Pericardiocentesis Can Be Nasty. Accidents Do Occur While "Rail-roading" Sheaths and Pigtails!

Abstract

Pericardiocentesis is a challenging procedure and complications may vary depending on the patient-specific risk factors and procedural indications. Cardiac chamber perforation and the subsequent insertion of pigtail catheter into the main pulmonary artery are an unreported mishap during attempted pericardiocentesis. This potentially life-threatening complication is completely preventable by identification of high-risk patients and appropriate use of available technologies. Adjunctive imaging decreases procedural risk for difficult-to-access pericardial fluid collections and must be used to prevent inadvertent morbidities.

Keywords: *Cardiac imaging techniques, cardiac rupture, complications, pericardial effusion, pericardiocentesis*

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Introduction

Pericardiocentesis is a challenging procedure, not uncommonly associated with iatrogenic complications. Pneumothorax, epicardial coronary vasculature injury, injury to intracardiac structures and valves, chamber puncture and great vessel injury or perforation, air embolism, and puncture of the peritoneal cavity or abdominal viscera have all been reported at the hands of unwary clinicians.[1] In the case being presented, a planned therapeutic pericardiocentesis ended up with a pigtail inadvertently threaded into the main pulmonary artery. Transesophageal echocardiography showed introducer sheath puncturing the right ventricular (RV) free wall and the pig tail catheter rail roaded into the main pulmonary artery, both of which had to be surgically extracted after sternotomy. Risk factors that predict difficulty in performing pericardiocentesis must be readily identified and use of adjunctive imaging is sine qua non for patient safety during the procedure. Morbidity associated with such dreaded complications is completely avoidable with an insight into the possibility of their occurrence and appropriate use of the available technology.

Case Report

A 33-year-old woman presented with complaints of shortness of breath, fever, and weight loss for 6 months. On the basis of echocardiography, a diagnosis of ostium primum atrial septal defect (OPASD) with effusive chronic constrictive pericarditis was made. Suspecting tubercular etiology, the patient was started on antitubercular therapy while being worked up for OPASD closure surgery. In the interim, she presented to the emergency department with severe shortness of breath (NYHA class 4) and hypotension. Urgent bedside echocardiography revealed that the effusive constrictive pericardial collection had progressively increased and was beginning to cause symptoms at rest which were unresponsive to medical therapy for almost 3 consecutive months. Therapeutic pericardiocentesis was planned with an aim to relieve the patient of his immediate symptoms and to continue with antituberculous treatment conservatively in the intensive phase to treat the active tubercular disease phase first. A 4.5 French sheath and a J-tipped pigtail catheter were inserted under fluoroscopic guidance in the cardiac catheterization laboratory under monitored anesthesia care. Malposition of the drainage catheter was suspected immediately when the aspirate revealed frank blood. Realizing a cardiac puncture, the sheath-pigtail assembly was secured to the skin with sutures and computed tomography (CT) angiography was urgently done which showed the pigtail catheter

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piercing the RV free wall and coursing through RV outflow tract and main pulmonary artery [Figure 1].

The patient was subsequently planned for emergency surgical removal of the sheath and pigtail catheter. Intraoperative transesophageal echocardiography (TEE) in the midesophageal RV inflow-outflow view showed the entry point of the sheath and pigtail assembly into the RV anterior free wall [Video 1]. The pigtail catheter was seen to course toward the RV outflow tract and the main pulmonary artery [Figure 2]. The tricuspid valve above showed moderate tricuspid regurgitation with a RV systolic pressure (RVSP) of 41 mm Hg. The OPASD shunted blood from left to right side [Video 2]. After sternotomy, the percutaneously inserted sheath and pigtail catheter were seen entering the RV anterior free wall after piercing the thickened pericardium [Figure 3].

The thickened pericardium was gradually dissected off its underlying attachments and excised. After having accomplished systemic heparinization and aortobicaval cannulation, felted stay sutures were obtained around the sheath entry point into the RV and the sheath pigtail assembly was carefully pulled out under TEE guidance, to ensure no further damage has been brought about by it. The cardiac puncture site was directly repaired, and atrial septal defect was subsequently closed on cardiopulmonary bypass. Post bypass TEE revealed mild tricuspid regurgitation with a RVSP of 36 mm Hg. The patient was weaned of cardiopulmonary bypass on dobutamine infusion at 5 mcg/kg/min as mild RV dysfunction was noted, extubated after 4 hours of mechanical ventilation, and discharged on 5th postoperative day. Histopathological evaluation of the pericardial specimen sent for evaluation confirmed tubercular etiology.

Discussion

Performing a safe pericardiocentesis is an onerous task and not uncommonly associated with major complications that include coronary artery and coronary vein injury, cardiac chamber perforation, great vessel injury, lung injury, reflex hypotension, and malignant arrhythmias. Other major devastating complications that have been reported include pulmonary valve injury, pulmonary artery perforation, and cardiac chamber pseudoaneurysm.[2] In our case, the sheath was misplaced by the unwary clinician into the RV due to strong pericardial adhesions that caused right-side rotation of the heart with an altered position of the cardiac cavity. This was then followed by railroading of the pigtail catheter into the main pulmonary artery across the pulmonary valve. Iatrogenic insertion of pigtail catheter into the main pulmonary artery during pericardiocentesis represents a very rare, but severe and potentially life-threatening complication, which is readily avoidable provided that due efforts are made to ensure patient safety.

