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BRIEF COMMUNICATION

Computed Tomography-guided Pericardiocentesis: An alternative approach for accessing the pericardium

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Pericardial effusions compress the heart, decrease cardiac output, and lead to haemodynamic collapse. Ultrasound (US)-guided pericardiocentesis is the gold standard for treating pericardial effusions. Recently, the incorporation of computed tomography (CT) guidance has increased patient safety while entering the pericardium. Despite the superior performance of CT-guided pericardiocentesis in smaller, complex effusions, this procedure is not routinely performed by cardiologists and surgeons. Unlike those with an intact pericardium, patients with mediastinal trauma, pericardial adhesions, temporary pacing wires, and vascular conduits are high risk for pericardiocentesis. Tamponade physiology also increases patient susceptibility to the hypotensive effects of anaesthesia during surgical drainage. Here we illustrate the technique of CT-guided pericardiocentesis and demonstrate its application in specific clinical scenarios. We conclude that CT-guided pericardiocentesis provides a useful, alternative strategy for treating cardiac tamponade in high risk patients.

Keywords Tamponade • Mediastinum • Effusion • Pericardium

Introduction

Excessive fluid accumulation in the pericardium can compress the heart causing clinical features of tamponade including dyspnoea, tachycardia, pulsus paradoxus, and elevated jugular venous pressure [1]. Techniques to evacuate the pericardium include percutaneous drainage or operative (thoracotomy, subxyphoid, or video-assisted thoracic surgery (VATS)) pericardial window. These procedures can be dangerous and complicated by pneumothorax, arrhythmia, myocardial laceration, pericardial fistula, hypotension, and cardiac arrest with anaesthetic induction [1,2].

Tamponade caused by pericardial effusion is a well-recognised complication after cardiac surgery [1,3]. Although US-guided pericardiocentesis (USP) is considered the gold standard for treating pericardial effusions, the use of this technique after pericardiotomy is restricted to large volume effusions, with a limited ability to visualise extra-cardiac structures, has high failure rates with posterior and circumferential effusions, and may result in multiple access attempts [1]. Less than 72 hours after cardiac surgery, 60% of effusions cannot be visualised by transthoracic US when effusions are small and localised [3].

Cross-sectional imaging provides a valuable alternative for evaluating a hostile pericardium. Advantages of CT-guided pericardiocentesis (CTP) include reduced interference by mediastinal emphysema, less incisional pain, and improved access to loculated and posterior compartments [4]. Our group and others have used this technique with great precision, evacuating as little as 75cc of pericardial fluid [5]. For

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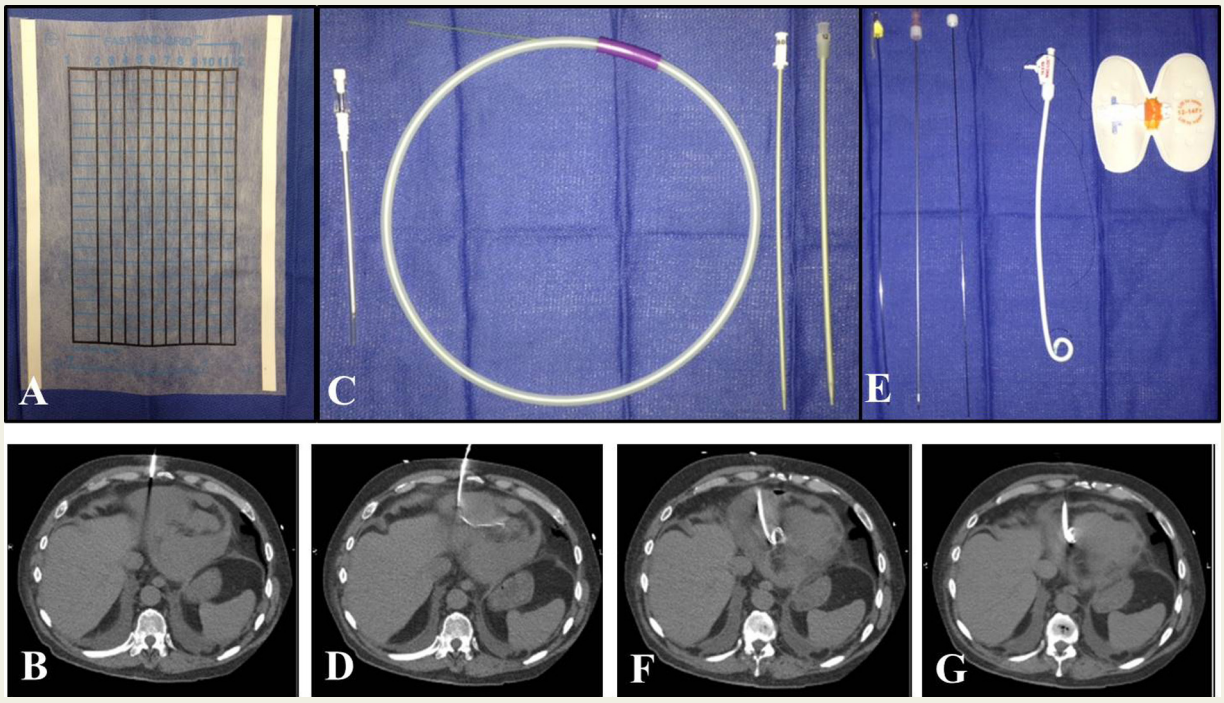

