Original Article

Clinical and historical features of emergency department patients with pericardial effusions

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BACKGROUND: Diagnosing pericardial effusion is critical for optimal patient care. Typically, clinicians use physical examination findings and historical features suggesting pericardial effusion to determine which patients require echocardiography. The diagnostic characteristics of these tools are not well described. The objective of this study is to determine the prevalence of historical features and sensitivity of clinical signs to inform clinicians when to proceed with echocardiogram.

METHODS: A retrospective review of point-of-care echocardiograms performed over a two and a half year period in two emergency departments were reviewed for the presence of a pericardial effusion. Patient charts were reviewed and abstracted for presenting symptoms, historical features and clinical findings. The prevalence of presenting symptoms and historical features and the sensitivity of classic physical examination findings associated with pericardial effusion and tamponade were determined.

RESULTS: One hundred and fifty-three patients with pericardial effusion were identified. Of these patients, the most common presenting complaint was chest pain and shortness of breath. Patients had no historical features that would suggest pericardial effusion in 37.5% of cases. None of the patients with pericardial effusion or pericardial tamponade had all of the elements of Beck's triad. The sensitivity of Beck's triad was found to be 0 (0%–19.4%). The sensitivity for one finding of Beck's triad to diagnose pericardial tamponade was 50% (28.0%–72.0%).

CONCLUSION: History and physical examination findings perform poorly as tests for the diagnosis of pericardial effusion or pericardial tamponade. Clinicians must liberally evaluate patients suspected of having a pericardial effusion with echocardiography.

KEY WORDS: Pericardial effusion; Ultrasound; Echocardiography; Cardiac tamponade; Physical examination

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INTRODUCTION

Emergency department diagnosis of pericardial effusion is crucial to proper patient care as the finding of pericardial effusion may dramatically alter patient care. Patients may need appropriate diagnostics to determine an underlying condition, follow-up to ensure resolution and the finding may preclude further work-up which would be necessary to determine the cause of a patient's symptoms. If left untreated, early pericardial tamponade can lead to worsening hemodynamic instability and

possible cardiac arrest. With earlier detection, the necessary interventions, such as pericardiocentesis or consultations with cardiology or cardiothoracic surgery, can be implemented. Therefore, accurate and prompt diagnosis is key.

Often patients with pericardial effusions have underlying medical conditions, perhaps several (i.e. renal failure, congestive heart failure, cancer).^[1,2] In developed nations, most pericardial effusions are idiopathic, though in developing countries tuberculous disease

predominates.^[3,4] An underlying disease contributing to the pericardial effusion is present in most patients with pericardial effusion.^[4] These co-morbidities may predispose the patient to pericardial effusion and alert the treating physician to the possibility of a pericardial effusion. Conversely, these conditions may also confuse the clinical picture. These underlying conditions may be erroneously assumed to be the underlying cause of a patient's hemodynamic instability.^[5] This may lead to delays in diagnosis of the pericardial effusion.

The presence of a pericardial effusion may be suggested on history and physical examination. Classic teaching is that patients with pericardial effusion will have muffled heart sounds and that Beck's triad (hypotension, distended neck veins and muffled heart sounds) will be present in patients with pericardial tamponade. The specificity and prevalence of these clinical features, either singly or in combination with each other, is unknown. Although aspects of the history and physical exam may suggest the presence of a pericardial effusion, these signs and symptoms may be unreliable diagnostic tools.^[5-7] To our knowledge, no prior research has determined the diagnostic accuracy of physical examination findings or historical features that would indicate the presence of a pericardial effusion.

Transthoracic echocardiography is recommended in patients with suspected pericardial effusion for definitive diagnosis. Echocardiography is currently the most often used imaging modality to detect pericardial effusions, though they can be detected with computed tomography or magnetic resonance imaging as well. Benefits of ultrasound as an imaging modality include its availability, rapidity, paucity of contraindications, lack of ionizing radiation, low cost and excellent sensitivity for the detection of pericardial effusion. In most emergency department settings, this can be done easily using point-of-care (POC) ultrasound. As POC ultrasound has become increasing ubiquitous in emergency departments and emergency care, the ability to screen for pericardial effusion has become easier. Emergency physicians have been shown to have a high level of accuracy in making the diagnosis, decreasing the need for the time or cost of comprehensive or consultative echocardiography.^[8]

A key step in the process of making the correct diagnosis is determining which patients require emergent bedside echocardiogram. The indications for an emergent echocardiogram based on clinical findings are not clearly defined. The past medical history may suggest a pericardial effusion and the physical examination may as well, but it is unclear which historical or examination

features are found most commonly in patients with pericardial effusions or if these can be relied upon to screen patients. Therefore, selecting the correct patients to screen for pericardial effusion may be the greatest challenge to making the diagnosis.

