CURRENT TOPIC

Prehospital emergency care for children

F Jewkes

The greatest mortality in children occurs before the first birthday. The highest rate of all is in the first month of life and is related mainly to perinatal events. From 1 month to 1 year of age the commonest cause of death is cot death and between 1 and 4 years congenital abnormality and trauma are about equal. After that age children die predominantly because of trauma.[1] It can be seen therefore that most life threatening events leading to cardiac arrest are likely to commence outside hospital. The provision of an effective prehospital emergency service is an important element in reducing childhood mortality.

Most cardiac arrests are secondary to hypoxia or less commonly circulatory failure (shock), rather than primary cardiac arrest.[2] Early attention to adequate oxygenation and correcting shock may therefore be life saving if instituted early enough. Children who arrive at the hospital pulseless and apnoeic have a poor chance of survival and if they do survive, a high chance of neurological deficit.[3 4]

Only about 10% of the emergency calls made to the ambulance service are for children and only about 5% of these will require rescuscitation.[5 6] The need for paediatric emergency care in the community is therefore rare, but when it is required, the response must be prompt and effective.

Prehospital health care professionals have an unrivalled opportunity to improve the outcome for a seriously ill or injured child. They are present during the critical initial time following an accident or the onset of severe illness (the so called "golden hour" of resuscitation) before the child reaches hospital. This is time in which simple lifesaving measures can halt and reverse the otherwise inevitable progression to cardiac arrest. In addition, they have the opportunity to assess the child's surroundings at the time of the emergency—particularly valuable in traumatised children (to assess the mechanism of injury) and sometimes in other circumstances such as suspected child abuse.

Department of Child Health, Cardiff Royal Infirmary, Newport Road, Cardiff, UK
F Jewkes

Correspondence to:
Dr Jewkes
f.jewkes@btinternet.com

Accepted 21 September 2000

The difficulties of the prehospital environment

Most hospital clinicians will have learnt and practised their resuscitation in a purpose built, equipped area within the hospital environment. Outside hospital the environment may be hostile.

- Some *physical dangers* may be easily identified, but there are also less obvious ones, such as disruptive onlookers and bystanders
- *Equipment* may be limited, not only because of the financial constraints of its infrequent use, but also because of space. The boot of a doctor's car or even the interior of an ambulance will not allow storage of emergency equipment to cover all eventualities at all ages
- The *number* of skilled people available outside hospital may vary from incident to incident
- The *skill mix* of personnel may also vary. From immediate care doctors (usually general practitioners) through paramedics to parents, there may be varying backgrounds of training in the emergency care of children
- *Emotions* run high when a child is involved in an emergency, resulting in rescuers endangering themselves, in inappropriate triage, overly hasty evacuation of the child, and a fear and reluctance to intervene with treatment[7]
- Finally, the decision as to when to *transport* the child to hospital requires skill and judgement.

All these factors have to be considered when designing training for those working outside hospital.

The "skills versus scoop and run" dilemma

Definitive care for a very sick or seriously injured child cannot be provided outside hospital. Those with the most knowledge of how to treat such children will be at the receiving unit. Very sick children must therefore be transported promptly.[2 8] Some hold the view that all interventions may cause delay in the child's arrival at hospital and thus the patient should be transported without any treatment—so called "scoop and run". Others favour teaching prehospital personnel a large number of skills to allow treatment to commence as early as possible within the golden hour. As interventions prolong prehospital time, if the skills are not used judiciously, this can lead to an undesirable practice known as "stay and play" in immediate care circles. Current teaching aims to strike a middle road—to teach sufficient background knowledge that an immediate care doctor or paramedic can weigh up the benefit of a particular skill against the

possible detriment to the patient caused by the delay in transportation.[9] In paramedic circles this concept has been welcomed, but is still considered novel as paramedics generally are taught to work using a clearly defined protocol given a certain clinical scenario, rather than making judgement decisions.

The difficulties of training

There are a number of problems in teaching emergency prehospital personnel (primarily paramedics) about the emergency care of children.

TEACHERS

While there are many people experienced in the prehospital environment and also many skilled in the emergency care of critically ill children, there are few with extensive experience in both areas. Those not trained in paediatrics do not always appreciate the many differences between adults and children, nor that there are specific paediatric techniques which may simplify patient care. Conversely, some hospital based paediatric doctors and nurses do not consider that they have sufficient experience in the prehospital environment to teach those working within it.

EQUIPMENT

Because of the lack of storage space, careful thought has to be put into equipment choice—there is no point teaching a skill if the equipment will never be available to carry it out. Improvisation can be useful under certain circumstances.[10]

COST

The cost of training initiatives must be prioritised along with all other demands that are made on health service resources. Paediatricians and others professionally committed to the emergency care of children must be advocates, to ensure that those responsible for prehospital resources understand the importance of good prehospital care.

What skills are needed?

As cardiac arrest usually follows a period of hypoxia and/or ischaemia, early recognition of a seriously ill child is vital. This can be safely taught to the inexperienced and will alert the paramedic or non-specialist doctor to the need for timely transfer to hospital. It is not possible nor appropriate to teach the whole of paediatric emergency practice to those infrequently involved with children; rather it is necessary to address situations where simple intervention saves lives. The use of tapes (similar to the Broslow tape) and charts such as the Oakley chart[2] have done much to alleviate the confusion of drug doses and other calculations. Intraosseous infusion[11] provides a simple way of gaining access to the circulation for those having difficulty in obtaining intravenous access.

