Trauma Surgeons Gone Wild: How To Crack The Chest

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Take Home Points

- **Visual inspection of the pericardium can't reliably identify tamponade. Always open the pericardium.**
- **Thoracotomies are always initiated on the left side, even in the presence of isolated right sided trauma, to allow for cross-clamping of the aorta and resuscitation of the heart.**
- **The patient should have a right sided thoracostomy (or thoracotomy if indicated) to rule out haemorrhagic shock from the right chest.**
- **The end goal of thoracotomy is restarting the heart into a viable perfusing rhythm. This may involve intracardiac epinephrine, massage and internal defibrillation.**

- **What are the essential actions in traumatic cardiac arrest?**
  1. Taking control of the airway and oxygenating the patient.
  2. Gaining vascular access and infusion of fluids.
  3. Performing ED thoracotomy on the left side to see what is in the left chest and start resuscitating the heart.
  4. Vent the right chest and make sure there isn't a large hemothorax or pneumothorax.

- **How do we set up?**
  - **You need to protect yourself.** These are high risk patients for communicable diseases. You need to have a gown, gloves and protect yourself from splatter. Double glove and cover the area between your gloves and gown.
  - **Call for help.** Whether it is surgery, anesthesiology or the hospitalist. Another set of hands can make a huge difference.
  - **If you have someone skilled who can help manage the airway and right chest, you can focus on the left chest.**

- **The ED thoracotomy should be a wide open thoracotomy.** You will insert the chest retractor(s). Make sure that you don't cut yourself or get hurt on the way in. The chest retractor is used to get the best possible view.

- **What are you seeing?**
  - **Is there a lot of blood and if so, where is it coming from? Is it coming up from the diaphragm, hilum, subclavian or apex of the lung?** If it is coming from below the diaphragm, you want to cross-clamp the aorta to decrease flow and loss into the abdomen. If it is from the hilum, you need to get control of it with a clamp. If it is an apical source, you need to apply pressure.
  - **Is there blood in the pericardium and can you get it out?** It can be difficult to see tamponade especially with a fatty pericardium. Always open the pericardium. Incise along the pericardium medially making sure that the phrenic nerve isn't injured. You should be able to see it. If there is no blood, you are done. If there is blood, you need to open the pericardium all the way and look for the hole. It is very rare to have blood in the pericardium in blunt injury.
  - **If there is a hole, you can use 2-0 prolene to repair the hole.** Otherwise you can place a foley catheter or your finger in place.
  - **Is there haemorrhagic shock from the right side of the chest?** Place a chest tube to see if there is a large amount of haemorrhage. If there is, the patient needs a right sided thoracotomy to control the haemorrhage.

- **Why are thoracotomies always initiated on the left side, even the trauma is isolated to the right side?** Because we can cross-clamp the aorta and restart the heart. If the left-sided thoracotomy is negative, you can then rule out a source of haemorrhage on the right side. The clamshell incision gives you unimpeded access to all of the thoracic and mediastinal contents.

- **What is the end goal of an ED thoracotomy?** The end goal is to get the heart restarted into a viable perfusing rhythm. After entering the left chest and stopping acute haemorrhage, you need to address the heart. Start with cardiac massage. You need to get some of the blood recirculating. Volume and epinephrine are both important. Resuscitation should be done with cross-clamp of the aorta in place. Intracardiac epinephrine is injected directly into the left ventricular cavity followed by cardiac massage. You want to place the needle in the hollow of the left ventricle. All efforts should be focused on getting the heart started.

- **What sequence of medications should we use?** It is not well established. At LAC+USC, they use a combination of epinephrine, 20-40 units of vasopressin and bicarbonate. However, there is no supporting evidence.

- **It is not uncommon to develop a fibrillating rhythm.** You need a defibrillator with internal paddles. Ventricular fibrillation is determined based on visual inspection and not cardiac monitoring. You need to defibrillate the heart directly. Ventricular fibrillation is better than cardiac standstill. The end goal is sinus tachycardia.

- **What do you need?** A scalpel and scissors. A chest retractor. The aortic cross-clamp. Sutures, staples or a Foley catheter. Crash cart with internal paddles plugged in.

- **When is it time to stop resuscitation?** This can be difficult to determine, particularly in paediatric patients. Check with the entire team to make sure everyone is okay with stopping resuscitation.

- **There are three potential outcomes that can occur with successful resuscitation.** Survivors. Neurologically intact survivors. Potential organ donors.

Chris Hicks on ED thoracotomy

- **This is procedure where you need a specific script.** We are not as comfortable with ED thoracotomies as trauma surgeons.

- **If you are going into the left chest, have someone decompress the right side of the chest.** You can't determine tamponade based on the appearance of the pericardium. Open up the pericardium.

- **If the patient is intubated, have the respiratory therapist hold ventilation or advance the tube into the right mainstem.** Drop the left lung and improve your view. Place an NG tube. The aorta can be difficult to distinguish from the oesophagus. You don't want to cross-clamp both.

- **Our primary role is to make the decision to open the chest in a patient that we think is salvageable.** Deliver the heart. Open the pericardium. Examine for cardiac injuries and try to repair or tamponade it. Do internal compressions if it is indicated. You can stop at this point unless you are at a trauma centre and feel comfortable with cross-clamping the aorta, doing a hilar twist, etc.

- **If you have a stab wound to the chest with isolated cardiac injury and tamponade, survival with good neurologic outcome is between 30-40%.** That is pretty extraordinary.