



Acute Circulatory Failure in Cardiology: Epidemiological, Etiological, Therapeutic, and Prognostic Aspects of 150 Cases in Dakar, Senegal

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Abstract

Introduction: Acute circulatory failure is a major clinical syndrome resulting from the heart's inability to pump enough blood to meet the body's metabolic needs. It is a real public health issue. The aims of the study were to determine the prevalence of acute circulatory failure; to describe the etiological, therapeutic, and prognostic aspects; and to analyse prognostic factors in a cardiological setting in Dakar, Senegal. **Methodology:** This was a multicentric, cross-sectional, descriptive, and analytical study conducted from 1st October 2019 to 30th June 2020. Included were patients aged at least 18 years, hospitalised in cardiology departments in Dakar, Senegal, for the acute circulatory failure of all etiologies. We studied socio-demographic aspects, clinical and paraclinical data, stratified patients' prognostic risk, and adapted therapeutic modalities and monitoring. Data analysis was performed using SPSS software version 24.0. Any difference less than 0.05 was considered statistically significant. **Results:** The study enrolled data from 150 patients hospitalised for acute circulatory failure, representing 8.69% of cardiology admissions. Among them, 24.75% presented with cardiovascular collapse and 75.25% with shock. The average age was 53 years with a range from 17 to 83 years, and a female predominance with a sex ratio of 0.78. The main risk factors included age (50.5%), sedentariness (41.6%), and high blood pressure (34.7%). About a fifth of the patients had a history of dilated cardiomyopathy. Echocardiogra-

phy revealed dilation of cardiac chambers (34.7%) and elevated ventricular filling pressures (43.6%). The origin of the failure was mainly cardiogenic (48.67%). Hospital mortality reached 38.61%, with the majority of deaths occurring within the first 15 days. Heart failure was correlated with the emergence of acute circulatory failure ($p = 0.014$), while septic shock was associated with increased mortality in cases of acute circulatory failure ($p = 0.03$). **Conclusion:** This research highlights, in a cardiological setting, the various aspects of acute circulatory failure, identified as a predominant pathology among cardiovascular disorders, associated with a high mortality rate, underlining the urgency of rapid and effective intervention in an intensive care unit.

Subject Areas

Cardiology

Keywords

Acute Circulatory Failure, Cardiology, Senegal

1. Introduction

Acute circulatory failure is a common reason for admission to cardiac intensive care units. The most frequent presentation is the acute decompensation of chronic heart failure (Da-CHF), often leading to hospitalisation. Nosologically, acute heart failure (AHF) represents a multifactorial syndromic ensemble, the understanding of which has evolved without reaching a consensual definition. This reflects the complexity and heterogeneity of the clinical presentations encountered, which pose significant obstacles to characterizing a single entity and to a uniform therapeutic approach [1]. It is defined as a failure of tissue perfusion. Two entities are distinguished: collapse and shock states. Collapse is a transient peripheral circulatory failure with a sudden drop in systolic blood pressure to <90 mmHg or a fall of at least 25% from previous systolic blood pressure [2]. Shock is a prolonged and generalized acute circulatory failure characterized by tissue hypoperfusion resulting in anoxic dysfunction of various vital organs [2].

This condition is a medical emergency where the prognosis depends on the timeliness of management and the etiological diagnosis, which is not always straightforward. Moreover, despite significant advances in therapeutic management, the overall mortality for patients with cardiogenic shock remains high, ranging from 52.3% to 72.8% [3]. Similarly, septic shock presents with a mortality of about 50% in adults [4].

Mortality for shock was 34% [5]. In France, nearly 15% of patients hospitalised in intensive care have severe septic syndrome, two-thirds of which are septic shock. It is estimated that around 75,000 severe septic syndromes are admitted to intensive care units in France annually, and the frequency of these syn-

dromes is increasing. Hospital mortality is 20% for simple sepsis, 40% and beyond for severe septic syndrome or shock; however, it has tended to improve over the past decade [6]. In Senegal, it is a frequent reason for admission to the Cardiac Intensive Care Units with a hospital mortality rate of 52.3% and a one-year survival rate of 27.2% [4].

This study aims to determine the prevalence of acute circulatory failure; to describe the etiological, therapeutic, and prognostic aspects; and to analyze the prognostic factors in the cardiology departments of General Hospital Idrissa Pouye and Aristide Le Dantec Hospital.

