Needle Pericardiocentesis

Synonyms: cardioparacentesis, pericardial tap, pericardial aspiration

See also separate articles Pericardial Effusion and Cardiac Tamponade.

Description

This is the process whereby excess fluid may be drained from the pericardial space. It can be used as a therapeutic or diagnostic procedure. It may be performed blind, or under echocardiographic (ECHO), fluoroscopic or CT guidance.\[1, 2, 3\] It is now rarely performed as a blind procedure due to the associated high morbidity and mortality. Current consensus is that the procedure should only be carried out blindly as a last resort in a life-threatening situation where ECHO guidance is unavailable, and preferably in experienced hands.\[4, 5\] Ideally, it should be performed with imaging guidance and electrocardiographic (ECG) monitoring. Some practitioners advocate the use of right heart catheterisation to allow pressure monitoring and detection of constrictive pericarditis.

Indications

Therapeutic

- Cardiac tamponade, ie haemodynamic compromise due to large/rapidly developing pericardial effusion - eg, trauma.\[6\]
- Management of a large pericardial effusion (>20 mm separation of pericardial membranes on ECHO.\[7\]
- Palliative in cases of metastatic neoplastic disease involving the pericardium.\[7\]

Diagnostic

- Obtaining pericardial fluid for analysis.
- Pericardioscopy.
- Epicardial or pericardial biopsy.

Contra-indications

- Aortic dissection as a cause for pericardial effusion.
- Uncorrected bleeding diathesis, including drug causes, ie anticoagulants.
- Marked thrombocytopenia (<50 x 10^9/L).
- Loculated pericardial effusion, or small pericardial effusion or posteriorly located pericardial effusion.
- Where the effusion is caused by cardiac trauma, a surgical approach is preferred, as it is likely that the effusion is caused by cardiac puncture. The fluid is likely to be coagulated blood and therefore unamenable to drainage, and likely to refill almost immediately. Pericardiocentesis may be used as an emergency 'holding' procedure in such circumstances, if there is likely to be an appreciable delay before a cardiac surgical approach may be attempted. Similarly, where pyopericardium is suspected, surgical drainage is preferred, as fluid is likely to be viscous and difficult to drain.

Cardiac tamponade and pericardial effusion
It will be important in some cases to distinguish a coincidental pericardial effusion from one that is causing cardiac tamponade. ECHO guidance will determine the presence of a pericardial effusion, but it is features such as right atrial systolic collapse and right ventricular diastolic collapse which will suggest cardiac tamponade. The features on ECHO should be combined with clinical findings to determine if there is cardiac tamponade. 

This includes findings of pulsus paradoxus, elevated JVP, hypertension and quiet heart sounds. However, comorbidity may be present which could account for the elevated blood pressure and quiet heart sounds. The use of ECG and CXR may also be helpful - only, however, if it is safe to wait for these. Once cardiac tamponade is suspected it is crucial to perform pericardiocentesis rapidly.

Who should perform pericardiocentesis?

**Emergency setting**

In cardiac arrest scenarios or when patients are acutely decompensating from a rapidly enlarging pericardial effusion, pericardiocentesis should be performed by any qualified practitioner. Ideally this should be a senior doctor with previous experience. In this situation a large gauge needle (eg, 18 G) should be attached to a 20 ml syringe. This should be introduced at the point where the left costal margin meets the xiphisternum. Then, whilst pulling back on the syringe and aiming for the left shoulder tip, gradually move the syringe forward. Once a flashback is obtained then hold the syringe and needle steady and gently remove pericardial fluid. If the patient's deterioration is due to pericardial fluid, a rapid improvement in parameters will be seen even with removal of just 50-100 ml of fluid. Remember that once the patient comes round they should be given adequate analgesia and possibly sedation. The underlying cause will also need to be determined.

**Elective setting**

Should be performed with resuscitation facilities and cardiac monitoring. Should probably be performed by specialists with expertise and previous experience - eg, a senior cardiologist. Patients should be given appropriate analgesia to begin with. They may also require sedation - but medications like midazolam may drop the blood pressure. In this setting usually a guide wire is used to site a drainage tube - eg, pigtail catheter. This allows for a more efficient system of draining pericardial fluid and reduces any risks as there are no sharp needles.