Figure 1 Illustration of CT-guided pericardiocentesis technique using Case #1. Radio opaque Fast Find Grid (A). Use of local anaesthetic needle to determine pericardial entry (B). Insertion of Yeuh needle with advancement of guidewire and serial dilation (C-D). Deployment of pigtail catheter (E-G).

these reasons, we believe that cardiologists and surgeons should be able to independently perform CTP as an alternative strategy for treating pericardial effusions in high risk patients.

Methods

A disposable fast find grid, comprised of 1 cm^2 radiopaque lines that guide needle entry, was placed over the left chest and CT scan performed (Figure 1A). This first image helped visualise an ideal approach into the pericardium. Needle entry, angulation, and depth were then approximated. Entry site and four corners of the fast grid were next marked and grid removed. The chest was then prepped and draped in standard sterile fashion and local anaesthetic injected. The injecting needle was then disconnected and used to approximate the entry path with repeat CT imaging (Figure 1B). Once the entry path was determined, the injecting needle was removed and replaced with an 18-gauge Yeuh needle. Imaging was repeated as this needle was advanced into the pericardium. Once the appropriate depth was reached, a 0.035″ Amplatz guidewire was advanced through the Yeuh needle into the pericardium (Figure 1C-D). The entry track was serially dilated and a 14-French multiple side-hole and end-hole Dawson-Mueller pigtail catheter inserted (Figure 1E-G). The guidewire and stylet were removed and the pigtail catheter was secured with suture.

Results

Case #1: A 77-year-old morbidly obese male with hypertension, coronary artery disease, and congestive heart failure presented with worsening shortness of breath, oxygen saturations of 70%, and clinical signs of cardiac tamponade. Chest CT demonstrated a large pericardial effusion. Emergent subxyphoid USP was attempted, but was repeatedly unsuccessful due to the patient's morbid obesity, protruding abdomen, and distorted anatomy. CT-guided pericardiocentesis was then chosen over operative pericardial window due to body habitus, posterior location of the pericardial effusion, and presence of pericardial adhesions. Approximately 1150cc of fluid was evacuated with resolution of tamponade physiology.

Case #2: A 67-year-old male presented with acute shortness of breath and heart failure symptoms refractory to diuresis. Past medical history included infiltrative cardiac amyloidosis, hypertrophic cardiomyopathy, QT prolongation, atrial fibrillation, bicuspid aortic valve, and aortic root dilation. Admit labs were insignificant but chest CT demonstrated cardiomegaly, a moderate pericardial effusion, and subpleural interstitial septal thickening (Figure 2A). Due to