2. Methodology

This was a multicentre, cross-sectional, descriptive, and analytical study with both retrospective and prospective data collection. The study was conducted over a nine-month period from 1st October 2019 to 30th June 2020. All patients aged at least 18 years, hospitalized in the cardiology departments of General Hospital Idrissa Pouye and Aristide Le Dantec Hospital during the study period and presenting with cardiovascular collapse or shock from all etiologies combined, were included in the study. Shock was defined by cardiovascular collapse involving acute arterial hypotension equal to or less than 80 mm Hg systolic blood pressure, tachycardia with a rapid, small, and thready pulse, cold extremities, and oliguria corresponding to a diuresis < 500 cc/24h or 20 cc/h. Patients were included either upon admission or during hospitalization. Patients presenting with chronic hypotension in follow-up were not included.

We examined socio-demographic aspects, cardiovascular risk factors, clinical and biological data, and echocardiography (to identify any underlying heart disease, evaluate biventricular systolic function, and the inferior vena cava). This initial evaluation allowed us to stratify the patient's prognostic risk and tailor the modalities and monitoring of therapy. These different parameters were collected using a questionnaire and compiled on a data collection form. The survey form was validated by a committee of experts consisting of three cardiologists and one epidemiologist with at least four years of experience.

This work was carried out in collaboration with the management of these hospitals after obtaining the approval of the cardiology services by signing the access form to patient records. For patients included during hospitalization at the time of the study, an information note was drafted for the patient's trusted person, summarizing the study. The two-page information letter mentioned the title, objectives, target, duration, number of patients to include, advantages and disadvantages of the survey, and contact details of the survey leaders. Written consent was obtained from the trusted person, and those who refused to participate were excluded, which did not impact on the care and follow-up. All trusted persons were informed of the confidential nature of the study.

Data analysis, word processing, and graph creation were conducted using Microsoft Word 2016, Excel 2013, and Sphinx version 5.1.0.2. Data analysis was

performed using SPSS (Statistical Package for the Social Sciences) version 24.0. In the descriptive analysis, qualitative variables were described by frequency and percentages, and quantitative variables by mean with standard deviation, extremes, and median. In the bivariate analysis, we used the binary logistic regression method. All variables with a p-value ≤ 0.05 were included in the modeling of poor prognosis. We used an ascending modeling approach. Adjusted odds ratios (OR) with their 95% confidence intervals were calculated for each variable retained in the final model. To assess the model's fit, we performed the Hosmer-Lemeshow test to check its adequacy.

3. Results

In our observational study, we enrolled 150 patients admitted to hospital for acute circulatory failure, representing an incidence of 8.69% of all admissions to the cardiology department. The study reveals that among the patients examined, 24.75% presented with cardiovascular collapse and 75.25% with shock. The average age of the patients was 53 years, ranging from 17 to 83 years, with a predominance in the age group of 60 to 74 years (**Figure 1**). Females accounted for 56% of cases with a sex ratio of 0.78.

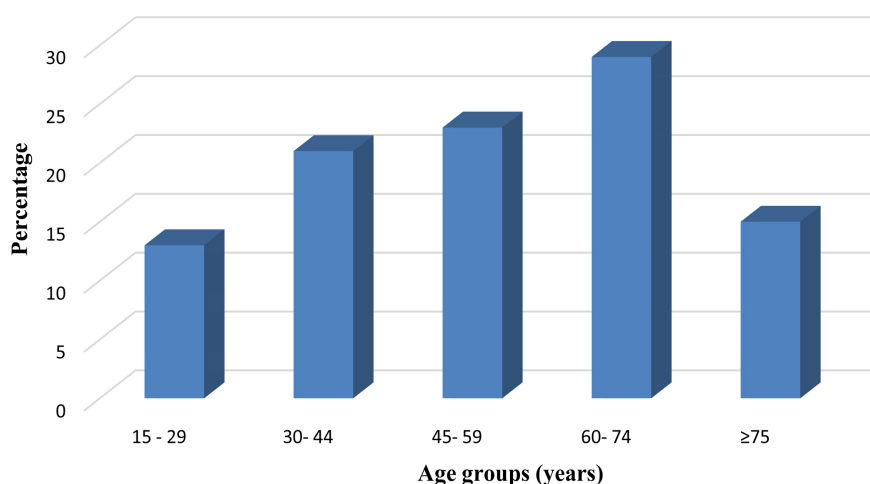


Figure 1. Distribution of the population by age groups (n = 150).

The most common cardiovascular risk factors were age (50.5%), sedentariness (41.6%), hypertension (34.7%), menopause (23.8%), smoking (14.9%), and diabetes (12.9%) (**Figure 2**). Regarding the medical history of the patients, 20.7% were monitored for dilated cardiomyopathy, 14.9% for ischemic heart disease, 12.8% for valvular heart disease, and others for various cardiovascular conditions. The most common oral treatments included angiotensin-converting enzyme inhibitors [45.6%], anti-aldosterones (42%), and beta-blockers (34%).

