

Title of procedure: Resuscitative Thoracotomy

Key words: Thoracotomy, Trauma, Resuscitative, Emergency

Alternative alphabetical listing:

1. Overview/procedure description

This procedure relates to the performance of a resuscitative thoracotomy. A resuscitative thoracotomy is only indicated in a small subsection of patients with a traumatic cardiac arrest. It is used to treat those patients who have cardiac tamponade in trauma or a simple cardiac wound from a penetrating injury.

2. Related Policy

Traumatic cardiac arrest algorithm

Rapid transfer to theatre procedure

3. Definition of Terms

Signs of life:

- Pupil response
- Respiratory effort
- Cardiac activity
- Spontaneous movement
- Palpable pulse

4. Procedure details

4.1 Potential benefits of procedure

- To relieve cardiac tamponade and thus alleviating refractory obstructive shock
- Haemorrhage control (e.g. control of simple cardiac wound secondary to penetrating trauma)
- Perform open cardiac massage
- Compression of the descending thoracic aorta to prevent exsanguination from catastrophic intra-abdominal bleeding.

4.2 Indications

Profound refractory shock despite bilateral chest decompression and aggressive 1:1 blood product resuscitation as per Massive Haemorrhage and Critical Bleeding Procedure

AND

Pericardial tamponade on POCUS or likely simple cardiac wound

AND

Cardiac Activity on POCUS

OR

Witnessed cardiac arrest (loss of signs of life) in ED or Pre-hospital Arrest (<10mins) in patient with no known non-survivable injuries.

Considerations:

The decision to proceed with a resuscitative thoracotomy will require a discussion between the senior decision makers present (ED / Paediatric Surgery / Anaesthetics / PICU). The following considerations should be taken into account:

- Elapsed time <10minutes since arrest?

Commencing resuscitative thoracotomy > 10 minutes since arrest is associated with lower rates of successful resuscitation so should be a prompt to reconsider if the intervention is required or not. While successful resuscitation has been achieved beyond 10 minutes of cardiac arrest, favourable neurological outcomes are less likely. It is worth noting that patients may have the appearance of cardiac arrest whilst in a low flow state. Identifying cardiac activity on POCUS is therefore a useful indicator – however, this may not be possible in all cases – in particular if there is significant subcutaneous emphysema that precludes clear imaging of the heart.

- Resuscitative thoracotomy is more likely to be successful in penetrating trauma

The successful return of spontaneous circulation with survival to discharge is low in paediatric traumatic cardiac arrest secondary to blunt trauma. Blunt trauma is also likely to be associated with a non-survivable head injury.

- Is the expertise available to perform?

At RCH the expected proceduralist for a resuscitative thoracotomy is the most senior paediatric surgeon available.

- Which is the appropriate environment to undertake procedure?

The benefits of performing this procedure in the operating theatre need to be weighed against the time taken to transport the patient to this environment. The patient already in cardiac arrest **and** meeting the other indications, would benefit from immediate resuscitative thoracotomy in ED.

- Is the required equipment available?

Equipment trays will be made available for ED and theatres (see also thoracotomy tray contents list)

4.3 Use of point of Care Ultrasound

Use of Point of Care Ultrasound

- Person performing ultrasound should have formal training and be accredited.

4.4 Location

Favourable neurological outcome is **more** likely following a thoracotomy if it is performed within 10 minutes of cardiac arrest. Therefore, it should proceed as a time critical intervention by rapid transit to theatre or in the ED trauma resuscitation room as determined by the team leader and surgeon. Either environment is appropriate in the select population where this intervention is justified.

4.5 Equipment

(see equipment list)

4.6 Procedure

A resuscitative thoracotomy is only indicated on a small subset of patients in traumatic cardiac arrest. Ensure the patient meets indications for this procedure. A resuscitative thoracotomy consists of opening the chest, relieving any tamponade, exposing the heart and repairing any defects. It may also involve managing stopping major intra-thoracic bleeding or aortic compression.

A resuscitative thoracotomy should be performed by the most senior paediatric surgeon present. Once a decision has been made to perform a resuscitative thoracotomy, the on-call cardiothoracic surgeon should be contacted at the earliest opportunity.

The major steps are as follows:

1. Ensure the proceduralist has appropriate PPE
2. The patient should be in a supine position with the arms above the head.
3. Where time allows rapidly apply skin preparation over the entire chest and abdomen – this should not delay the start of the thoracotomy
4. Make a left anterolateral incision in the intercostal space between 4th and 5th rib. Begin at the sternum and extend the incision past the posterior axillary line. If a thoracostomy incision has been made, incorporate this into incision
5. Using scissors cut through the intercostal muscles and gain access to the thoracic cavity – cutting along the superior margin of 5th rib to avoid

- intercostal blood vessels. Ensure underlying lung / heart is not injured in this process.
6. Use your hands to spread the ribs, then place rib spreader (Finochetto retractor) between the ribs with the handle and ratchet bar towards patients lateral aspect (axilla). Open the retractor to facilitate adequate exposure of the heart.
 7. Lift the pericardial sac with forceps and cut the pericardium with scissors – incise in a caudal-to-cephalad direction; stay anterior and parallel to the phrenic nerve.
 8. Evacuate any clot from the pericardial sac and inspect the heart for injury. Bleeding from the heart may initially be controlled with digital pressure. Staples or sutures may be used to close a defect. A clamp may be used to control bleeding from an atrial appendage.
 9. Consider need to convert left anterolateral thoracotomy into a clamshell thoracotomy by making an anterolateral incision on the right (at the same level as the left) and extending through the sternum. The sternum may be transected using trauma shears or mayo scissors. Replace the rib spreader in the midline.
 10. If there is no spontaneous cardiac contraction a two-handed technique should be used to perform internal cardiac massage – take care not to unnecessarily lift the heart which can kink the vascular pedicle.
 11. Should ventricular fibrillation be observed AND the patient is in theatre, then the heart may be shocked using internal paddles – dose of 0.6 joules/kg. Internal paddles are **NOT** available ED. If a shockable rhythm occurs during this procedure whilst the patient is in ED, then external defibrillation should be used – this requires the rib spreader to be removed, the chest closed, and the chest wall to be dried.
 12. If the procedure is successful – the patient may begin to wake – so anaesthesia (with minimal cardiac depression) may be required immediately. Ketamine is a reasonable agent in this situation. Bleeding may occur which should be controlled with haemostatic clamps. The patient should be moved to the hospital operating theatre for definitive repair.
 13. Transport to operating theatre must ensure the patient is transported via a suitable route to minimise use of public areas of the hospital, and with due care taken to minimise risk of infection.
 14. Performance of psychological first aid to staff and witnesses to the procedure is likely to be required following this procedure. This should be facilitated by any staff member with the requisite training who feels capable in performing this task.

5. Reference

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6. Contacts

Procedure number	RCH####
RCH Strategic goals	[Delete as appropriate] Excellence in Healthcare Focus on Quality and Safety Leadership in Research Education Partners in Paediatric Care Improved Organisational Environment
Category	Access Care Planning & Implementation Child Protection Communication Consumer focused equitable care Emergency Management Facilities Management

	Financial Management Governance Health Information Human Resources Infection Control Information Technology Intellectual Property Legislative Compliance Medication Management Quality & Improvement Research Risk Management
ACHS Function	[Delete as appropriate] Clinical Support Corporate
Policy type	Policy Procedure
Revision	0 (view history)
Author/Reviewer	Name / Committee Position Department
Authoriser	Policy and Procedure Committee
Date authorised	DD-Mmm-YYYY
Next review date	DD-Mmm-YYYY
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