Other scenarios in which difficulty in obtaining access to the pericardial space should be anticipated include

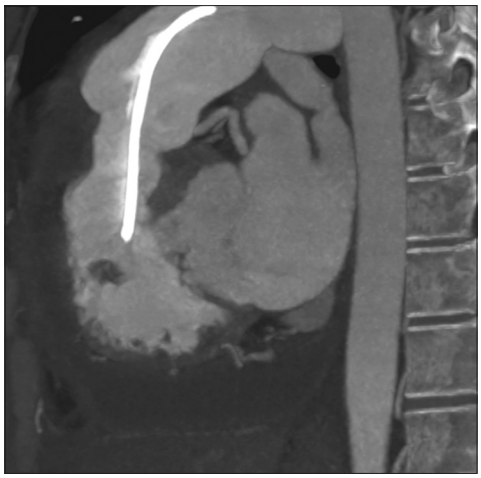

Figure 1: Computed tomography sagittal oblique reformatted image showing the pigtail catheter coursing through right ventricular outflow tract (black arrow) and main pulmonary artery (white arrow)

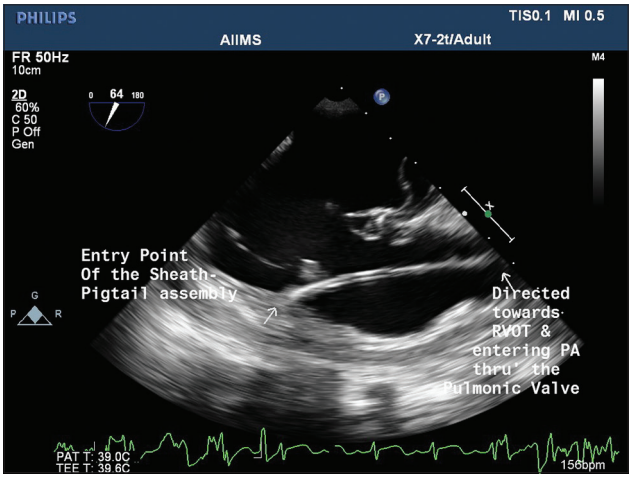

Figure 2: Midesophageal right ventricular inflow-outflow view showing the entry point of the sheath and pigtail assembly into the right ventricle and the coursing of the pigtail catheter toward the right ventricular outflow tract

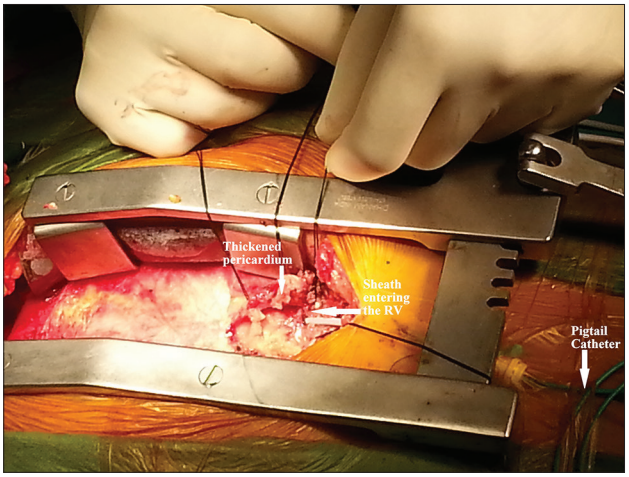

Figure 3: Percutaneously inserted sheath and pigtail catheter seen entering the right ventricular anterior free wall after piercing the thickened pericardium

patients with previous sternotomy/cardiac surgery, obesity, constrictive effusive collections, loculated pericardial collections, and cardiac chamber enlargement/dilatation. For optimal outcomes, the procedure should be performed under extreme caution by an experienced clinician at a facility well equipped for real-time radiographic, echocardiographic, and hemodynamic monitoring and to diminish the perils associated with pericardiocentesis, Continuous recording of cardiac rhythm and systemic blood pressure are bare minimum requirements. Addition of invasive hemodynamics and measurement of pericardial pressures are useful for the diagnosis in questionable cases.

Fluoroscopically guided pericardiocentesis, the most popularly used method by intervention cardiologists, uses ionizing radiation and cannot differentiate pericardial effusion from a cardiac mass which may be myocardial or pericardial in origin. Cardiac perforations have also been reported to occur despite the use of fluoroscopic guidance as also occurred in our case.[3] The use of echocardiography has gone a long way in minimizing the risk associated with pericardiocentesis. Echocardiography not only plays a pivotal role in diagnosis, quantification, and distribution of the pericardial effusion but also aids in real-time localization of needle tip, guidewire, and drainage catheter during the procedure, thereby increasing the safety of the procedure and bringing out an improved outcome.[4] Contrast echocardiography has gone a step further in immediate identification of the origin of blood-tinged fluid aspirated which could be pericardial, pleural, or from cardiac cavities before the pigtail catheter is inserted and opened for drainage. Real-time echocardiographic puncture monitoring using a finer needle must be used to avoid these iatrogenic complications once high-risk patients have been identified.

CT-directed pericardiocentesis is an alternative means of draining pericardial effusions trapped in compartments and overcomes many of the limitations associated with echocardiography, especially in postoperative patients with poor echocardiography window.[5] This technique has brought down the complication rate to a nadir even in difficult to reach effusions.

With blind pericardiocentesis now having become an archaic procedure, appropriate use of all the available technologies must be engaged to guide pericardiocentesis and enhance the safety of the procedure. This can drastically decrease the incidence of catheter-related perforation/tamponade and other unforeseen challenges that await during the procedure and reduce the morbidity/mortality associated with it.

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Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form the patient(s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

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Conflicts of interest

There are no conflicts of interest.

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