

# Resuscitative thoracotomy: a practical approach

Marius Rehn  
Gareth Davies  
David Lockey

## Abstract

The survival after traumatic cardiac arrest is low but 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.<sup>1</sup> The outcome of traumatic cardiac arrest (TCA) is poor in all reported series, although at best it is similar to out-of-hospital cardiac arrest of any cause.<sup>2–5</sup> The potential place of resuscitative thoracotomy is demonstrated in a TCA algorithm in Figure 1.<sup>6</sup> 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.<sup>7,8</sup> 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-

*Marius Rehn PhD is an Anaesthesiologist at Oslo University Hospital, Rikshospitalet, Oslo, Norway, the Director of Research at the Norwegian Air Ambulance Foundation and Assoc. Professor in Pre-hospital Critical Care. Conflicts of interest: none declared.*

*Gareth Davies MB ChB is a Consultant Emergency Physician and Medical Director for London's Air Ambulance, Barts Health NHS Trust, London, UK. Conflicts of interest: none declared.*

*David Lockey MD Res is a Consultant in Intensive Care Medicine, Research Lead for London's Air Ambulance, Barts Health NHS Trust, London, UK and Hon. Professor of Trauma & Pre-hospital Emergency Medicine. Conflicts of interest: none declared.*

hospital phase of care. It builds on a previous article that has been used in the standard operating procedures of several trauma services.<sup>9</sup>

## Resuscitative thoracotomy indications and contraindications

Immediate resuscitative thoracotomy is a well-established surgical intervention that may result in neurologically good outcome for some patients in TCA.<sup>10</sup> For blunt trauma patients who have received CPR 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.<sup>8,11</sup> However, ultrasound after cardiac arrest may have a role in identifying the rare case of blunt trauma with cardiac tamponade that may potentially benefit from resuscitative thoracotomy.<sup>12</sup>

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 delaying for less effective interventions.<sup>13,14</sup> 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. Gunshot injury is likely to involve significantly greater energy transfer than knife wounds and the chances of successful intervention are much lower than when the cardiac arrest is caused by cardiac tamponade and a simple cardiac wound. As the majority of tamponades are clotted, needle pericardiocentesis is unlikely to be effective, formal thoracotomy and pericardotomy is essential.<sup>15</sup>

## Resuscitative clamshell thoracotomy

### Indications

- 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, haemorrhage control and pericardotomy for cardiac tamponade.

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

### Contraindications

No cardiac output for more 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.<sup>10,13</sup> 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

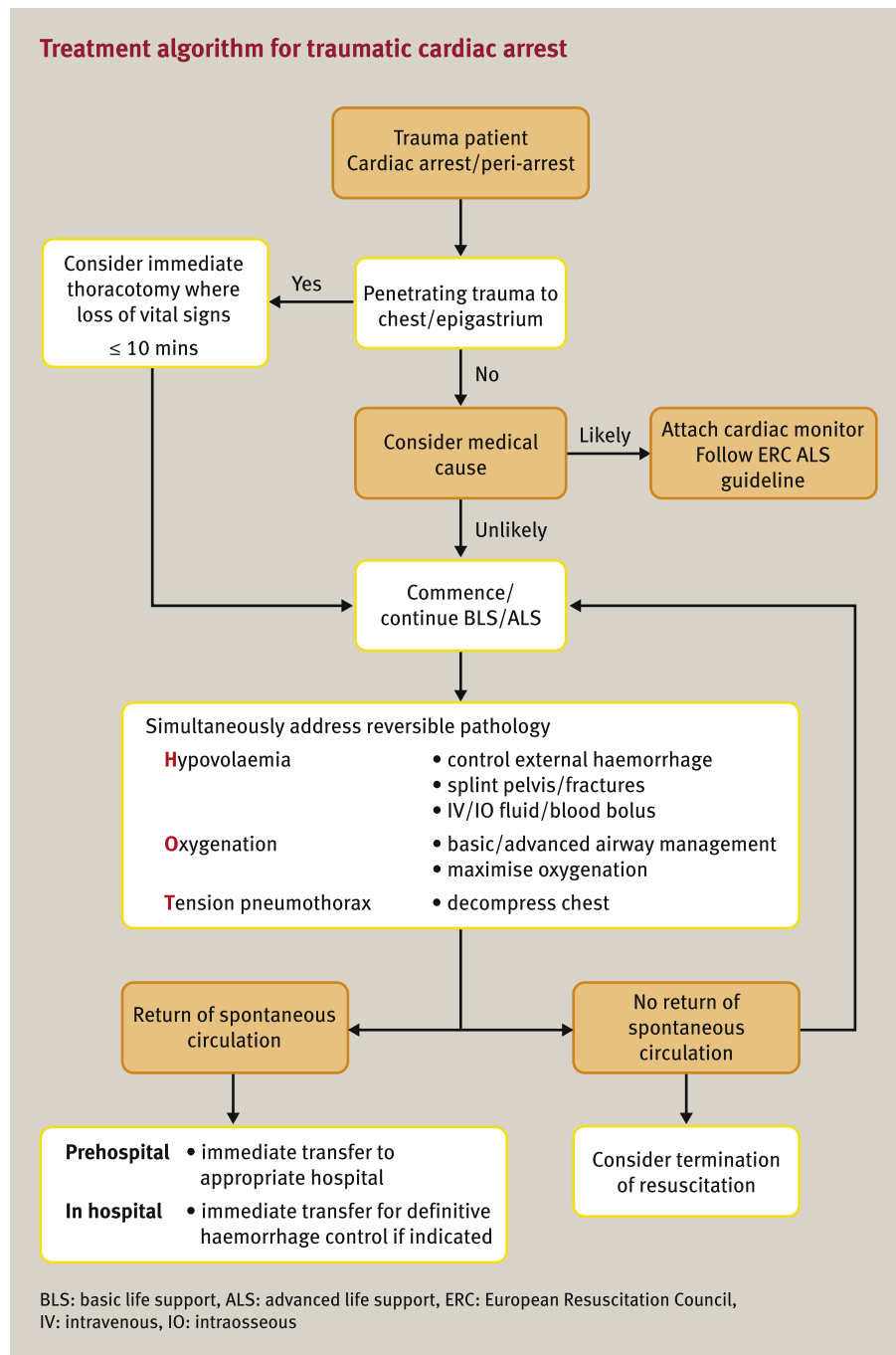


Figure 1

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 hemorrhage, perform open cardiac massage and temporarily occlude the aorta.<sup>9</sup>

#### 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

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 4th intercostal space using a scalpel and blunt forceps.
4. Make a skin incision along the line of the 4th interspace that joins both thoracotomy wounds. (Figure 2).

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