Acute circulatory failure was often associated with underlying pathologies, with 48.5% of cases occurring on a background of known heart disease. Clinical signs included clear consciousness in the majority of patients, but variations in

diuresis and blood pressure were common, with oliguria observed in 42% of patients. Physical examination primarily revealed tachycardia (74.3%), auscultatory arrhythmia (68.3%), and cold extremities (52.5%). Laboratory analyses often showed leukocytosis, anemia, and an inflammatory syndrome. Electrocardiographic abnormalities mainly included atrial fibrillation (7.9%) and atrial flutter (5%). Transthoracic echocardiography generally revealed dilation of the cardiac chambers (34.7%) and elevated ventricular filling pressures (43.6%). Radiographic findings most frequently observed were vascular redistribution (41.6%) and cardiomegaly (29.6%).

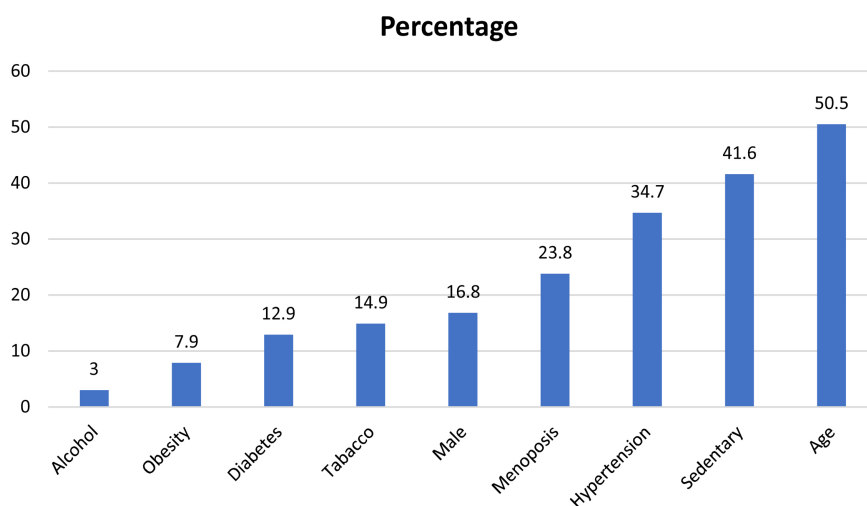


Figure 2. Distribution of the population by cardiovascular risk factors (n = 150).

Etiologically, acute circulatory failure of cardiogenic origin (48.67%) was the primary diagnostic hypothesis, followed by hypovolemic (14%) and rhythmic heart diseases (12.67%) (**Table 1**). Treatments included the use of positive inotropic drugs such as dobutamine (50.5%) and diuretics (45.5%) (**Table 2**).

Table 1. Mechanism of Acute Circulatory Failure (ACF) suspected at admission (n = 150).

Mechanism of ACF	Sample size	Percentage
Hypovolaemic	21	14
Cardiogenic	73	48.67
Rhythmic	19	12.67
Septic	9	6
Pulmonary embolism	6	4
Mixed	22	14.67

Hospital course was favorable in the majority of patients, but hospital mortality was 38.61%. A majority of deaths occurred within the first 15 days following admission (**Figure 3**). Heart failure was identified as a factor correlated with the

emergence of acute circulatory failure ($p = 0.014$), while septic shock was associated with an increase in mortality in cases of acute circulatory failure ($p = 0.03$).

Table 2. Treatment at admission.

Treatment	Sample size	Percentage
Digoxin	19	12.9
Dopamine	1	1
Noradrénaline	6	4
Dobutamine	80	53.46
Thrombolysis	12	7.9
Diuretic	68	45.54
Antibiotics	21	13.9
Isotonic Saline Solution	21	13.9
30% Glucose Solution	3	2
Electrical Cardioversion	27	17.8
Antalgic	10	9.6

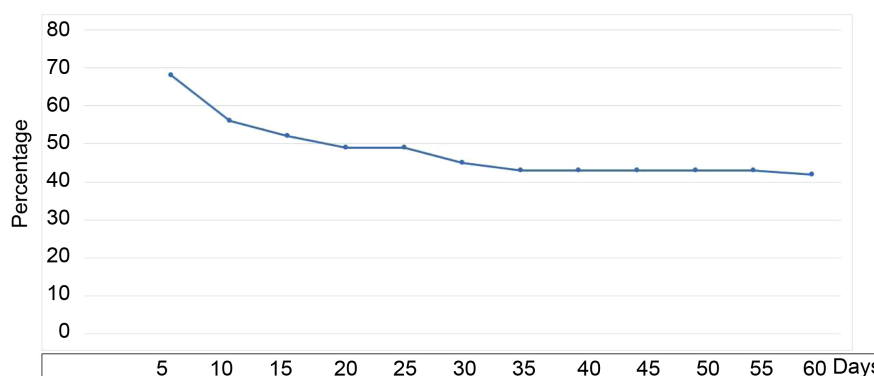


Figure 3. Mortality curve.