Paramedics have very limited training compared to doctors and nurses, and there is a tendency by many to overestimate their skills, knowledge, and training.[12] Authorising the use of interventional skills by paramedics requires experience and judgement. It is the remit of the Joint Royal Colleges Ambulance Liaison Committee (JRCALC) (on which there are three members of the Royal College of Paediatrics and Child Health) to advise on these matters at national level and also to advise on the national paramedic training syllabus. Locally, each ambulance trust employing paramedics is required to have a Local Ambulance Paramedic Steering Committee (LAPSC), consisting of experts—usually hospital consultants from different disciplines—who must also approve all paramedic treatments and interventions before paramedics can perform them locally, to allow for regional preferences and logistics. Generally speaking, for a skill to be useful, its acquisition should lead to treatment of a problem that will not wait until the child reaches hospital[9] (such as airway management or defibrillation), or may improve or stabilise the child without delaying admission or unduly jeopardising the child in any other way (such as giving oxygen, salbutamol, or rectal diazepam).

Skill retention may be difficult because most paramedics care for seriously ill or injured children infrequently. Less than 1% of paramedics are required to perform more advanced techniques such as endotracheal intubation per year.[13] One study reported that only about 20% of children transported had any advanced procedure performed, and none were intubated or received intraosseous infusion.[14] If a paramedic is likely to perform a skill only rarely, retraining and reassessment must be frequent and the skill simple and safe. In the USA, where paramedics have been performing paediatric skills for some years, audit has documented that endotracheal intubation in children has about a 33% complication rate,[15] whereas intraosseous infusion has a 15% complication/failure rate.[11] A recent controlled study from the USA, of more than 800 children, has shown no benefit of endotracheal intubation over bag–valve–mask ventilation in mortality and neurological outcome,[16] emphasising the need for continued close audit and review of permitted skills here in the UK, where such figures are not available because they are relatively new techniques.

The current levels of paediatric training and skill acquisition in the UK vary widely from area to area and it is hoped that the introduction of the new paramedic training syllabus (see below) will encourage a more uniform approach.

New initiatives

There are several new initiatives. Firstly, the ambulance service has acknowledged the need for formal paediatric training in the paramedic syllabus and has now incorporated a paediatric section in the new training syllabus and manual.[17] This is being piloted in several areas around the UK. It is much more prescriptive and comprehensive than the more informal methods used previously and has been approved by JRCALC. Secondly, the Advanced Life Support Group has developed a prehospital course (the Prehospital Paediatric Life Support Course) to complement the hospital

orientated Advanced Paediatric Life Support course, providing those who undertake it with the skills and knowledge to care for a critically ill child in the prehospital environment, without delaying hospital admission. Finally, increasing numbers of doctors, nurses, and paramedics have realised there is a deficiency in prehospital paediatric emergency care. There are now far more hospital paediatric specialists working together with senior ambulance trainers and paramedics, each acknowledging the discipline of the other and sharing skills and expertise. It is to be hoped that soon this goodwill and enthusiasm, in conjunction with the new training, will benefit children with life threatening illness or injury throughout the UK.

1 Office of National Statistics. *England and Wales 1997*. London: Office of National Statistics.
2 Advanced Life Support Group. *Prehospital paediatric life support*. London: BMJ Publishing Group, 1999:4–5,8,21–3.
3 Schindler MB, Bohn D, Cox P, *et al*. Outcome of out of hospital cardiac or respiratory arrest in children. *N Engl J Med* 1996;**335**:1473–9.
4 Sirbaugh PE, Pepe PE, Shook JE, *et al*. A prospective, population-based study of the demographics, epidemiology, management, and outcome of out-of-hospital pediatric cardiopulmonary arrest. *Ann Emerg Med* 1999;**33**:174–84.
5 Kumar VR, Bachman DT, Kishkaddon RT. Children and adults in cardiopulmonary arrest: are advanced life support guidelines followed in the prehospital setting? *Ann Emerg Med* 1997;**29**:743–7.
6 Institute of Medicine. A call to action: the Institute of Medicine report on emergency medical services for children. *Pediatrics* 1995;**96**(suppl):173–210.
7 Lacher ME, Bausher JC. Lights and siren in pediatric 911 ambulance transports: are they being misused? *Ann Emerg Med* 1997;**29**:223–7.
8 Jewkes F. Paediatric advanced life support. *Prehospital Immediate Care* 1998;**2**:83–9.
9 Cooke MW. How much to do at the accident scene? *BMJ* 1999;**319**:1150.
10 Markenson D, Foltin G, Tunik M, *et al*. The Kendrick extrication device used for pediatric spinal immobilization. *Prehosp Emerg Care* 1999;**3**:66–9.
11 Miner WF, Corneli HM, Bolte G, *et al*. Prehospital use of intraosseous infusion by paramedics. *Pediatr Emerg Care* 1989;**5**:5–7.
12 Stephenson J, Cooke MW. General practitioners overestimate ambulance paramedic skills. *Prehospital Immediate Care* 1998;**2**:75–6.
13 Su E, Mann C, McCall M, Hedges JR. Use of resuscitation skills by paramedics caring for critically injured children in Oregon. *Prehosp Emerg Care* 1997;**1**:123–5.
14 Reisdorff E, Howell KA, Saul J, *et al*. Prehospital interventions in children. *Prehosp Emerg Care* 1998;**2**:180–3.
15 Sing RF, Reilly PM, Rotondo MF, *et al*. Out-of-hospital rapid-sequence induction for intubation of the pediatric patient. *Acad Emerg Med* 1996;**3**:41–5.
16 Gausche M, Lewis RJ, Strattons SJ, *et al*. Effect of out of hospital pediatric endotracheal intubation on survival and neurologic outcome. A controlled clinical trial. *JAMA* 2000;**283**:783–90.
17 Institute of Health Care and Development. *Ambulance service paramedic training 1999*. Institute of Health Care and Development.