

Management of Cardiogenic Shock in Intensive Care Unit: A Case Series Analysis

ABSTRACT

Introduction : Cardiogenic shock (CC) is a critical condition characterized by acute cardiac failure and tissue hypoxia, affecting around a third of intensive care patients. With mortality exceeding 50%, its early diagnosis and prompt management are essential to improve clinical outcomes. This review highlights the characteristics, etiologies, management and challenges associated with cardiogenic shock.

This study included adult patients (age > 18 years) hospitalized in the ICU (Intensive care unit) at CHU Ibn Rochd for cardiogenic shock between October 2023 and April 2024.

Results and Discussion : Cardiogenic shock is mainly caused by myocardial infarction, accounting for 70-80% of cases, and is often associated with other cardiovascular risk factors such as hypertension and diabetes. Data from 48 patients show a high prevalence of complications such as renal failure and hyperlactatemia. Management of this condition relies on a multidisciplinary approach and includes early revascularization and the use of inotropic drugs. Rapid identification of underlying etiologies enables treatment to be adapted and myocardial function to be improved, while preventing secondary complications.

Conclusion : The management of cardiogenic shock is complex, requiring rapid intervention to optimize prognosis. Therapeutic strategies need to be individually tailored, and ongoing evaluation of clinical practices is essential to reduce mortality. Future research into innovative treatments and improved care protocols can help improve outcomes for patients suffering from this dreaded condition.

Keywords: Cardiogenic shock, Epidemiology, Etiology, Therapeutic, case series

1. INTRODUCTION

Shock is the clinical expression of circulatory failure resulting in inadequate cellular oxygen utilization. This condition is common in intensive care, affecting around a

third of intensive care unit (ICU) patients (1). The diagnosis of shock is based on clinical, hemodynamic and biochemical signs.

Cardiogenic shock (CC) is defined as acute cardiac failure associated with decreased cardiac output and tissue hypoxia, while maintaining adequate blood volume. Hemodynamically, CC is characterized by persistent hypotension (systolic blood pressure < 90 mmHg), reduced cardiac index (CI < 2.2 l/min/m²), peripheral vasoconstriction and systemic tissue hypoperfusion. This type of shock has a high mortality, exceeding 50%, a rate that remains constant despite advances in coronary angioplasty and antiplatelet therapy (2).

Cardiogenic shock is one of the most challenging conditions to manage, both in the emergency department and in critical care units. This article not only discusses the fundamentals of management but also explores complex clinical scenarios and presents management strategies incorporating recent advancements.

2. EPIDEMIOLOGY

The etiologies of cardiogenic shock are diverse, with myocardial infarction accounting for around 70-80% of cases, particularly when more than 40% of the myocardium is damaged (3). Other causes include mechanical complications such as ventricular rupture or acute mitral insufficiency. Conditions such as myocarditis, arrhythmias, hypertensive crises and acute pulmonary edema can also lead to CC, accounting for up to 30% of cases (4).

Recent studies show that early management of cardiovascular risk factors, notably hypertension and diabetes, may reduce the incidence of cardiogenic shock (5). Moreover, patients with a history of coronary heart disease are particularly vulnerable, underscoring the importance of systematic cardiological assessment in this population (6).

3. MATERIALS AND METHODS

This study included adult patients (age > 18 years) hospitalized in the ICU at CHU Ibn Rochd for cardiogenic shock between October 2023 and April 2024. Cases of cardiogenic shock of septic origin or in the context of hemorrhagic shock were excluded, as were patients with significant missing medical data.

Clinical, biological and demographic data were collected prospectively from medical records. Hemodynamic parameters (heart rate, blood pressure, oxygen saturation, diuresis) were recorded during hospitalization. Biological parameters, including arterial blood gases and troponin, as well as echocardiographic data were collected on admission and the statistics were compiled using excel

4. RESULTS

A total of 48 patients were included in the study over a six-month period.

