

CASE REPORT

Shock Management in Patient with Heart Failure and Sepsis: The Role of Hemodynamic Assessment

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ABSTRACT

Sepsis is a life-threatening organ dysfunction resulting from a dysregulated host response to infection. Septic shock, a severe subset of sepsis, must be promptly recognized and managed as a medical emergency. We present the case of a 51-year-old male who developed shock during hospitalization for infected leg ulcers, with a background of chronic heart failure (HF), hypertension, and poorly controlled type 2 diabetes mellitus. Despite his history of HF, bedside echocardiography revealed low systemic vascular resistance and preserved cardiac output, findings more consistent with septic shock than cardiogenic shock. This case underscores the pivotal role of early hemodynamic assessment, particularly with echocardiography, in accurately identifying the type of shock in patients with pre-existing HF. Differentiating the underlying etiology is essential to initiate appropriate therapy and improve clinical outcomes. *Malaysian Journal of Medicine and Health Sciences* (2026) 22(SUPP1): 20-23. doi:10.47836/mjmhs.22.s1.4

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crucial for shock recognition, it alone cannot accurately distinguish the type of shock or determine whether cardiac output is high, normal, or reduced. Thus, early hemodynamic assessment becomes essential to identify the shock subtype and tailor therapy accordingly (1).

INTRODUCTION

Circulatory shock is a potentially fatal condition characterized by the inability of the circulatory system to deliver sufficient oxygen to meet the tissues' metabolic demands, resulting in organ failure (1). Sepsis and septic shock are defined by multiorgan dysfunction arising from dysregulated inflammation in response to infection, frequently involving the respiratory, renal, neurological, and hepatic systems (2). Clinical outcomes are poorer among patients with sepsis who have pre-existing heart failure (HF), with approximately one-quarter of deaths in HF patients attributed to sepsis or septic shock (3).

Sepsis and HF pose overlapping and sometimes conflicting hemodynamic and therapeutic challenges. While aggressive volume resuscitation and vasopressors (and occasionally inotropes) are the initial cornerstones of septic shock management when fluids fail to restore perfusion, such strategies may be harmful in HF patients, where preload and afterload reduction are often emphasized (3). Although clinical examination remains

Echocardiography is increasingly recognized as the preferred tool for initial hemodynamic evaluation in shock. It has been associated with better outcomes in observational studies and offers a rapid, bedside assessment of cardiac function and volume status (1). Early identification of shock type through echocardiography provides critical information that can directly influence therapeutic decision-making.

In this case report, we present a 51-year-old male who developed shock during hospitalization for infected leg ulcers, with a background of chronic heart failure (CHF), hypertension, and diabetes mellitus. This case emphasizes the importance of timely echocardiographic assessment in differentiating the etiology of shock in patients with pre-existing HF.

CASE REPORT

A 51-year-old man presented to the emergency room (ER) with complaints of wounds and swelling of the right leg, accompanied by fever for two days. The patient

denied chest pain and palpitations. His medical history included CHF, hypertension, and poorly controlled type 2 diabetes mellitus. His regular medications included furosemide, digoxin, Aspirin, and metformin.

On initial examination, vital signs were as follows: blood pressure 100/70 mmHg, pulse rate 150 beats per minute, respiratory rate 21 breaths per minute, and body temperature 36°C. Physical examination revealed redness and ulceration of the right lower extremity (Figure 1). Electrocardiography (ECG) demonstrated atrial fibrillation with rapid ventricular response (AF-RVR) (Figure 2). The patient was administered intravenous digoxin 0.5 mg over 10 minutes.



Figure 1: Redness and swelling of the right lower extremity

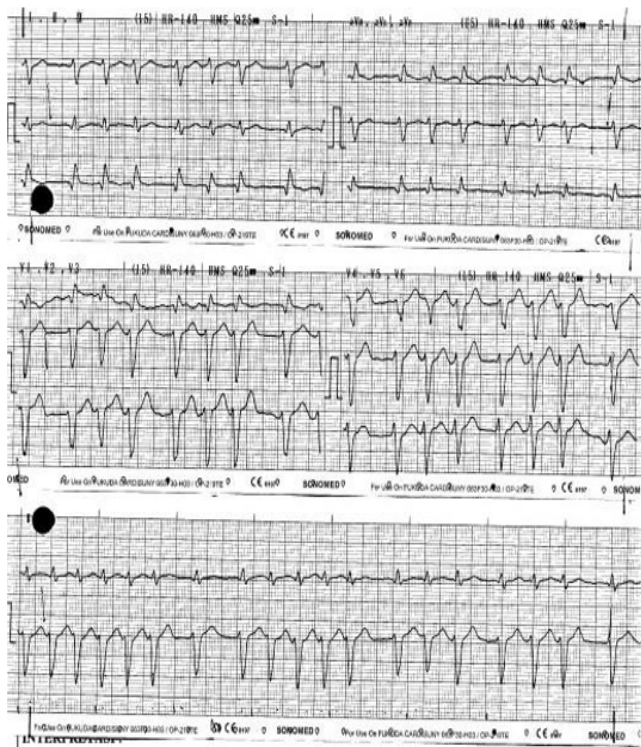


Figure 2: ECG show AF RVR (rate 140x/minute)

During treatment in the ER, the patient developed shock and anuria, with blood pressure dropping to 90/60 mmHg and a palpable weak pulse of 68 beats per

minute. Laboratory investigations revealed leukocytosis (white blood cell count 19,000/ μ L) and hyperglycemia (blood glucose 215 mg/dL). Despite administration of furosemide, the patient remained anuric. A repeat ECG performed four hours after digoxin administration showed AF, albeit with a slower ventricular rate.

