http://elynsgroup.com

http://dx.doi.org/10.19104/jemi.2015.109

Case Report | Journal of Emergency Medicine and Intensive Care | Open Access

Bedside Echocardiographically Guided Pericardiocentesis for Cardiac Tamponade after Coronary Artery Injury Secondary to Percutaneous Coronary Intervention: A Descriptive Technique of a Necessary Skill

Graham Brant-Zawadzki*, Marina Trilesskaya and Arun Nagdev

Department of Emergency Medicine, Alameda Health System, Highland Hospital, 1411 East 39th Street, Oakland, California 94602, USA

Received Date: January 29, 2016, **Accepted Date:** March 09, 2016, **Published Date:** March 18, 2016

***Corresponding author:** Graham Brant-Zawadzki, Department of Emergency Medicine, Highland Hospital, Alameda Health System, 1411 East 39th Street, Oakland, California 94602, USA, Tel: 510-437-4564; Fax: 510-437-8322; E-mail: gzawadzki@alamedahealthsystem.org*

Abstract

Given the over 2.64 million total percutaneous coronary interventions (PCI) performed in the United States in 2007 alone, and that acute cardiac tamponade is one of the most common complications of such percutaneous coronary intervention presenting with hypotension, clinicians should be familiar with diagnosing impending pericardial tamponade and a simple and safe bedside technique for drainage. We describe a technique available to even novice sonographers for echocardiographically guided rescue pericardiocentesis in the setting of acute tamponade. This case demonstrates the efficacy and safety of this technique for pericardial drainage with reduced complication risk as compared to a landmark-based approach. One of two landmark-based approaches may be utilized for emergency pericardiocentesis. In the subxiphoid approach the practitioner introduces the needle between the xiphisternum and left costal margin at a 30-45° angle aiming at the left shoulder. In the parasternal approach, the needle is introduced at the left fifth intercostal space superior to the inferior rib and 1cm lateral to the sternum [1]. A case of a 52-year-old male was brought to the Emergency Department after a witnessed cardiac arrest. He underwent cardiac catheterization and percutaneous coronary stent implantation. Thirty minutes after stenting, the patient developed signs of cardiac tamponade, and first year resident performed point-of-care echocardiogram confirmed a pericardial effusion. An in-plane ultrasound-guided pericardiocentesis was successfully performed by the junior house-staff under direct attending supervision. Serial echocardiograms demonstrated preserved left ventricular systolic function without new effusion. The patient remained hemodynamically stable for 48 hours following the procedure at which time the pericardial catheter was removed. Ultrasound image guided pericardiocentesis is a rapid and safe technique for pericardial drainage with reduced complication risk as compared to a landmark-based approach.

Keywords: Pericardiocentesis; Echocardiography; Ultrasound Guided; Tamponade; Pericardial Effusion; Percutaneous Coronary Intervention

Introduction

In 2007, over one million cardiac catheterizations and 2.64 million total percutaneous coronary interventions (PCI) were performed in the United States [2]. Immediate life threatening complications that manifest as post-procedural hypotension are rare and may include hematoma, retroperitoneal hemorrhage, stent thrombosis and cardiac tamponade. Acute cardiac tamponade is one of the most common hypotensive complications and, though the total rate over all percutaneous coronary interventions is difficult to assess, data suggest tamponade may be seen in up to 0.6% of all PCI [3,4]. Echocardiographically guided pericardiocentesis (EGP) has been shown to be both safe and effective therapy for emergent rescue in the setting of tamponade [5]. Emergency echosonographers can both identify and successfully perform pericardiocentesis at the bedside safely with an in-plane technique, which allows for needle visualization [6-8].

Clinicians caring for patients after cardiac catheterization and coronary interventions should be aware of the most common post-procedural causes of hypotension and be facile in point-of-care (POC) echocardiographic evaluation of the unstable patient. Although coagulopathy is considered a relative contraindication to pericardiocentesis, pre-procedure anticoagulation reversal may not be feasible due to hemodynamic instability, and a simplified method that allows for needle guidance into the pericardial space should be a part of the armamentarium of the critical care physician. We present a case of successful bedside rescue pericardiocentesis after cardiac tamponade secondary to coronary guide wire arterial perforation in an anticoagulated patient. If not already a mainstay of critical care training, this POC echocardiograph guided evaluation and intervention should be incorporated into the education of any practitioners responsible for the care of post-PCI patients.