4-1. Demographics

Number of patients: 48

Sex: 66% male (n=32/48)

Mean age: 68 [60-78] years

Cardiovascular risk factors:

- Hypertension (n=36/48, 75%)
- Type 2 diabetes (n=28/48, 58%)
- Dyslipidemia (n=24/48, 50%)
- Active smoking (n=20/48, 41%)
- History of coronary heart disease (n=16/48, 33%)
- Chronic heart disease on beta-blockers and/or ACEI/ARB2 (n=28/48, 58%)

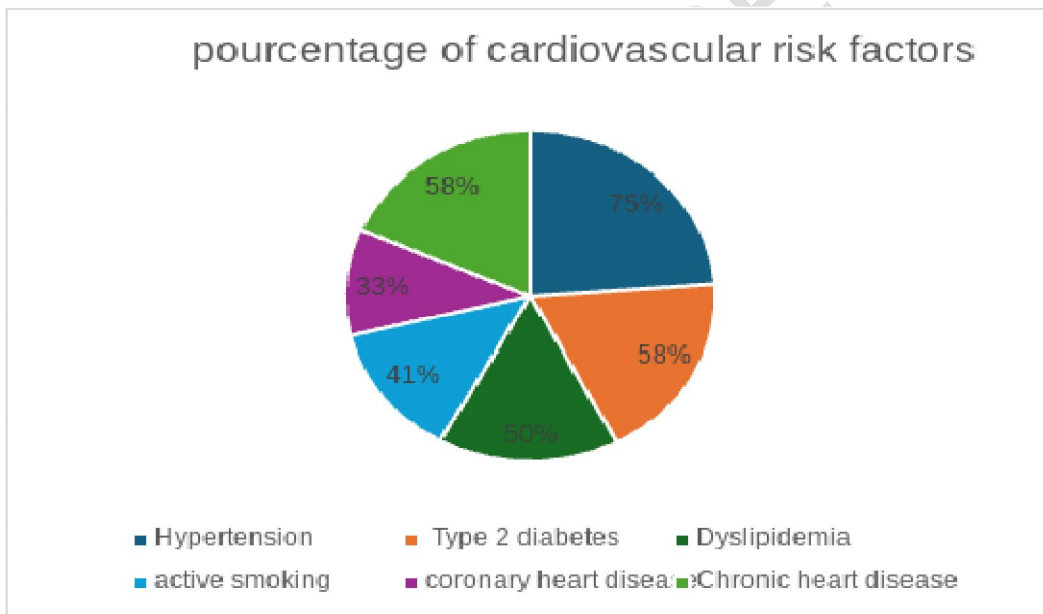


Figure 1-Pourcentage of Cardiovascular risk factors

4-2. Hemodynamic characteristics

- Median systolic blood pressure at entry: 106 [94-125] mmHg
- Median MAP (Mean arterial pressure):70 [60-80] mmHg
- Median diuresis:1350 [500-2400] mL
- Mean LVEF(Left ventricular ejection fraction) : 30% (15-45%), with significant Left Ventricular dilatation observed in 75% of patients
- Reduced cardiac output:observed in all patients

4-3- Biological characteristics

- Renal insufficiency: 83 %
- Hepatocellular insufficiency: 75 %
- Hyperlactatemia: 58 %
- Elevated troponins: 66 %
- Inflammatory syndrome: 41 %

4-4. Etiologies

The main etiologies identified for cardiogenic shock are :

- ACS (Acute coronary syndrome) (66%)
- Low cardiac output due to cardiac decompensation (25%)
- Ventricular rhythm disorders (9%) on:
Ischemic heart disease (41%) and Dilated cardiomyopathy (33%)

