Misconceptions and Facts about Pericardial Effusion and Tamponade

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ABSTRACT

Several common misconceptions can make the clinical diagnosis of subacute pericardial tamponade challenging. Widely known physical findings of pericardial tamponade lack sensitivity and specificity. Interpretation of echocardiographic signs requires good understanding of pathophysiology. Over-reliance on echocardiography may result in over-utilization of pericardial drainage procedures. Awareness of these misconceptions with an integrative approach to both clinical and imaging data will help clinicians to assess the hemodynamic impact of pericardial effusion and the need for drainage.

KEYWORDS: Echocardiography; Pericardial effusion; Pericardial tamponade; Pulsus paradoxus

MISCONCEPTION #1: PATIENTS WITH PERICARDIAL TAMponade ARE HYpOTENsIVE

Facts
This statement is true for acute (surgical) pericardial tamponade, for example, a wall perforation during a percutaneous cardiac procedure. However, hypotension is rather uncommon in patients with subacute (medical) tamponade who accumulate pericardial effusion within days to weeks.\(^1\)\(^-\)\(^3\)
To the contrary, many patients with subacute pericardial tamponade are actually hypertensive on admission. In studies of pericardial tamponade, the mean systolic blood pressure ranged from 127 mm Hg to 144 mm Hg.\(^3\)\(^,\)\(^4\) According to a recent review, hypertensive tamponade is seen in 27% to 43% of patients.\(^4\) Tamponade and hypertension are more likely to be associated with advanced renal disease and pre-existing hypertension and less likely with systemic malignancy.\(^4\) hypertensive pericardial tamponade probably results from activation of the sympathetic nervous system and high levels of circulating catecholamines in response to hemodynamic stress.\(^6\) Systolic blood pressure commonly decreases in these patients after pericardial effusion drainage, and treating the hypertensive response without draining the effusion can be dangerous.\(^4\)\(^,\)\(^6\)

MISCONCEPTION #2: PERICARDIAL TAMponade IS A CLINICAL DIAGNOSIS

Facts
Although it is often taught that pericardial tamponade is a “clinical diagnosis,” the existing evidence suggests that it is a difficult diagnosis to make on mere clinical grounds. Dyspnea is the most common symptom of subacute pericardial tamponade, but it is very nonspecific.\(^1\) Other clinical findings of pericardial tamponade such as tachycardia, jugular venous distention, pulsus paradoxus, and diminished heart sounds lack both sensitivity and specificity.\(^1\) Tachycardia is common in hospitalized patients for many reasons and it could be blunted by medications such as beta-blockers. In a systematic review, the jugular venous distention had a pooled sensitivity of 76%.\(^1\) Assessment of jugular venous distention is limited by the experience of the observer; it could be difficult in some patients, even for experienced clinicians.\(^7\)\(^,\)\(^8\) Besides, jugular venous distention may be associated with other etiologies such as pulmonary hypertension and congestive heart failure.
pulsus paradoxus is considered to be the cornerstone of the clinical diagnosis of pericardial tamponade, a wide variation in the incidence of pulsus paradoxus has been reported in these patients, ranging from 12% to 75%.9 According to one study, approximately 20% of tamponade patients had “low-pressure” cardiac tamponade defined as low intrapericardial pressure and low postdrainage right atrial pressure.10 In “low-pressure” tamponade patients, the incidence of jugular venous distention was 22% and pulsus paradoxus was reported in only 7% of patients.10

MISCONCEPTION #3: PULSUS PARADOXUS DENOTES A PARADOXICAL DECREASE IN BLOOD PRESSURE WITH INSPIRATION

Facts
Pulsus paradoxus (the term introduced by Kussmaul in 1878)11 is not a “paradoxical” phenomenon but an exaggeration of the physiologic decrease in systolic arterial pressure with inspiration. Under normal conditions, the decrease in blood pressure is < 10 mm Hg, and it is explained by phasic variation in the filling of the right- and left-sided cardiac chambers related to intrathoracic pressure changes with respiration. With tamponade, the accumulating pericardial effusion restricts cardiac filling and makes the respiratory variation in the right and left ventricular filling more pronounced and independent.12 Of note, pulsus paradoxus is measured by manual sphygmomanometer as the difference between intermittent and persistent Korotkoff sounds during normal respiration, not with deep breathing.13 Besides limited sensitivity for pericardial tamponade, pulsus paradoxus is not very specific. A myriad of conditions have been reported to be associated with pulsus paradoxus; a short list includes asthma, right ventricular infarction, severe hypovolemia, constrictive pericarditis, restrictive cardiomyopathy, pneumothorax, chronic obstructive lung disease, and pulmonary embolism. Some of these conditions also can cause jugular venous distention and tachycardia, common associated findings of pericardial tamponade.

