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Case Study

Early Pericardiocentesis for Pericardial Effusion Post-Thrombolysis Using Narrow Blood Pressure Shock Index as a Diagnostic Indicator

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Abstract

Emergency departments manage a wide range of life-threatening conditions that span both surgical and medical domains. Among these, acute cardiac emergencies require immediate and specialized intervention. Cardiac life support is crucial in such scenarios, and the integration of cardiac critical care into emergency settings has increasingly gained importance. Timely acute cardiac intensive care can be life-saving, especially in cases involving complications following myocardial infarction. One advanced technique that has become a focal point for emergency physicians in cardiac critical care is pericardiocentesis, particularly when performed under ultrasound guidance. This minimally invasive procedure, although technically demanding, has been employed with varying success rates in emergency departments. It plays a pivotal role in addressing pericardial effusion—a potentially fatal condition when it progresses to cardiac tamponade. Notably, pericardial tamponade is a rare, yet life-threatening complication of thrombolytic therapy used in the treatment of acute myocardial infarction (AMI). Therefore, early detection and prompt management are essential to avert serious consequences. A key tool in the early identification of hemodynamic instability is the Blood Pressure Shock Index (BPSI), defined as the ratio of heart rate to systolic blood pressure. A narrow BPSI serves as a sensitive early indicator of impending circulatory collapse. This report highlights a clinical case where the identification of a narrow BPSI led to timely pericardiocentesis, ultimately resulting in the successful management of a pericardial effusion that developed post-thrombolysis. This case underscores the value of combining clinical acumen with diagnostic tools to guide lifesaving interventions in emergency care.

Keywords: *Blood Pressure Shock Index (BPSI); Cardiac Critical Care; Pericardial Effusion; Pericardiocentesis; Thrombolysis*

Introduction

Thrombolysis remains a widely used and effective intervention for acute myocardial infarction (AMI), significantly improving patient outcomes by restoring coronary blood flow. However, like all invasive therapeutic strategies, it carries certain risks. Among the rare but severe complications is hemorrhagic pericardial effusion, which can progress to cardiac tamponade if not promptly identified and treated (Damluji *et al.,* 2021). Cardiac tamponade is a critical condition that arises when fluid accumulation in the pericardial sac exerts pressure on the heart, impairing ventricular filling and leading to hemodynamic collapse. In emergency medical settings, such complications demand immediate recognition and intervention to prevent fatal outcomes.

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Pericardial effusion following thrombolysis is uncommon, but when it does occur, it can be rapidly fatal without timely management. Mohebbi (2022) emphasized the life-threatening nature of cardiac tamponade as a complication of thrombolytic therapy in AMI. As emergency departments increasingly serve as the frontline for acute cardiac care, the ability of clinicians to detect and act upon such complications swiftly is critical. This includes not only diagnostic vigilance but also procedural readiness to intervene effectively. Emergency physicians, therefore, must be well-versed in cardiac critical care protocols and skilled in utilizing real-time imaging to enhance diagnostic and procedural outcomes.

Cardiac critical care is gaining prominence in emergency medicine, especially with the increasing use of bedside diagnostic tools and minimally invasive procedures. The Blood Pressure Shock Index (BPSI), calculated by dividing heart rate by systolic blood pressure, offers a simple yet effective tool for detecting early signs of hemodynamic compromise before the onset of overt clinical deterioration. A narrow BPSI can serve as an early red flag, prompting further evaluation and urgent intervention. When combined with point-of-care ultrasound (POCUS), emergency physicians can perform life-saving procedures such as pericardiocentesis with greater accuracy and speed.

In this report, the study presents a case where the use of BPSI enabled the early detection of hemodynamic instability due to pericardial effusion following thrombolysis. Prompt ultrasound-guided pericardiocentesis was performed, leading to the successful stabilization of the patient. This case illustrates the vital role of BPSI in acute cardiac settings and underscores the evolving capabilities of emergency departments in delivering timely cardiac critical care using minimally invasive techniques.

Case Presentation

A 40-year-old male with no prior cardiac history presented to the emergency department with acute chest pain and was diagnosed with ST-segment elevation myocardial infarction (STEMI) based on electrocardiography. The patient received thrombolysis with intravenous streptokinase, which led to the resolution of chest pain and normalization of ST segments. Initial post-thrombolysis monitoring showed hemodynamic stability and no immediate complications.

However, approximately six hours later, the patient began to exhibit new symptoms, including progressive fatigue, mild dyspnea, and nonspecific chest discomfort. Vital signs at that time revealed a heart rate of 101 beats per minute and blood pressure of 90/70 mmHg. The calculated Blood Pressure Shock Index (BPSI) was 1.22 (normal < 0.7), indicating early hemodynamic compromise. Physical examination findings included jugular venous distention and muffled heart sounds, though overt hypotension or pulsus paradoxus was absent.

Recognizing the elevated shock index as a potential early marker of deterioration, a bedside transthoracic echocardiogram (TTE) was promptly performed. The TTE revealed a moderate pericardial effusion with early diastolic collapse of the right atrium, consistent with the early stages of cardiac tamponade. These findings, combined with clinical indicators, prompted an urgent response to prevent further decompensation.

Although traditional shock markers such as a systolic blood pressure below 90 mmHg were not present, the elevated BPSI suggested reduced perfusion and circulatory insufficiency. A high index of suspicion was maintained, and further investigations were conducted, including critical care-focused ultrasound to determine the underlying pathology.