The patient was subsequently admitted to the high care unit (HCU) for closer monitoring. Consultations were made with a surgeon for evaluation of the cruris ulcers and with an internist for management of type 2 diabetes mellitus. The patient was treated with intravenous furosemide 40 mg, oral Aspirin 80 mg daily, carvedilol 6.25 mg twice daily, and candesartan 8 mg once daily. Surgical debridement was planned once the patient's condition stabilized. Meanwhile, local wound care with Rivanol and normal saline (NaCl 0.9%) compresses was initiated, and intravenous antibiotics (sulbactam-sodium/cefoperazone 2 g daily and metronidazole 500 mg three times daily) were administered. The internist initiated insulin therapy with Lantus 10 IU once daily and Apidra 3 IU three times daily.

Given the patient's deteriorating hemodynamic status and history of CHF, a bedside transthoracic echocardiographic assessment was performed to differentiate the underlying cause of shock. Echocardiography revealed low systemic vascular resistance (SVR). SVR was calculated using the formula: $SVR = (MAP - RAP) / CO \times 80$. The mean arterial pressure (MAP), based on a blood pressure of 70/41 mmHg, was 51 mmHg. Right atrial pressure (RAP) was estimated by assessing the inferior vena cava (IVC) diameter during expiration (2.93 cm) with a collapsibility index of 15.3%, resulting in an RAP of 15 mmHg (Figure 3c). The cardiac output (CO) was measured at 4.9 L/min (Figure 3b), indicating adequate output. The calculated SVR was 576 dynes-sec/cm⁵, consistent with hypovolemia and septic shock.

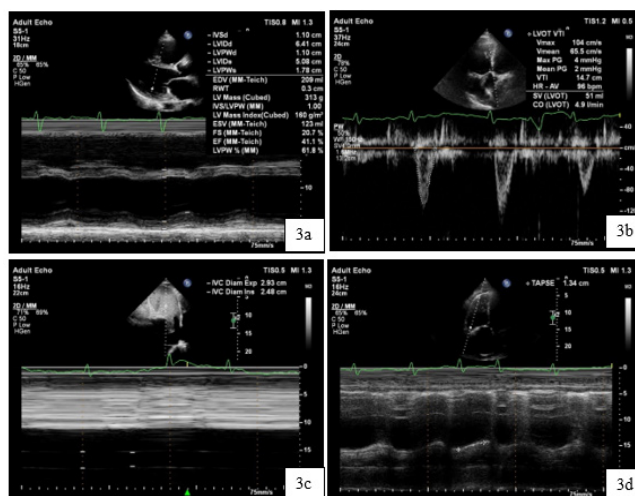


Figure 3: Echocardiography. 3a. show the ejection fraction teich 41.1%. 3b show cardiac output 4.9 l/min. 3c show inferior vena cava diameter during expiration 2.93cm and inspiration 2.48cm. 3d show TAPSE 1.34cm

The patient was managed in the HCU for three days, during which he received fluid resuscitation and norepinephrine infusion. After stabilization, he was transferred to a general ward, and surgical debridement was performed on the fifth day of hospitalization. The patient showed continued clinical improvement and was discharged in good condition after nine days of treatment.

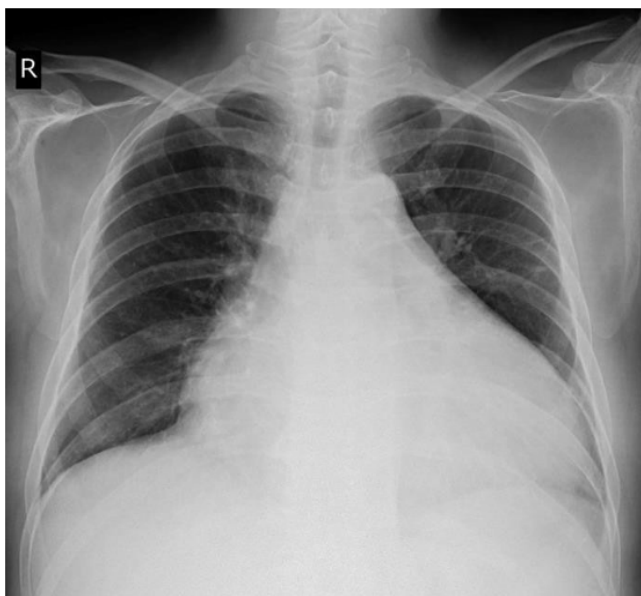


Figure 4: Thorax x-ray shows cardiomegaly

DISCUSSION

Anaesthesia related uvula injury is uncommon but Accurate identification of the hemodynamic mechanism underlying shock is crucial for selecting the most appropriate therapeutic strategy. Moreover, ongoing hemodynamic monitoring is essential to guide subsequent therapy adjustments and optimize outcomes (4). Echocardiography has emerged as the preferred initial tool for hemodynamic assessment in shock due to several advantages. It can be rapidly performed at the patient's bedside and allows characterization of the shock pathophysiology in less than five minutes, as demonstrated in several studies. Echocardiographic evaluation can discern hemodynamic patterns typical of different types of shock, assess right ventricular afterload, fluid responsiveness, and detect left or right ventricular dysfunction. Additionally, it enables real-time evaluation of the impact of therapeutic interventions (1).

