A practical approach to resuscitative thoracotomy

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Abstract

The survival after traumatic cardiac arrest is similar to out-of-hospital cardiac arrest of any cause. Potential reversible pathologies must be addressed immediately, regardless of patient location at the time of diagnosis. Resuscitative thoracotomy is a well-established surgical intervention that may result in a neurologically good outcome for some patients in traumatic cardiac arrest. This paper describes a simple approach to resuscitative thoracotomy that can be used by a doctor in the pre-hospital environment and in the emergency department.

Keywords Blunt trauma; emergency medical service; emergency thoracotomy; penetrating trauma; resuscitation; resuscitative thoracotomy

Resuscitative thoracotomy is an important resuscitative intervention that has been used to treat traumatic cardiac arrest or peri-arrest in the emergency department (ED) or operating theatre for many years.[1] The outcome of traumatic cardiac arrest (TCA) is poor in all reported series although in the best series similar to out-of-hospital cardiac arrest of any cause.[2–5] The potential place of resuscitative thoracotomy is shown in one TCA algorithm in Figure 1.[6] Guidelines have questioned the value of thoracotomy after cardiac arrest and have recommended concentrating on patients with penetrating trauma with short duration of cardiac arrest as the group who are most likely to benefit.[7,8] In the UK although the rate of penetrating trauma is relatively low it has been recognized that resuscitative thoracotomy is occasionally required in all major trauma centres and rarely in trauma units. Because any delay rapidly reduces the chances of survival the intervention may need to be performed by junior surgeons and non-surgeons. This article describes a straightforward technique for resuscitative thoracotomy that has been used successfully by non-surgeons in the ED and in the pre-hospital phase of care. It builds on a previous article that has been used in the standard operating procedures of several trauma services.[9]

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Resuscitative thoracotomy indications and contraindications

Immediate resuscitative thoracotomy is a well-established surgical intervention that may result in a neurologically good outcome for some patients in TCA.[10] For blunt trauma patients who have received cardiopulmonary resuscitation for over 10 minutes, resuscitative thoracotomy is likely to be futile as injuries are often more complicated and less amenable to treatment by less-experienced surgeons.[8,11] However, for penetrating trauma victims with definite loss of cardiac output for less than 10 minutes, the procedure has proven effective and should be carried out without any delay for less effective interventions.[12] When the penetrating wound is in the epigastrium, chest or between the scapulae, the cardiac arrest is usually caused by cardiac tamponade and obstructive shock or hypovolaemia. The chances of success increase when the cardiac arrest caused by cardiac tamponade and a simple cardiac wound. As the majority of tamponades are clotted, needle pericardiocentesis is unlikely to be effective.[13]

Resuscitative clamshell thoracotomy

The indications are:

- penetrating injury to the chest or epigastrium with peri or cardiac arrest
- penetrating trauma to other body regions for aortic compression and haemorrhage control
- blunt trauma for aortic compression and haemorrhage control.

Indications for resuscitative thoracotomy in children should be the same as those used for adult trauma patients.

The contraindications are:

- no cardiac output for greater than 10 minutes.

Provider competence, equipment required and technique

Ideally, patients with severe penetrating chest trauma should have their operations done by a cardiothoracic surgeon in the controlled environment of the operating theatre. Unfortunately, with only minutes to relieve cardiac tamponade after the onset of cardiac arrest this standard of care is not possible for many patients and the procedure may need to be performed in the ED or (where physician-led pre-hospital services are available) in the field. Although resuscitative thoracotomy is normally performed by surgeons, the procedure can also be performed successfully by non-surgeons such as emergency physicians or anaesthetists.[10,12] When the resuscitative thoracotomy procedure is performed on the roadside or in the ED a simple technique is essential. The technique should be rapid, give excellent exposure, and the provider can only be expected to address a limited number of pathologies. The equipment required should be minimal, lightweight, and familiar to operators (Table 1). The aims of the procedure are to rapidly decompress pericardial tamponade, control haemorrhage, perform open cardiac massage and temporarily occlude the aorta.[9]

London's Air Ambulance resuscitative clamshell thoracotomy technique

1) Position the patient supine in an area where there is 360 degrees of access. Intubation, ventilation, intravenous

