

include hypotension or cardiac arrest in conjunction with signs suggestive of a pneumothorax (respiratory distress, hypoxia, absent unilateral breath sounds, subcutaneous emphysema and mediastinal shift (tracheal deviation and jugular venous distention).⁸⁹ During CPR, not all of these signs may be present. When it is suspected in the presence of a cardiac arrest or severe hypotension, chest decompression should be carried out immediately⁹² before radiographic confirmation.⁹³ Also, numerous studies note that lung ultrasound is one of the best means of accurately diagnosing a pneumothorax. While time is of the essence, point-of-care ultrasound should be considered.⁹⁴

In ventilated patients, TPT presents rapidly with signs of respiratory and cardiac compromise. The incidence of cardiac arrest is significantly higher than in spontaneously breathing patients.⁸⁹ Rising ventilator pressures, reduced air entry and haemodynamic compromise should alert the clinician to the possibility of a TPT. Immediate thoracic decompression should be performed. The technique employed will depend on the available technical skills and access to the patient.^{95,96}

Decompression of the chest effectively treats TPT in patients with TCA and takes priority over all other measures. Finger thoracostomy is easy to perform and is used routinely in the prehospital field.⁹⁷ This step is the first stage of standard chest tube insertion – a simple incision and rapid dissection into the pleural space (see TCA, and Appendix 2, <http://links.lww.com/EJA/A812>). Chest tube insertion requires additional equipment, takes longer to perform and creates a closed system that has the potential for building retention inside of the thorax. Chest drain tubes may become blocked with lung or blood clots and have the potential to kink.

Cardiac tamponade

- (1) In suspected cardiac tamponade, point-of-care ultrasound should be used to confirm the diagnosis.
Strong recommendation, low-quality evidence (1C)

This recommendation is based on a systematic review of retrospective evidence,⁹⁸ the guidelines of the European Society for Cardiology, the Diagnosis and Management of Pericardial Disease⁹⁹ and one animal experimental study.⁷⁵

Point-of-care ultrasound is recommended to confirm the extent of cardiac tamponade and the resulting effect on haemodynamics. Causes of pericardial tamponade can be divided into surgical (mostly acute onset) and medical (mostly chronic). Cardiac tamponade in the perioperative period may develop after cardiac surgery, percutaneous cardiac interventions, central venous cannulations, laparoscopic surgery, radiofrequency ablation for hepatocellular carcinoma or in patients presenting for aortic dissection surgery.^{100–104}

Today, cardiac tamponade is recognised as an essential diagnosis to exclude as a reversible cause during CPR. Ultrasound should be the principal diagnostic test to confirm pericardial tamponade and should be used to guide pericardiocentesis.

Pericardiocentesis

- (1) In case of cardiac tamponade, we recommend immediate decompression of the pericardium.
Strong recommendation, low-quality evidence (1C)
- (2) Immediate decompression can be achieved by either ultrasound-guided pericardiocentesis or, in the case of a haemopericardium, by resuscitative thoracotomy.
Strong recommendation, low-quality evidence (1C)

Needle pericardiocentesis under ultrasound guidance and resuscitative thoracotomy are the cornerstones of treatment for pericardial tamponade of nontraumatic origin.⁹⁹ In trauma, needle pericardiocentesis has been replaced by resuscitative thoracotomy and has virtually disappeared from clinical practice in the treatment of pericardial tamponade. This change of practice in TCA has come about because the pericardial blood collection is frequently clotted and cannot be aspirated by needle pericardiocentesis.⁹⁸ However, there may be a role for needle pericardiocentesis and catheter insertion as bridging measures before definitive surgical repair in severely compromised patients if resuscitative thoracotomy is not immediately available.¹⁰⁵ In order to avoid complications such as cardiac perforation and tension pneumothorax, needle pericardiocentesis should be carried out under ultrasound guidance.^{99,106}

If pericardial tamponade has caused cardiac arrest, chest compressions are not effective. In hypovolaemic cardiac arrest, the circulatory collapse is caused by a lack of preload. Chest compressions further increase intrathoracic pressure and reduce venous return to the heart. Asynchronous chest compressions also hamper ventricular filling. Both factors compromise cardiac output,⁷⁵ particularly during positive pressure ventilation.¹⁰⁷ Volume expansion with intravenous fluids¹⁰⁸ and immediate relief of the tamponade therefore take priority over chest compressions.

Preparational aspects of cardiac arrest

Cardiac arrest team training

- (1) When training for peri-operative cardiac arrest, we suggest a co-ordinated protocol to improve the quality of mechanical CPR.
Weak recommendation, low-quality evidence (2C)

In a prospective, before–after cohort evaluation,¹⁰⁹ the implementation of cardiac arrest team training incorporating an automated chest compression device (ACCD) resulted in a decrease of the no-flow ratio from 0.42 to 0.27 (95% CI, 0.10 to 0.19, $P < 0.005$) and from 0.24 to 0.18 (95% CI, 0.01 to 0.11, $P = 0.02$) for the next 5 min.