The purpose of our study was to investigate the presenting historical and clinical features of emergency department patients with pericardial effusion. Our aim was to determine the prevalence of various historical features and sensitivity of clinical signs to inform clinicians when to proceed with echocardiogram.

METHODS

This study was conducted at two urban academic emergency departments with a total of three emergency medicine residencies (two categorical emergency medicine residencies and one pediatric/emergency medicine residency) and one emergency ultrasound fellowship program. This study was reviewed by the institutional IRB and approved.

A retrospective review of all POC ultrasound examinations archived in our online system over a two and a half year period was performed. Every POC ultrasound examination recorded in these two departments is automatically archived in an online archival system (Qpath, Telexy Healthcare, Everett, WA). Every ultrasound examination in the two departments was screened for cardiac images, including those recorded as part of a focused assessment with sonography in trauma (FAST) examination. The identified cardiac images were reviewed by an expert sonologist for adequacy of images to make an emergent diagnosis of pericardial effusion. By definition, adequate images could include only one image if it was felt to be diagnostic in an emergent situation, however, a completely circumferential image of the pericardial space was required for inclusion. An expert sonologist then reviewed these images for the presence or absence of a pericardial effusion. The collection of studies with pericardial effusions was reviewed and patients less than 18 years old and cases in which the patients could not be identified due to a lack of patient identifiers were excluded. Duplicate studies were identified and recorded as duplicates, however all cardiac images recorded during one patient encounter were utilized for image review.

A retrospective chart review was performed on all studies in which pericardial effusion was identified using a standardized data abstraction form for historical

features and physical examination features suggestive of presence of pericardial effusion by three different abstractors. The emergency department visit record, including nursing notes and physician notes were utilized to compile information that physicians would routinely use to determine if a patient may have a pericardial effusion prior to imaging, such as past medical history, vital signs and physical examination features. Final diagnosis of pericardial tamponade was used as the gold standard for diagnosing pericardial tamponade. The remainder of the patient record was searched from the date of visit to one year later for procedure notes and follow-up related to the pericardial effusion. Summary statistics are presented as percentages with 95% confidence intervals (CIs) or medians with interquartile range (IQR). All analyses were performed using Stata version 12.2 (Statacorp, College Station, Texas).

RESULTS

A total of 210 patients with pericardial effusions were identified for an estimated prevalence of 6.4% (95%CI 5.6–7.3). Of these, 153 adult patients with pericardial effusions and available data were identified (Figure 1). Median patient age was 59 years old (IQR 49–71 years) and 48.3% (40.2%–56.6%) were female. Patients with traumatic injuries accounted for 9.8% (5.6%–15.7%) of all patients. Table 1 demonstrates the sizes of the observed effusions.

The frequency of the most prevalent historical

Figure 1. Flow chart of included patients.

features of patients with pericardial effusions was as follows: renal disease [23.2% (16.7%–30.7%)], cancer [16.5% (10.9%–23.3%)], congestive heart failure [15.1% (9.8%–21.8%)]. Sixty two percent (54.6%–70.4%) of patients had historical features that would suggest pericardial effusion (any cancer, congestive heart failure, any renal disease, any known liver disease, any autoimmune disease, any prior pericardial disease, any recent cardiac surgery), leaving 37.3% (29.6%–45.4%) with no historical features that would suggest a pericardial effusion. Of the patients with tamponade, 37.5% (15.2%–64.6%) of patients had no past medical history that would suggest the presence of a pericardial effusion.

The presenting complaints of patients found to have pericardial effusions are presented in Table 2. Tachycardia (defined as a heart rate greater than 100 during the emergency department visit) was present in 59.5% (51.3%–67.3%) of patients and hypotension (defined as systolic blood pressure equal to or less than 90 mmHg or a diastolic blood pressure equal to or less than 60 mmHg at any point during the emergency room visit) was present in 31.4% (24.1%–39.4%) of patients. A total of 20.3% (14.2%–27.5%) of patients had both hypotension and tachycardia. Seven patients presented in cardiac arrest or developed cardiac arrest during their emergency department visit.

Sixteen [10.5% (6.1%–16.4%)] patients were determined to have pericardial tamponade during the concurrent hospital stay. One patient was admitted directly from the emergency department to hospice care. Fifteen [9.8% (5.6%–15.7%)] patients had the pericardial effusion drained during the concurrent hospital stay (12 immediately and three within 5 days of admission). Of these 12 were classified as large, 1 as moderate and 2 as small.