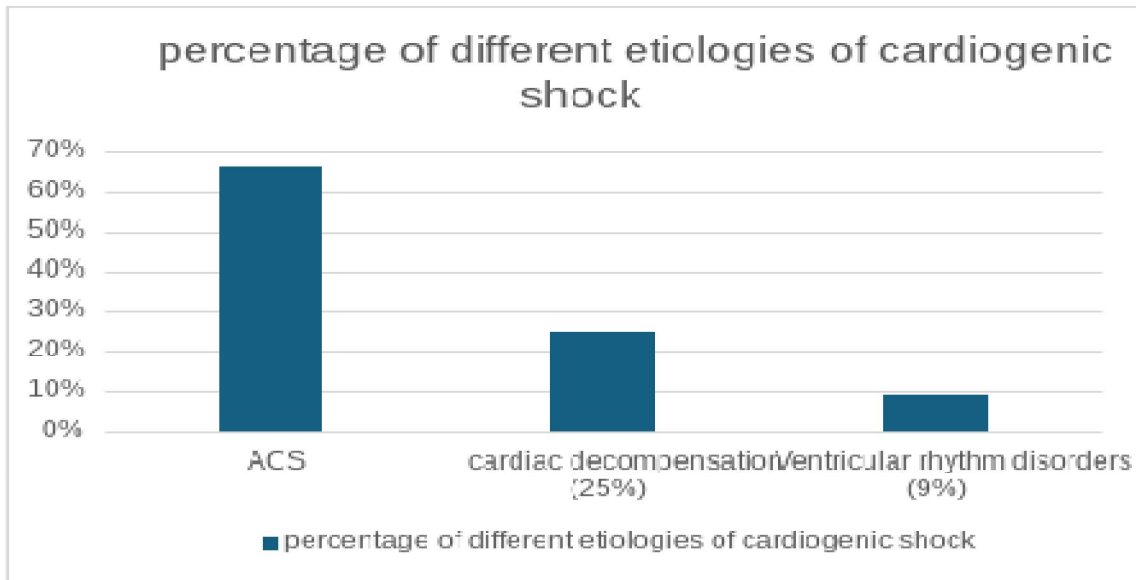


Figure 2- Etiologies of cardiogenic shock

4-5. Therapeutic

All patients received high doses of catecholamines, especially dobutamine and norepinephrine: 7.5 [5.0-10.0] µg/kg/min for dobutamine and 2.2 [1.0-7.9] mg/h for norepinephrine. Adrenaline was administered at a dose of 7.0 [2.2-13.7] in 33% of cases. Extra-renal dialysis was required in 41% of patients, and mechanical ventilation was used in 58%. Specialist treatment was considered depending on the aetiology, including revascularisation in all patients with cardiogenic shock in acute coronary syndrome by angioplasty or bypass surgery, which improved the prognosis with a mortality rate of no more than 30%.

5.DISCUSSION

The management of cardiogenic shock (CC) in intensive care remains a major challenge due to the complexity of etiologies and clinical manifestations. CC, defined as acute circulatory failure leading to tissue hypoperfusion despite adequate blood volume, has a high mortality rate, often in excess of 50% (1). This underscores the importance of rapid identification and early intervention to improve clinical outcomes.

Early diagnosis of cardiogenic shock (CC) is crucial for a number of reasons, from reducing mortality to improving clinical outcomes. Key aspects of this importance include:

5-1. Reducing mortality

Mortality associated with cardiogenic shock is high, often in excess of 50%, and has not improved significantly despite recent therapeutic advances (1). Studies show that patients benefiting from early diagnosis and rapid intervention have significantly better survival rates. Intervention within two hours of symptom onset is associated with a reduction in 1-year mortality (2).

5-2. Improved Myocardial Function

Rapid diagnosis enables immediate treatment to restore myocardial perfusion, such as revascularization in the case of acute coronary syndrome. Improving blood flow and tissue oxygenation can prevent permanent myocardial damage (3). For example, early revascularization with angioplasty can reduce infarct size and improve left ventricular function, which is essential for long-term recovery (4).

5-3. Identifying underlying etiologies

Early diagnosis also facilitates identification of the underlying causes of cardiogenic shock. By quickly recognizing conditions such as myocardial infarction, myocarditis, or arrhythmias, clinicians can tailor treatment accordingly. This early identification is essential for therapeutic decisions, such as the appropriate use of inotropic agents or circulatory support devices (5).

In our study, coronary syndrome was identified in 66% of cases, and treatment by revascularization was carried out, which improved the prognosis.

5-4. Hemodynamic assessment and monitoring

Early diagnosis allows for intensive haemodynamic monitoring and follow-up of vital parameters such as blood pressure, heart rate and signs of tissue hypoperfusion, which was performed in our study and is essential in the management of cardiogenic shock. The use of diagnostic tools such as transthoracic echocardiography was performed in our study and provided essential information on cardiac function and the presence of complications such as pericardial effusion (6,7). Careful monitoring can guide therapeutic interventions and adjust treatments in real time.

5-5. Multidisciplinary collaboration

Early diagnosis also promotes multidisciplinary collaboration between cardiologists, intensivists and other specialists. Rapid and effective communication between these healthcare professionals is essential to optimize the management of critically ill patients (8). Establishing a standardized care protocol can also facilitate a rapid response, which is particularly important in an intensive care environment.

5-6. Prevention of Secondary Complications

Early diagnosis and intervention can also reduce the risk of secondary complications such as acute renal failure, respiratory failure or cardiac arrhythmias, which were present in a high percentage of patients in our study.