Cardiogenic shock typically results from pump failure, severe valvular dysfunction, or the presence of intracardiac shunts, leading to a significant reduction in contractility. It is characterized by low cardiac output and elevated filling pressures. Echocardiographic features commonly include low stroke volume, increased left atrial pressure (as evidenced by an elevated E/E' ratio and mitral E-wave velocity), and, in chronic conditions, dilation of the left ventricle (LV). However, LV dilation

may be absent in acute settings such as myocardial infarction or malignant arrhythmias. In cases of isolated right heart failure, low cardiac output with elevated right atrial pressure without significant pulmonary hypertension may be observed. Comprehensive valvular assessment is also crucial to identify underlying structural abnormalities (1,4).

In contrast, distributive shock, including septic shock, is primarily characterized by low systemic vascular resistance and preserved or elevated cardiac output due to profound vasoplegia and endothelial dysfunction. Despite the potential for myocardial depression in sepsis, the reduced afterload often masks left ventricular dysfunction until hypotension is corrected. Hypovolemia secondary to venous dilation is also common. Recent literature describes five distinct echocardiographic patterns in sepsis: hyperkinetic, predominant LV dysfunction, well-resuscitated, persistent fluid responsiveness, and severe right ventricular failure. A high or normal aortic velocity time integral (VTI) is often used to support the diagnosis of distributive shock (2). Echocardiographic evaluation should focus not only on cardiac function but also on preload responsiveness, both of which are crucial in guiding therapy. Although cardiac dysfunction is common in sepsis, many patients maintain adequate cardiac output and may not require inotropic support. Right ventricular function assessment is particularly important, as sepsis, acute respiratory distress syndrome (ARDS), and mechanical ventilation can impair right heart function. Dynamic left ventricular outflow tract or midventricular obstructions should also be carefully evaluated (1,2).

This case illustrates the critical importance of early hemodynamic evaluation in a patient with pre-existing chronic heart failure (CHF) who develops acute shock in the emergency setting. Despite the initial diagnostic uncertainty—where cardiogenic shock may seem more plausible given the history of CHF, atrial fibrillation with rapid ventricular response, and cardiomegaly on imaging—the bedside echocardiographic findings played a pivotal role in steering the clinical diagnosis toward septic shock.

Several important clinical insights can be drawn from this case. First, it highlights that clinical examination alone may be misleading, particularly in complex cases where symptoms of septic and cardiogenic shock overlap, as seen in this patient with CHF. The use of bedside echocardiography was critical in real-time differentiation, revealing preserved cardiac output and markedly reduced systemic vascular resistance—findings that pointed toward distributive rather than cardiogenic shock. This is consistent with the framework proposed by Vieillard-Baron et al., who emphasize the pivotal role of echocardiography in early hemodynamic stratification for septic patients and its impact on improving outcomes through personalized

management strategies. The calculation of SVR, which is often underutilized, proved decisive in confirming this diagnosis, particularly in a patient with confounding cardiac comorbidities. Additionally, the co-existence of atrial fibrillation with a rapid ventricular response and multiorgan involvement initially obscured the clinical picture, underscoring the diagnostic complexity. What makes this case unique is how echocardiography clarified the etiology of shock and guided a targeted intervention strategy—fluid resuscitation and vasopressor support—leading to clinical improvement. In many resource-limited or non-specialist settings, such utilization of focused cardiac ultrasound remains underexploited, yet it can be life-saving. As also discussed by Dalla et al., point-of-care ultrasound offers rapid, accessible, and dynamic assessment tools, enabling clinicians to make timely decisions in septic shock management, especially in complex or unstable patients. This case supports findings from Vallabhajosyula et al. and Jones et al., who emphasize the dynamic cardiovascular profile of sepsis and the critical need for individualized hemodynamic assessment in patients with underlying heart failure (2,3).

CONCLUSION

This case reinforces that not all shock presentations in patients with pre-existing heart failure are of cardiogenic origin. The ability to differentiate shock types accurately—particularly through early bedside echocardiography—can drastically alter clinical management and outcomes. In patients with complex comorbidities, a focused hemodynamic assessment, including cardiac output and SVR evaluation, should be

an essential part of the initial workup. This approach enables timely and appropriate therapy, as illustrated in this case of septic shock successfully managed in a patient with chronic heart failure. Early integration of point-of-care ultrasound into emergency and critical care practice holds great promise for improving diagnostic precision and patient prognosis.

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