Cardiac arrest following trauma is not a dead end

In this issue, Lockey et al. from London's Air Ambulance present their concept of a common algorithm for effective management of traumatic cardiac arrest, including resuscitative thoracotomy in penetrating chest injuries.\(^1\) According to the authors, the algorithm does not necessarily distinguish between prehospital and in-hospital care. However, their approach of delivering resuscitative thoracotomy by non-surgeons to the trauma patient in the field with cardiac arrest, instead of scooping and run, will be perceived as provocative; emergency room thoracotomy by surgeons is well established but even this is controversial. Let’s face it: enormous efforts have been undertaken for decades to educate, train and perform high quality resuscitation in patients with out-of-hospital cardiac arrest even though the majority are in asystole and have dismal low survival rates. Now the London HEMS group have initiated a new and radical approach by performing standardised resuscitative thoracotomy in the field. And they have been successful – achieving survival rates of 18% in patients with cardiac arrest following penetrating chest injuries.\(^2\) Following non-traumatic cardiac arrest, worldwide survival to hospital discharge is 8–11% for all-rhythm and 21–22% for ventricular fibrillation.\(^3\) Following traumatic cardiac arrest, survival is between 0 and 17%, with much higher survival rates in penetrating injuries versus blunt trauma. Since 2005, published survival rates have improved reasons that are not clear.\(^4,5\)

To this day there are only few studies analysing prehospital thoracotomy. Though, a recent literature review confirmed the limited evidence resulting in five case series, four of them were from London HEMS.\(^6\) Already 12 years ago, Coats et al. from London HEMS published their first retrospective analysis and later in 2011 Davies et al. reported a 15-year retrospective database review of 71 prehospital thoracotomies with 13 survivors and good neurological outcome in 85% of survivors.\(^2,7\) Following their established standard operating procedure, prehospital thoracotomy was performed in penetrating chest injury with cardiac arrest occurring within 10 min before team arrival at scene and at least 5 min transport time to an appropriate centre. All reported survivors suffered from stab wounds to the chest or epigastrium with cardiac tamponade, all neurologically intact survivors developed cardiac arrest with the HEMS team in attendance or within 3 min of their arrival; five presented with initial asystole, six with pulseless electrical activity and two with unknown rhythm.\(^2\) Based on these promising data, the authors developed a simple algorithm to guide effective management of traumatic cardiac arrest, including resuscitative thoracotomy in penetrating chest injuries.

However, some aspects of successful prehospital thoracotomy reported by the authors have to be considered as potential requirements for survival. The relatively high incidence of penetrating trauma enabled competence to be acquired in what is otherwise a rare procedure. London HEMS is a long-established out-of-hospital trauma service, including a physician with at least 5 years of postgraduate experience mainly in emergency medicine or anaesthesiology. The service uses standard operating procedures to promote an aggressive approach to the rapid transfer of patients with penetrating trauma to appropriate centres. Training of physicians includes one-to-one teaching, supplemented by pictures, video, manikin, and sometimes cadaver training. The procedure of prehospital thoracotomy is aimed at one specific remediable pathology – obstructive cardiac tamponade. All these aspects have to be considered, as done by the authors when they suggest recommendations on the introduction of prehospital thoracotomy in EMS systems. They also suggested a system of audit and quality assurance, adequate training and resources, including firm links with their receiving hospitals.\(^8\) Mattox – one of the ‘fathers’ of trauma care and doubtful about thoracotomy in the field – also expressed these overriding governing principals in his recent editorial accompanying a review on prehospital thoracotomy.\(^9\)

We would like to mention two further aspects about the suggested algorithm for effective management of traumatic cardiac arrest. Firstly, traumatic cardiac arrest following cardiac tamponade in penetrating trauma has highest survival rates when early and effective thoracotomy with pericardiostomy is performed. Therefore the London HEMS group focuses on this pathology in prehospital thoracotomy performed by non-surgeons. Resuscitative thoracotomy is a resource-intense procedure with risks for both the patient and operating physician – a focused ultrasound examination is a simple, fast and reliable diagnostic tool to confirm cardiac tamponade and if this is not confirmed it can be used to identify other reversible causes of cardiac arrest. This enables a more selective approach and for non-surgeons with less expertise in resuscitative thoracotomy, it may be especially helpful to distinguish between cardiac tamponade and other causes of traumatic cardiac arrest. In the context of the proposed algorithm, focused cardiac ultrasound would be performed within the first 10 s to diagnose traumatic cardiac arrest and would not add significant delay. Recognition of cardiac arrest by ultrasound may even be quicker than searching for a central pulse over a 10 s period. Portable, handheld systems are available, enabling sonography in the field. Ultrasound is also recommended by the current European Resuscitation Council guidelines.\(^2\) Secondly, as the authors emphasise, oxygenation is crucial in the trauma patient. However checking and monitoring correct tracheal tube placement is important because tube displacement may occur when moving the patient. Capnography is used to confirm and monitor tube
placement, as recommended by the current European Resuscitation Council guidelines.3

As surgeons and emergency physicians, we congratulate the authors from London HEMS not only for their extraordinary success in prehospital trauma care but in particular for their scientific efforts in this topic. They initiated a paradigm shift with standardized on-scene thoracotomy and consequently saving lives. Certainly, the success of on-scene thoracotomy depends on many factors, above all the nature of injury and time of intervention relative to the cardiac arrest. Future studies will have to demonstrate whether the algorithm for management of traumatic arrest has to be calibrated to save more lives and whether it can be used in different EMS systems. We are looking forward to reading further fascinating papers by the authors.

Conflict of interest statement

None.

References


Bernd A. Leidel a,b,*

a Department of Emergency Medicine, Campus Benjamin Franklin, University Hospital Charité – Universitätsmedizin Berlin, Hindenburgdamm 30, 12200 Berlin, Germany
b HEMS Christoph 31, ADAC-Luftrettung and EMS, Berlin Fire Department, Campus Benjamin Franklin, University Hospital Charité – Universitätsmedizin Berlin, Germany

Karl-Georg Kanz a,b

a Department of Emergency Medicine, University Klinikum rechts der Isar of Technische Universität München, Ismaninger Straße 22, 81675 Munich, Germany
b Munich EMS, Board of Medical Directors, Rupprechtstraße 19, 80337 Munich, Germany

* Corresponding author at: Department of Emergency Medicine, Campus Benjamin Franklin, University Hospital Charité – Universitätsmedizin Berlin, Hindenburgdamm 30, 12200 Berlin, Germany.

E-mail address: bernd.a.leidel@charite.de (B.A. Leidel)

26 March 2013