Prolonged hypoperfusion can lead to irreversible renal damage, further complicating management (9). By intervening early, clinicians can help prevent these complications and improve overall outcomes.

The therapeutic approach to cardiogenic shock (CS) is complex and requires rapid assessment of the underlying cause and implementation of appropriate treatments to stabilize the patient's condition. The main therapeutic strategies are

a. Early revascularization

Revascularization is a priority in patients with cardiogenic shock secondary to acute coronary syndrome (ACS). Percutaneous coronary angioplasty (PCI) should be performed as soon as possible, ideally within the first two hours of symptom onset.

In our study, revascularisation was performed in all patients whose cardiogenic shock was caused by acute coronary syndrome, which improved their prognosis.

Studies have shown that early revascularization significantly reduces one-year mortality in patients with cardiogenic shock due to myocardial infarction (2, 4). This highlights the importance of early intervention to restore blood flow and minimise myocardial damage.

b. Inotropic drugs and vasopressors

Inotropic agents, such as dobutamine and dopamine, are commonly used to improve cardiac output and support blood pressure. Dobutamine, a β 1-adrenergic agonist, improves cardiac contractility and may increase cardiac output, particularly in patients with residual systolic function (5).

However, their use must be individualized according to the etiology of the shock and clinical responses. For example, in cardiogenic shock of ischemic origin, the inotropic effect of dobutamine may be insufficient, and higher doses may be required (6).

Vasopressors such as noradrenaline are also used to treat persistent hypotension. Studies show that noradrenaline administration can improve blood pressure and perfuse vital organs (8-9). However, excessive use of vasopressors can lead to

adverse effects, such as ischemic complications.

The drugs used in our study were dobutamine, noradrenaline and epinephrine, with clinical improvement and a reduction in mortality of no more than 30%.

c. Mechanical circulatory support

In cases of refractory cardiogenic shock, the use of circulatory support devices, such as percutaneous ventricular assist devices (VADs), is a therapeutic option. These devices provide temporary hemodynamic support, allowing the heart to recover while maintaining organ perfusion (9-10). A recent meta-analysis indicated

that early use of these devices in severe cardiogenic shock improves survival and may reduce the need for heart transplantation (11).

d. Ventilatory support

Respiratory failure is common in patients in cardiogenic shock, often due to pulmonary edema. Mechanical ventilation may be necessary to ensure adequate oxygenation and support ventilation in the event of respiratory distress (12). **In our case, mechanical ventilation was used in 58% of cases.**

A lung protection strategy, with reduced tidal volumes and positive end-expiratory pressure, should be adopted to minimize lung damage associated with mechanical ventilation.

e. Risk factor management and multidisciplinary care

Management of underlying cardiovascular risk factors, **such as hypertension, diabetes and hyperlipidaemia, which are implicated in the development of the heart disease that causes cardiogenic shock, as shown in our study, is crucial in preventing the recurrence of cardiogenic shock.**

A preventive approach combining lifestyle advice, pharmacological treatment and regular monitoring can reduce the incidence of cardiac events (13-14). A

multidisciplinary approach is essential to optimise patient outcomes.

Collaboration between cardiologists and nursing teams ensures integrated and effective management of patients with cardiogenic shock. Clear communication between members of the healthcare team is essential to ensure continuous monitoring and rapid response to clinical changes (15).

6. CONCLUSION

Cardiogenic shock remains a major complication in intensive care requiring rapid and effective management. Early recognition of the underlying aetiologies, optimisation of therapeutic strategies and monitoring of outcomes are crucial to improve patient prognosis.

This study aims to provide some guidelines for the management of cardiogenic shock by analysing data from 48 patients in the intensive care unit of the CHU Ibn Rochd Hospital in Casablanca, Morocco, highlighting the importance of managing cardiogenic shock to improve patient health and reduce mortality, which is over 50%.

Continued research into innovative treatments and evaluation of current practices are essential to reduce the mortality associated with this condition.

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Availability of data and materials

The data of this case report includes the echocardiography film and all other patient's data that we had a consent to publish. These data are available from the corresponding author on reasonable request.

Disclaimer (Artificial intelligence) :

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc.) and text-to-image generators have been used during the writing or editing of this manuscript.

Consent

Written informed consent was obtained from the parents for publication of this case report and accompanying images

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