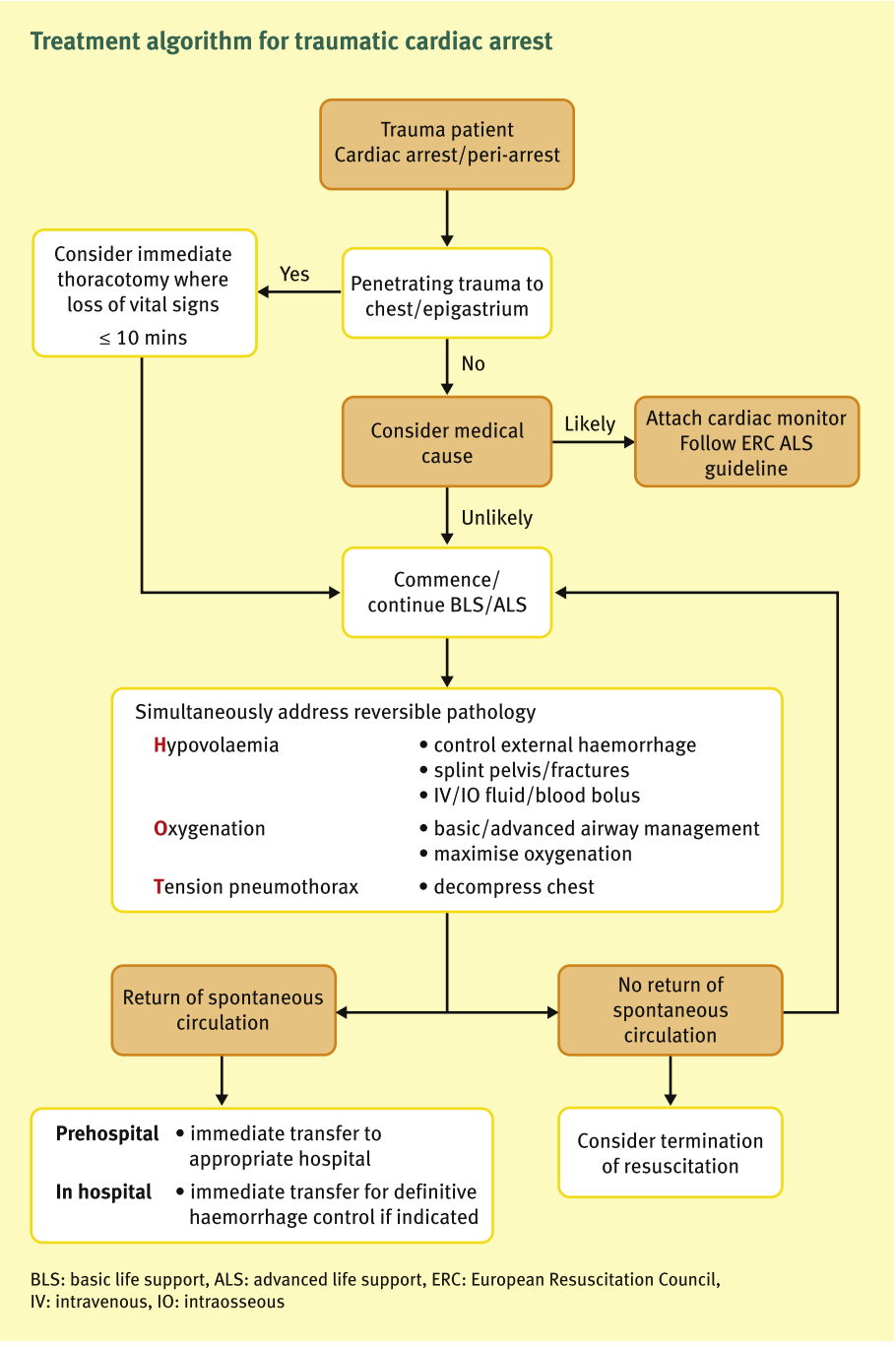

Figure 1

access, etc. should be performed by other members of the team and not delay the thoracotomy.

2) Wear sterile gloves and restrict aseptic technique to a rapid application of skin preparation. Surgical draping is not essential for resuscitative thoracotomy.
3) Undertake simple bilateral 4 cm long thoracostomies (breaching the intercostal muscles and parietal pleura) in the mid-axillary line fourth intercostal space using a scalpel and blunt forceps.
4) Make a skin incision along the line of the fourth interspace that joins both thoracostomy wounds (Figure 2).
5) Two fingers are inserted into a thoracostomy to hold the lung out of the way while you extend the thoracotomy wounds on both sides up to the sternum using a heavy scissor. It may be possible to cut through the sternum with the scissors. If not, blunt forceps are passed behind the sternum and the serrated wire of the Gigli saw are pulled behind the sternum. The serrated wire is then attached to the handles and saw and the sternum divided horizontally in a few saw strokes.
6) The incision in the intercostal space is then extended posteriorly to the posterior axillary line. This allows full chest