Case

A 52-year-old man was brought into the Emergency Department (ED) after experiencing a witnessed cardiac arrest. In the field, bystander initiated cardiopulmonary resuscitation (CPR) within ten minutes of the event. Emergency medical service personnel were contacted and on assessment identified ventricular fibrillation and defibrillated the patient, after which he developed an asystolic rhythm. Standard Advanced Cardiac Life Support (ACLS) protocol was continued with king laryngeal tube intubation, and administration of epinephrine and amiodarone resulting in return of spontaneous circulation (ROSC) in the field. After arrival in the ED post-ROSC electrocardiogram (ECG) was notable for inferior ST-elevations with reciprocal changes in the anterior precordial leads (Figure 1). Hypothermia protocol was initiated and the patient was taken to cardiac catheterization laboratory where 100% occlusion of the obtuse marginal artery was noted, and percutaneous coronary intervention with stent implantation

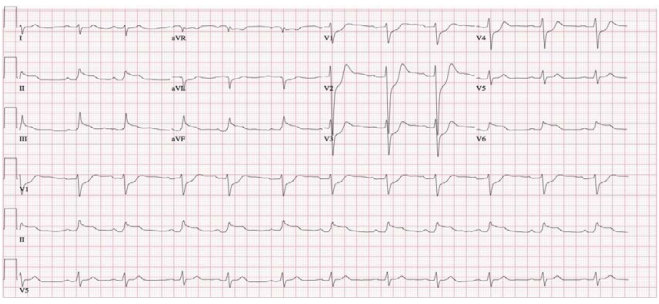

Figure 1: The patient's Emergency Department ECG, Pre-catheterizations. An ECG during the hypotensive event was not obtained given immediate identification of pericardial effusion on bedside ultrasound in the setting of tamponade physiology.

was performed. Approximately thirty minutes after arrival to the intensive care unit (ICU), the patient developed hypotension (72/51 mmHg) and tachycardia, refractory to fluid resuscitation and dopamine. Cardiac tamponade was suspected, and point-of-care (POC) echocardiogram was performed by a junior resident. A small to moderate pericardial effusion was noted lateral to the left ventricle and was confirmed by the attending interventional cardiologist (Figure 2). The effusion was thought to be secondary to wire perforation in the setting of recent anticoagulation with bivalirudin, compounded by and ongoing therapeutic hypothermia.

Given the patient's hemodynamic compromise refractory to medical therapy, and another active case barring return to catheterization lab, an in-plane ultrasound-guided pericardiocentesis was performed by the house-staff under direct attending supervision [8]. A low frequency curvilinear transducer (5-2MHz SonoSite TM M-Turbo, Bothell, WA) was used for the pericardial drainage instead of a more commonly used phased-array transducer in order to better visualize the needle as it entered the pericardial space. Our preference is to use the curvilinear transducer, but either probe can be used as long as the clinician is able to clearly visualize the needle tip as it enters the pericardial space. Visualization of the effusion in the pericardial sac was accomplished in a view that best delineated the pericardial effusion (modified apical view from the anterior chest), and insertion of an over-wire catheter into the pericardial space via Seldinger technique under in-plane ultrasound guidance. Once catheter placement was confirmed on ultrasound (Figure 3), 350 ml of frank blood were immediately evacuated from the pericardial space followed by resolution of tachycardia and a noted rise in mean arterial blood pressure (MAP) from 58 mmHg to 101 mmHg. Given the patient's hypercoagulable state in the setting of both therapeutic hypothermia and administration of direct thrombin inhibitor peri-catheterization, frank blood continued to fill the pericardial space following initial aspiration and while awaiting fresh frozen plasma (FFP) to correct the coagulopathy. Over the course of one hour, the catheter drained an additional 500 ml of frank blood from the pericardial space. In the setting of ongoing bleeding, the patient was taken for a repeat coronary angiogram. This showed no obvious contrast extravasation, dissection or perforation and no further intervention was performed. It was felt that the patient's pericardial effusion was the result of a micro-perforation, which failed to resolve spontaneously due to significant coagulopathy. Hypothermia protocol was discontinued, the pericardial drain was maintained overnight, and serial POC echocardiographic evaluations were performed while the patient

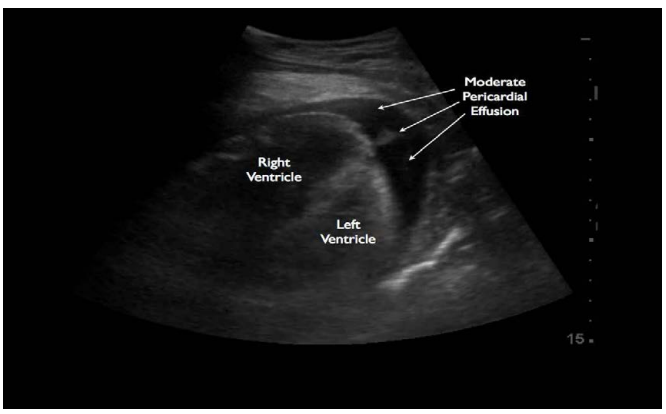

Figure 2: Modified four chamber view with clear visualization of the small to moderate sized pericardial effusion noted between the apex of the right and left ventricles