Focused cardiac ultrasound confirmed the diagnosis of pericardial effusion with tamponade physiology, evidenced by right ventricular diastolic collapse. Considering the patient's recent thrombolysis, clinicians weighed the elevated risk of hemorrhagic complications before proceeding. After careful evaluation, an ultrasound-guided pericardiocentesis was chosen to minimize procedural risks.

The procedure was performed at the bedside under real-time ultrasound guidance, ensuring precise needle placement and drainage of the effusion. It was completed successfully without complications. The patient stabilized rapidly after the intervention, with improvements in both clinical signs and

hemodynamic parameters. This case highlights the importance of early detection, risk stratification, and image-guided interventions in post-thrombolysis cardiac emergencies.

Figure 1: Ultrasound-Guided Pericardiocentesis in a Post-Thrombolysis Cardiac Tamponade Case

Discussion

Recognizing shock in a patient who may require interventional procedures is key in avoiding the onset of adrenal insufficiency and suppression, which can lead to an irreversible state of shock. This can be effectively achieved using the shock index—a simple method of dividing the patient's heart rate by the systolic blood pressure (Mori *et al.,* 2021). Generally, the shock index should not exceed 1. However, studies have shown that values above 0.7 or 0.8 can already indicate hemodynamic instability. Recognizing this early allows timely interventional procedures that may prevent the progression to overt shock, which significantly complicates resuscitation efforts. The use of the Blood Pressure Shock Index (BPSI) in emergency care serves as a valuable adjunct to clinical judgment, enabling physicians to act swiftly in the absence of classical signs such as hypotension or altered mental status.

In patients presenting with inferior myocardial infarction and concurrent pericardial effusion, clinicians must maintain a high index of suspicion for aortic dissection (Levy *et al.*, 2024). This condition often presents similarly to myocardial infarction but requires an entirely different treatment approach. Administering standard AMI treatments such as thrombolysis in cases of unrecognized aortic dissection can be catastrophic, potentially worsening the patient's condition. Aortic dissection, known as the

"greatest masquerader," should almost always be ruled out before initiating thrombolytic therapy, especially when pericardial effusion is identified. This distinction is not only diagnostic but also therapeutic, as the wrong intervention could accelerate mortality.

Furthermore, interventional procedures performed post-thrombolysis are not without risk (Kakkos, de Ceniga & Naylor, 2021). The patient is at an elevated risk of profuse bleeding and life-threatening hemorrhagic shock due to impaired coagulation. Controlling bleeding at the puncture site can be extremely difficult, especially during thoracic procedures where access for direct compression is limited. In such settings, it is strongly advised to perform interventional procedures under ultrasound guidance to minimize the risk of complications. Ultrasound guidance improves procedural accuracy, minimizes damage to surrounding structures, and enhances safety, particularly in high-risk post-thrombolysis patients.

In the presented case, early identification of an elevated BPSI prompted further diagnostic imaging, revealing pericardial effusion with early tamponade physiology. The ultrasound-guided pericardiocentesis, although conducted in a patient who had recently undergone thrombolysis, was performed safely and successfully. This case underscores the importance of integrating clinical indicators like BPSI, differential diagnosis such as aortic dissection, and precision-guided interventions in managing complex cardiac emergencies within the emergency department.

Limitations

This report is based on a single case and may not be generalizable to all clinical settings. The effectiveness of the Blood Pressure Shock Index (BPSI) as an early marker may vary across patient populations. Additionally, performing pericardiocentesis post-thrombolysis carries bleeding risks, requiring careful clinical judgment. Lack of long-term follow-up limits insights into delayed complications or outcomes.

Conclusion

In conclusion, emergency departments must be equipped with emergency medicine specialists across both district and tertiary settings, as timely acute care interventions can be life-saving. Emergency physicians are uniquely positioned to pursue specialist interest areas, and among them, critical care stands out as a vital, skill-intensive domain. Cardiac critical care, in particular, represents a focused subspecialty where the development and application of core procedural skills are essential for improving patient outcomes in life-threatening scenarios. Pericardiocentesis, being a minimally invasive yet potentially life-saving procedure, should be performed by trained emergency physicians within the emergency department. Its integration as a core competency in interventional cardiac critical care is crucial to reducing mortality, especially in cases such as cardiac tamponade post-thrombolysis. Furthermore, patients with multiple comorbidities can also benefit from these interventions when performed under enhanced supervision, supported by critical care echocardiography and point-of-care ultrasound (POCUS) to ensure precision and increase procedural success rates.

Looking ahead, the future of emergency cardiac critical care lies in expanding training programs to include advanced interventional procedures and diagnostic imaging for emergency physicians. Developing dedicated cardiac critical care modules within emergency medicine residency programs can foster greater procedural competence and confidence. The widespread adoption of POCUS and critical care ultrasound in routine emergency practice will continue to revolutionize bedside diagnostics and interventions. Additionally, integrating telemedicine support and AI-driven diagnostic tools can enhance decision-making in resource-limited or rural settings. Research into the outcomes of emergency-performed pericardiocentesis, especially in post-thrombolysis patients, could further standardize best practices and safety protocols. Overall, the evolution of emergency cardiac critical care holds immense potential for improving survival and recovery in acute cardiovascular emergencies.

Conflict of Interest

The authors declare that there have no conflict of interest.

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