Critical Cardiovascular Skills and Procedures in the Emergency Department

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KEYWORDS

• Emergent pericardiocentesis • Cardiac pacing
• Implantable cardioverter-defibrillator • Cardioversion • Defibrillation
• Sudden cardiac arrest • Tachyarrhythmias • Induced hypothermia

KEY POINTS

- Emergent pericardiocentesis for cardiac tamponade can be lifesaving in a prearrest or arrest situation.
- Temporary emergent cardiac pacing is a way to ensure or restore myocardial depolarization and can be lifesaving.
- It is important for emergency physicians to have a basic understanding of pacemaker (PM) and implantable cardioverter-defibrillator (ICD) function and to be familiar with the possible complications of these devices.
- Prompt recognition and treatment of tachyarrhythmias can be lifesaving. It is of utmost importance for the emergency physician to know the indications, contraindications, and complications of cardioversion and defibrillation.

EMERGENT PERICARDIOCENTESIS

Pericardiocentesis, the aspiration of fluid from the pericardial sac, was first performed in 1840.[1] Cardiac tamponade occurs when the pericardial effusion causes hemodynamic compromise or circulatory collapse. Emergent pericardiocentesis for cardiac tamponade can be lifesaving in a prearrest or arrest situation. The pathophysiology clinical presentation, and detailed review of the procedure for emergent pericardiocentesis are discussed in this article.

The pericardial sac is inelastic. When fluid accumulates in the sac, it progressively increases the intracardiac pressure until it impairs filling of the right heart, which leads

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to a decrease in cardiac output. The degree to which this occurs depends more on how quickly the fluid accumulates rather than the absolute volume of the fluid. The pericardial sac is able to stretch and accommodate a much larger volume of fluid with a slow accumulation. In contrast, even 50 mL of rapid accumulation can lead to cardiovascular collapse.[2] Causes of pericardial effusions include trauma, post–cardiac surgery, myocardial rupture after infarction, aortic dissection, malignancy, infections, connective tissue disease, and volume overload states such as cirrhosis, congestive heart failure, nephritic syndrome, and liver failure.[3]

The diagnosis of cardiac tamponade is clinical. **Box 1** shows the most common signs and symptoms associated with cardiac tamponade. No single finding or a combination of findings is sensitive or specific for cardiac tamponade. Beck's triad, consisting of hypotension, muffled heart sounds, and jugular venous distention, is present in less than 30% of patients and is more likely to be seen with rapid accumulation of pericardial fluid.[4,5] Pulsus paradoxus is often difficult and time consuming to measure and is not specific to cardiac tamponade (**Box 2**).[5]

Direct visualization with the use of ultrasound is the best tool to confirm the presence of an effusion and should be used when available.[7] This method has sensitivities and specificities approaching 100% when performed by emergency physicians[6] and is rapid and noninvasive. The presence of tamponade is suggested by the collapse of the right ventricle during diastole, abnormal septal movement, and decreased respiratory variation of the inferior vena cava, which should collapse during inspiration.[2] Tamponade is also one of the causes of pulseless electrical activity (PEA) arrest and should be considered in this situation.[8]

Box 1
Symptoms and signs of cardiac tamponade

Symptoms

- Dyspnea
- Confusion
- Dizziness
- Fatigue
- Chest pain
- Palpitations

Signs

- Tachycardia
- Hypotension
- Jugular venous distention
- Muffled heart sounds
- Friction rub
- Pulsus paradoxus
- Low-voltage electrocardiogram (ECG)
- Electrical alternans on ECG
- Enlarged heart on radiograph
- Pulseless electrical activity (PEA)