Table 1. Size of effusion in observed cases

Effusion size	Frequency (percent)
Trace	39 (25.49)
Small	65 (42.5)
Moderate	30 (19.6)
Large	19 (12.4)

Table 2. Presenting symptoms of patients with pericardial effusion

Presenting symptoms	Percent frequency (95%CI)
Shortness of breath	62.5 (54.3–70.2)
Chest pain	42.4 (34.4–50.7)
Syncope	15.1 (9.8–21.8)
Altered mental status	11.8 (7.2–18.1)

CI=confidence interval.

Of the patients with pericardial effusion, 7.2% (3.6%–12.5%) had muffled heart sounds. Sensitivity of muffled heart sounds for diagnosing pericardial tamponade was 37.5% (18.5%–61.4%). Of the patients with a pericardial effusion, 5.9% (2.7%–10.9%) of patients had jugular venous distension (JVD). Sensitivity of JVD as a clinical finding in patients with pericardial tamponade was calculated at 12.5% (3.5%–36.0%). No patients with pericardial effusion or pericardial tamponade had all of the elements of Beck's triad, meaning the sensitivity of Beck's triad was 0% (0%–19.4%). The sensitivity for one finding of Beck's triad to diagnose pericardial tamponade was 50% (28.0%–72.0%). The sensitivity of presenting hypotension for detecting an ultimate diagnosis of cardiac tamponade was 37.5% (18.5%–61.4%) while the sensitivity for tachycardia was 68.8% (44.4%–85.8%).

DISCUSSION

This retrospective study illustrates the limitations of clinical criteria in determining the need for an echocardiogram in diagnosing pericardial effusion. In this study, historical features that would suggest a patient has a pericardial effusion were not present in more than one third of patients, making this an unreliable way to determine patients to screen. The sensitivity of the classic physical examination findings is very poor for the diagnosis of pericardial effusion or tamponade. These physical examination features cannot be relied upon for diagnosis. This study demonstrates that there are patients presenting to the emergency department with pericardial effusions that may have no suggestive physical examination findings or historical features, even patients with tamponade as a cause of hemodynamic instability. Because of this clinicians must maintain a very low threshold for evaluating patients presenting with hemodynamic instability, chest pain or shortness of breath for pericardial effusion with sonography.

Prior study has shown that patients with medical pericardial effusion and pericardial tamponade have often been symptomatic for a long period of time prior to diagnosis or drainage.^[9] The nonspecific symptoms that are often present are non-specific, leading to misdiagnosis, failure to diagnosis and delays in diagnosis.^[10] Diagnosing pericardial effusion with echocardiography is considered a basic sonographic skill for an emergency physician.^[11,12] POC ultrasound is now widely available in most emergency departments

and emergency physicians are capable of diagnosing pericardial effusions with great accuracy.^[8] In departments with no POC ultrasound, cardiology consultation and consultant-performed echocardiography could be requested. The institutional and system-wide monetary costs of liberal screening patients for pericardial effusion with consultative echocardiography are steep. The patient care time spent arranging, transporting and performing consultative examinations may take away from other concurrent care. For these reasons, bedside limited echocardiography is preferred.

In the era of widespread use of point-of-care ultrasound and increasing smaller and more portable machines, liberally evaluating patients who present with dyspnea, chest pain, hemodynamic instability or risk factors has become more possible. Portable machines and use of limited echocardiographic protocols makes this more feasible from an efficiency and economic perspective.^[13,14]

Our study is limited by its retrospective nature. The pool of patients who have been studied were selected for echocardiogram based on the concerns of their treating physician, leading to a selection bias. Additionally, many of the patients who had cardiac exams recorded in the database had inadequate images recorded. This study is limited by the quality of images saved in the archive. Although the treating physician may have been able to make a clear diagnosis at the point-of-care, these studies could not be used due to the inability of the reviewer to make a clear diagnosis of effusion. Also, patients who did not have a bedside ultrasound examination performed were not included in the data set.

CONCLUSION

In summary, past medical history is not a good indicator of patients who likely have a pericardial effusion or tamponade. Physical examination findings are poorly predictive of pericardial effusion or tamponade as well. Our study supports the liberal use of bedside ultrasound when evaluating patients with shortness of breath and chest pain.

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Conflicts of interest: None of the authors have financial or other conflicts of interest to report.

Contributors: Stolz L proposed the study and wrote the first draft. All authors read and approved the final version of the paper.

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