4. Discussion

Our study acknowledges several limitations, particularly issues with data collection such as diuresis and the unavailability of certain laboratory analyses like complete blood counts and inflammatory profiles for some patients. These limitations could have influenced the study results and should be considered when interpreting the data.

Epidemiologically, the prevalence of acute circulatory failure was 8.69%, which is double that observed in a Senegalese study conducted in 2015, where the hospital prevalence was only 4% [3]. The female predominance in acute circulatory failure has been documented by several authors [7]. Meuzebou reported a female predominance of 57.6%, with a sex ratio of 0.73 [8]. In contrast, Bahloul M observed a male predominance of 59% [7] and Djibril M in Togo reported 57.9%,

with a sex ratio of 1.4 [5]. These figures highlight the importance of considering variations in epidemiological profiles across different health facilities and populations studied.

Our average age (53 years) was similar to that found by Gaye in Senegal [3], where it was 54.9 years, and the most represented age group was also 60 to 74 years. Conversely, the study by Meuzbo revealed a younger population, with an average age of 40.7 years [8]. This trend towards an older population could reflect an increased prevalence of cardiovascular diseases in older cohorts and underscores the importance of vigilant monitoring in these patients.

Clinically, the most prevalent cardiovascular risk factor was age (50.5%), consistent with the findings of the Gaye study [3], which reported a prevalence of 61.4%. Hypokinetic dilated cardiomyopathy (DCM) and ischemic heart disease, the most frequently observed conditions, were also described by Aw [4], who found 20.8% of hypokinetic DCM and 11.6% of ischemic heart disease. These results emphasize the significance of DCM as an underlying cause of acute circulatory failure and highlight the need for proactive management of this pathology [9]-[11].

Regarding previous treatments, the use of angiotensin-converting enzyme inhibitors predominated (45.6%), aligning with the data from the study [3], where ACE inhibitors were administered in 29.5% of patients.

Etiologically, acute circulatory failure of cardiogenic origin (48.51%) predominated in our study, consistent with the 2015 Senegal study [3], which revealed a predominance of 43.2%. In the face of cardiac pump failure, cardiac tonics were the most prescribed therapeutic class, with dobutamine leading at 50.5%, while it was administered in 79.5% of cases in the Aw study [4]. These findings underscore the critical importance of monitoring and managing cardiovascular diseases to prevent the development of acute circulatory failure.

Finally, the high mortality rate observed in our study (38.6%) was comparable to those of other studies conducted in similar contexts by Djibril M.A in Togo [5] where the lethality was 34.2% and Bahloul in Tunisia [7] of 30.8%, whereas in the Gaye study, the in-hospital mortality was 52.3% [3]. These results underline the intrinsic severity of acute circulatory failure and highlight the imperative for rapid and effective management to improve clinical outcomes for patients.

5. Conclusion

This research highlights the various aspects of acute circulatory failure in a cardiological setting, including its epidemiological, clinical, paraclinical, etiological, therapeutic aspects, and progression. Acute circulatory failure is identified as a predominant pathology among cardiovascular disorders, associated with a high risk of complications and a high mortality rate. These factors underscore the urgency of rapid and effective intervention in an intensive care unit. The necessity for early diagnosis is crucial to accurately determine the cause and underlying mechanism of acute circulatory failure, in order to tailor the treatment. Fur-

thermore, it is essential to improve medical equipment and strengthen health policies to combat common causes such as ischemic heart disease. This would significantly contribute to the prevention of acute circulatory failure, thereby reducing the risks of serious complications. This study also highlights the importance of these measures in optimizing clinical outcomes and reducing the lethality associated with this severe condition.

Authors and Contributors

A.A.N and A.K designed the study protocol, participated in the data collection and contributed to analyzing the data and writing of the draft manuscript.

N.D.G and A.M oversaw the execution of the study, participated in data analysis and critically revised the manuscript for important intellectual content.

N.A.N and M.D participated in study design and in data analysis.

J.S.M participated in statistical analysis and interpretation of results.

All authors have read and approved the final version of the manuscript.

Conflicts of Interest

The authors declare no conflicts of interest.

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