Figure 3: Model demonstration of in-plane, parasternal approach. Under real-time ultrasound guidance, the needle is advanced at a 45° angle into the pericardial space. Following aspiration of blood, a guide wire is placed into the pericardial space, and a drainage catheter may be advanced along the wire. Ultrasound visualization allows for direct confirmation of entry into the pericardial space/effusion.

was resuscitated with a total of four units of packed red blood cells and four units of fresh frozen plasma. A formal echocardiogram the following morning demonstrated minimal effusion and preserved left ventricular systolic function. The patient remained hemodynamically stable on the ventilator for 48 hrs following the procedure at which time the pericardial catheter was removed. Despite clinical stabilization, the patient's neurologic status failed to improve beyond basic brainstem function. In accordance with the family's understanding of the patient's wishes, supportive care was withdrawn and the patient expired one week after presentation.

Conclusion

Acute cardiac tamponade is one of the most common complications of percutaneous coronary intervention that may present with hypotension. The number of coronary interventions and other procedures with a risk of inadvertent guidewire perforation of the coronary artery or myocardium such as pacemaker insertions, pulmonary angiograms, and even central line placement is high in the United States [1]. Clinicians must be familiar with diagnosing impending pericardial tamponade, and a simple and safe bedside technique for drainage. In the hypotensive, post-cardiac procedure patient, bedside echocardiography should be a first-line screening tool to be employed alongside checking catheter insertion site for hematoma and 12-lead ECG and should be incorporated into formal curriculum for any critical care provider. In the case of tamponade, echocardiographically guided rescue pericardiocentesis is an effective and safe technique for pericardial drainage with reduced complication risk as compared to a landmark-based approach [4]. We recommend that any provider caring for post-cardiac intervention patients be facile with the echocardiographic diagnosis of pericardial effusion and a simple ultrasound-guided approach for drainage.

References

1. Gluer R, Murdoch D, Haqqani HM, Scalia GM, Walters DL. Pericardiocentesis - How to do it. Heart Lung Circ. 2015;24(6):621-5. doi: 10.1016/j.hlc.2014.11.009.

2. Hall MJ, DeFrances CJ, Williams SN, Golosinskiy A, Schwartzman A.

National Hospital Discharge Survey: 2007 Summary. Natl Health Stat Report. 2010;(29):1-20, 24.

3. Tsang TS, Freeman WK, Barnes ME, Reeder GS, Packer DL, Seward JB. Rescue echocardiographically guided pericardiocentesis for cardiac perforation complicating catheter-based procedures. The Mayo Clinic experience. J Am Coll Cardiol. 1998;32(5):1345-50.

4. Tavakol M, Ashraf S, Brener SJ. Risks and Complications of Coronary Angiography: A Comprehensive Review. Glob J Health Sci. 2012;4(1):65-93. doi: 10.5539/gjhs.v4n1p65.

5. Tsang TS, Enriquez-Sarano M, Freeman WK, Barnes ME, Sinak LJ, Gersh BJ, et al. Consecutive 1127 Therapeutic Echocardiographically Guided Pericardiocenteses: Clinical Profile, Practice Patterns, and Outcomes Spanning 21 years. Mayo Clin Proc. 2002;77(5):429-36.

6. Mandavia DP, Hoffner RJ, Mahaney K, Henderson SO. Bedside Echocardiography by Emergency Physicians. Ann Emerg Med. 2001;38(4):377-82.

7. Nagdev A, Stone MB. Point-of-care ultrasound evaluation of pericardial effusions: does this patient have cardiac tamponade? Resuscitation. 2011;82(6):671-3. doi: 10.1016/j.resuscitation.2011.02.004.

8. Nagdev A, Mantuani D. A novel in-plane technique for ultrasound guided pericardiocentesis. American Am J Emerg Med. 2013;31(9):1424.e5-9. doi: 10.1016/j.ajem.2013.05.021.

***Corresponding author:** Graham Brant-Zawadzki, Department of Emergency Medicine, Highland Hospital, Alameda Health System, 1411 East 39th Street, Oakland, California 94602, USA, Tel: 510-437-4564; Fax: 510-437-8322; E-mail: gzawadzki@alamedahealthsystem.org

Received Date: January 29, 2016, **Accepted Date:** March 09, 2016, **Published Date:** March 18, 2016

Citation: Brant-Zawadzki G, Trilesskaya M, Nagdev A (2016) Bedside Echocardiographically Guided Pericardiocentesis for Cardiac Tamponade after Coronary Artery Injury Secondary to Percutaneous Coronary Intervention: A Descriptive Technique of a Necessary Skill. J Eme Med Int Care 2(1): 109 http://dx.doi.org/10.19104/jemi.2015.109.