly access the emergency services and to lack of bystander cardiopulmonary resuscitation (CPR). A similar lack of impact on mortality was reported after the introduction of defibrillators in the London ambulance service where only 30% of arrests that were not witnessed by crews had bystander CPR.⁵

Basic life support

The survival advantage conferred by supplying ambulance personnel with defibrillators will only be maximised if emergency medical services are alerted rapidly and CPR is initiated early. In one series of 126 out-of-hospital cardiac arrests there were no survivors from ventricular fibrillation when the delay to basic life support was greater than four minutes. However, when resuscitation was initiated within four minutes the survival rates for inefficient and efficient CPR were 61% and 93% respectively.⁶

Increasing the frequency of bystander CPR requires education of the general public, which can be directed either at target groups or at the population as a whole. Patients who have suffered a myocardial infarction or an out-of-hospital cardiac arrest are at higher risk of sudden cardiac death. The families of these patients can be successfully taught CPR, although skills are rapidly lost and refresher courses are often required.⁷ However, few victims of cardiac arrest have a history of known ischaemic heart disease. McIlwaine *et al* examined all ischaemic heart disease deaths in Belfast over a one year period and found that in out-of-hospital cardiac arrests a relative was the first source of help in 70% of cases.⁸ However, in a subgroup of 128 out-of-hospital deaths in individuals aged < 70 years where resuscitation was considered to be possible—that is, the death was witnessed by someone aged 13–64 and was due to a presumed primary rhythm disturbance—there was a history of known ischaemic heart disease in less than 50%. Thus restricting CPR training to a family-based strategy would have a limited effect on overall survival.

There is therefore a need for greater general public awareness of CPR skills. Systematic teaching has resulted in more than 450 000 residents of Seattle and the surrounding King County being taught CPR, and consequently they report bystander CPR rates of close to 60%.⁹ In the United Kingdom the learning of basic resuscitation

skills has largely been by enthusiasts on a voluntary basis. We should be encouraging the compulsory teaching of such skills. This can be done effectively in schools where it should be part of the core curriculum for all children. Legislation could also be enacted requiring certification in CPR skills for all employees of emergency services, the health service, the civil service, and in all industries with sufficient numbers of staff. For those individuals not reached by such schemes the mass media could be used to pass on the simple message that emergency services must be called early after a cardiac arrest.

Early defibrillation

By prolonging the duration of ventricular fibrillation cardiopulmonary resuscitation will lengthen the time window in which defibrillation remains effective. However, even with early CPR a delay of greater than eight minutes in the delivery of definitive care greatly reduces the chance of survival.¹⁰ Leslie *et al* reported an improvement in ambulance response times in Glasgow, although still less than 40% arrived within seven minutes of the call to the emergency services.⁴ Similarly, in the London ambulance service only 30% of ambulances equipped with defibrillators arrived within eight minutes of the collapse.⁵

The delay to defibrillation could be shortened by more widespread use of automated external defibrillators (AEDs) by minimally trained individuals. These could include fire-fighters, police officers, aircraft crews, and those responsible for delivering first aid in factories, offices, shopping malls, and at large public meetings. The use of these devices by such staff has potential medical and medico-legal implications. Although AEDs have a high specificity for shockable rhythms, there have been reports of the inappropriate delivery of DC shocks by these devices.^{11,12} Ventricular tachycardia also remains a diagnostic problem for AEDs because heart rate may not correlate well with the haemodynamic state of the patient and this may result in a false positive diagnosis of a shockable rhythm.¹³ Instructions are given that these devices should not be attached to conscious patients, thereby reducing the risk of inappropriate shocks, but such advice is not always followed.¹⁴ There is thus a need for a haemodynamic sensor to confirm cardiac arrest before a DC shock is delivered.¹⁵

An alternative method of remote defibrillation with a potential for 100% specificity is transtelephonic defibrillation.¹⁶ The device is attached to the patient by a minimally trained individual and the electrocardiogram is transmitted by cellular telephone to the base station where a doctor can analyse the rhythm and ask about the clinical state of the patient over a voice link. The DC shock can then be administered remotely after checking that everyone is standing clear of the patient. These devices are currently large and relatively immobile but the development of low energy defibrillation using biphasic waveforms will lead to a reduction in defibrillator size.¹⁷

In conclusion, although the major determinants of sur-

vival from out-of-hospital cardiac arrest have been known for more than two decades we have not substantially improved the numbers of patients where resuscitation was started by bystanders or our delay to defibrillation. The time has come for compulsory teaching of CPR, which should be part of the core curriculum in schools, and the use of innovative defibrillation techniques in the United Kingdom.

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