**Equipment**

- Sterile procedure.
- ECG monitoring equipment.
- Resuscitation facilities, ie defibrillator and emergency medications.
- Nowadays it is commonplace to perform the procedure under ECHO guidance.
- Use a trolley with equipment as for central line insertion, including the following:
  - Sterile drapes and gowns for the operator.
  - Antiseptic cleansing fluid such as chlorhexidine/povidone-iodine or isopropyl alcohol.
  - 10 ml syringe and fine-gauge needle with 5-10 ml 2% lidocaine for local anaesthesia.
  - 22/25 G needles.
  - Pericardiocentesis needle with guide wire and dilators.
  - Scalpel and blade.
  - Pigtail catheter with many holes.
  - Drainage bag.
  - 3-way tap.
  - Variety of syringes (10, 20 and 50 ml capacity).

**The procedure**

- Ensure adequately experienced individuals are available to carry out the procedure and ideally under ECHO/fluoroscopic guidance.
- If time permits, check FBC and clotting parameters and correct any abnormality.
- Sit the patient at a 30-45° angle (this allows the pericardial fluid to pool inferiorly).
- Select an entry site closest to the pericardial space as revealed by ECHO, avoiding important structures such as the internal mammary artery, liver, lungs, and neurovascular bundle on the inferior surface of rib.
- Clean the procedure site.
- Administer local anaesthesia to the relevant area.
Incise the skin over the entry site (about 0.5 cm long) to ease the insertion of the needle, and dissect subcutaneous tissues as necessary. With the guide wire system, incision may not be necessary as the needle may have a wide bore through which the wire can be passed.

Introduce the needle towards the pericardial space using ECHO guidance or, if the fluoroscopic method is employed, use the left subxiphoid approach and advance the needle towards the left shoulder at a 15-20° angle from the abdominal wall.

Intermittently instil local anaesthesia as the needle is advanced.

Confirm gaining of pericardial space by ECHO guidance using pulsed saline instillation or by fluoroscopic detection of injected contrast medium (inferior pooling of contrast, rather than rapid dissolution which indicates needle in cardiac chamber). More commonly, pericardial space is determined by a 'give' when the parietal pleura is pierced and by obtaining flashback of pericardial fluid.

Once pericardial space has been gained and confirmed, insert a soft-tipped guide wire, remove the needle and pass dilators over to enlarge the track.

After this, pass the soft-tipped cannula with multiple side holes over the guide wire, ie a pigtail catheter.

Then remove the guide wire and connect to drainage tubing and secure (sutures are usually needed).

Obtain samples of fluid for analysis - eg, cytology, MC&S, biochemistry, etc.

If the sample is blood-stained then the fluid haematocrit can be rapidly checked and compared with the patient's previous procedure haematocrit.

Cannula may be left in situ for up to 24 hours to drain large effusions, with drainage under negative pressure using a vacuum container (most effective).

Post-procedure

Closely observe and record vital signs and ECG monitoring during and after the procedure, looking for evidence of complications, as listed below. Consider post-procedure CXR and ECHO to confirm the position of the cannula and to exclude pneumothorax.

Complications

- Myocardial laceration.
- Myocardial perforation.
- Coronary artery/vein laceration.
- Coronary artery/vein perforation.
- Pneumothorax.
- Cardiac arrhythmias (particularly bradycardia).
- Peritoneal puncture.
- Laceration/puncture of abdominal viscera, particularly the liver.
- Internal mammary artery fistula (rare).
- Purulent pericarditis (rare).
- Acute cardiac decompensation and pulmonary oedema (rare).

Outcome

Use of ECHO guidance has reduced morbidity and mortality, but only in experienced hands.

Further reading & references

- Emergency Pericardiocentesis Video; The New England Journal of Medicine
- Image of pericardiocentesis; University of Sydney
- Ainsworth CD, Salehian O; Echo-guided pericardiocentesis: let the bubbles show the way. Circulation. 2011 Feb 1;123(4):e210-1. doi: 10.1161/CIRCULATIONAHA.110.005512.

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