MISCONCEPTION #4: THE ECHOCARDIOGRAM IS VIRTUALLY DIAGNOSTIC FOR CARDIAC TAMPOANDE

Facts
Echocardiogram allows for diagnosing the presence of effusion, reporting the size of the effusion, and assessing its hemodynamic significance. Chamber collapse (usually right atrium and right ventricle) documented by echocardiography indicates that the intrapericardial pressure transiently exceeds intracardiac pressure.14 Right ventricular collapse is more specific but less sensitive for pericardial tamponade compared with right atrial collapse.14 Although theoretically a very attractive concept, the interpretation should be made with caution. Transient buckling of the right atrium is commonly seen in patients with pericardial effusion and it is not specific.15 A more sustained collapse of the right atrium lasting at least one third of the cardiac cycle appears to be more specific.15 More importantly, a study by Merce et al showed that 34% of patients with pericardial effusion but without clinical features of pericardial tamponade have at least one chamber collapse on echocardiography.16 Therefore, in patients with pericardial effusion who have chamber collapse, one should carefully document respiratory flow variation across valves as a sign of ventricular interdependence. Moreover, inferior vena cava size and collapsibility should be documented as a sign of increased right-sided filling pressures. These echocardiographic signs, when present, increase the specificity of diagnosis.17 In contrast, there is a list of conditions that decrease the accuracy of echocardiographic assessment such as elevated end-diastolic pressures, atrial septal defects, etc.13 Finally, the size of pericardial effusion seems to be an important but frequently underappreciated part of the echocardiographic assessment. In one study of hospitalized patients with pericardial effusion, the size of the effusion was the only independent predictor of adverse in-hospital outcomes in a multivariate model, but not chamber collapse or inferior vena cava plethora.18

The diagnosis may be particularly difficult in patients with pulmonary hypertension and right ventricular failure because they commonly accumulate pericardial effusion.19 Pericardial effusion in these patients is a marker of adverse outcomes.20,21 Common clinical findings of pericardial tamponade such as tachycardia and jugular venous distention may not be helpful in differential diagnosis for shortness of breath and progressive right-sided heart failure. Collapse of the left-sided cardiac chambers has been described as an important clue to the presence of cardiac tamponade in these settings.22,23 Conversely, the typical echocardiographic findings of tamponade such as right atrial and ventricular collapse can be masked by elevated right-sided filling pressures,12 and a poor outcome has been reported with routine draining of pericardial effusion in these patients.24

CLINICAL SIGNIFICANCE

- Subacute pericardial tamponade is a difficult diagnosis to make on mere clinical grounds because widely known signs of pericardial tamponade lack sensitivity and specificity.
- More than one third of patients with pericardial effusion without clinical features of pericardial tamponade have at least one chamber collapse on echocardiography.
- Integrative approach with careful consideration of both clinical and imaging data can help to assess the hemodynamic impact of the pericardial effusion and the need for drainage.
**MISCONCEPTION #5: THIS PERICARDIAL EFFUSION IS NOT HEMODYNAMICALLY SIGNIFICANT**

**Facts**

Pericardial tamponade gives rise to a continuum of hemodynamic derangements and is not an all-or-none phenomenon. The study by Reddy et al.26 included a complete hemodynamic assessment of patients with pericardial effusion undergoing diagnostic or therapeutic pericardiocentesis. The investigators defined 3 groups of patients based on hemodynamic findings before the drainage: intrapericardial pressure was less than right atrial and pulmonary arterial wedge pressures; intrapericardial pressure was equilibrated with right atrial but not pulmonary arterial wedge pressures; and intrapericardial pressure was equilibrated with right atrial and pulmonary arterial wedge pressures. Logically, the improvement in hemodynamics was greatest in patients in group 3, but even patients in group 1 had a significant hemodynamic improvement after pericardiocentesis such as decrease in the right atrial pressure and pulmonary arterial wedge pressure. This important study spanning 14 years of clinical experience proved that even pericardial effusion without pressure equilibration effect has significant hemodynamic consequences and that therefore, pericardial tamponade represents a spectrum of hemodynamic abnormalities (Figure 1). At the same time, routine drainage of pericardial effusion, even a large effusion, may not be indicated because many patients can be successfully managed conservatively and the diagnostic yield of routine pericardiocentesis is low.16

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**MISCONCEPTION #6: ALL PATIENTS WITH PERICARDIAL TAMPOONADE SHOULD BE STABILIZED INITIALLY WITH INTRAVENOUS FLUIDS**

**Facts**

In a hemodynamic study by Sagrista-Sauleda et al.27 49 patients with nonacute pericardial tamponade were given 500 mL of intravenous normal saline before pericardiocentesis. Increase in cardiac index > 10% from baseline was observed in 47% of patients. Several important findings from this elegant study should be kept in mind when applying the study results to patient care. The improvement in cardiac index was modest, and only patients with systolic blood pressure < 100 mm Hg got the benefit. Actually, 31% of patients experienced decrease in the cardiac output as the result of volume expansion. Intravenous saline infusion also consistently caused a significant increase in intra-pericardial pressure, right atrial pressure, and left ventricular end-diastolic pressure. Although no adverse events were reported in the study, it is reasonable to assume that high-volume fluid resuscitation of these patients may potentially cause worsening of symptoms and even give rise to pulmonary edema.

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**CONCLUSION**

The diagnosis of subacute pericardial tamponade can be challenging because most patients are not hypotensive and...
can actually be hypertensive. An integrative approach that includes careful consideration of both clinical and imaging data helps clinicians to assess the hemodynamic impact of the pericardial effusion and the need for drainage (Table 1).^28,29

References


