

Research Article

Management Delays and Outcomes in ST-Elevation Myocardial Infarction (STEMI) in the COVID-19 Era in Senegal: Insights from a Tertiary Center

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Abstract

Low-and middle-income countries (LMICs) face many challenges regarding the timely management of STEMI, and the COVID-19 pandemic has impacted our already fragile health systems. The aim of this study was to assess the delays in managing STEMI during COVID-19 and evaluate the 6-month mortality rates related to these delays. A retrospective cross-sectional study was conducted over two years starting from January 2020 at a tertiary center in Dakar, Senegal. All patients referred for STEMI during the study period were included. Statistical analysis was performed using R, version 4.4.0 (R Foundation for Statistical Computing). A total of 273 patients were enrolled during the study period (65.9% males, mean age: 59 ± 12.4). Diabetes Mellitus was present in 37.7% of cases. Only 1 out of 5 patients (20.5%) reached medical attention within 1 hour after symptoms onset, and the time from first medical contact to ECG was < 10 minutes in 39 % of cases. Primary PCI within the first 24 hours was performed in 23.5% of cases. Factors significantly associated with late hospital admission (<12h) were first medical contact < 1h (P 0.0009, OR: 4.06 95% CI; 1.8-9.64), time to first ECG < 10 minutes (P 0.002, OR: 2.79 95% CI; 1.45-5.41) and number of facilities visited < 2 (P 0.004, OR: 3.4 95% CI 1.51-8.22). The 6-month mortality rate was 18.7%, and the probability of death increased with a more significant delay in first medical contact. Our study found persisting delays in STEMI management in Senegal. Establishing a standard of care for STEMI in Senegal is mandatory to overcome healthcare system weaknesses and improve the outcomes of our STEMI patients.

Keywords

Acute Coronary Syndromes, COVID-19, Management Delays, LMICs

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1. Introduction

International guidelines emphasize timely reperfusion for acute STEMI patients as ischemic time is closely related to patient outcome [1]. Prompt recognition and early management of acute STEMI is critical in reducing morbidity and mortality [2-4]. In high-income countries, advanced healthcare infrastructure and robust emergency response systems have somewhat mitigated the impact of these delays. Conversely, inadequate prehospital emergency medical services (EMS) and lack of coordination between facilities contribute to the poorer clinical outcomes observed in most LMICs [5]. In addition, access to interventional cardiology facilities and catheterization laboratories is exceedingly scarce in LMICs, with the majority located in large, urban areas [5-9]. Previous studies support excessive pre-hospital delays among STEMI patients in LMICs, influenced by clinical factors and health system [5, 10, 11]. Furthermore, pre-hospital treatment delay is a significant factor for the higher morbidity and mortality associated with ACS among STEMI patients residing in LMICs. [12-14]. Unfortunately, the COVID-19 pandemic has further stretched these fragile systems, complicating timely access to critical care. Like many low and middle-income countries, Senegal is experiencing a shift towards non-communicable diseases such as ischaemic heart disease and a critical lack of proper surveillance systems to evaluate risk factors and disease management. Furthermore, it is vital to note the scarcity of reliable epidemiological data regarding ischemic heart disease in Senegal. To our knowledge, no studies have evaluated the delays management and mortality rate of STEMI in the COVID-19 era in Senegal. Thus, the aim of our study was to evaluate the management delays and prognosis of STEMI patients in Senegal during the COVID-19 pandemic era.

2. Materials and Methods

2.1. Study Design and Data Collection

In this retrospective cross-sectional study, were included all patients admitted for STEMI in the cardiology department of Idrissa Pouye General Hospital from January 2020 to December 2022. This study was conducted at Idrissa Pouye General Hospital because it is one of the two biggest tertiary centers in Dakar and has a high rate of STEMI patient referrals.

Data collected were:

- 1) Socioeconomic status: age, gender, place of residence, work status, education level, marital status.
- 2) Cardiovascular risk factors: hypertension, diabetes mellitus, high LDL cholesterol, smoking (current or stopped less than three years ago), sedentarity (less than 150 minutes of moderate physical activity or 75 minutes of vigorous physical activity per week).
- 3) Clinical status:
 - a. Typical or atypical pain of myocardial infarction.

b. Killip Class

- 4) First Medical Contact (FMC): time between the onset of symptoms and medical consultation.
- 5) Time between FMC and ECG.
- 6) Time from FMC to admission in the cardiology department.
- 7) Number of facilities visited before referral to the cardiology department.
- 8) Admission modalities to the cardiology department: through the Emergency Medical Services (EMS), coming directly from the transfer facility, or arriving by their own means.
- 9) 6-months mortality status

2.2. Statistical Analysis

Data analysis was performed using R, version 4.4.0 (R Foundation for Statistical Computing). In the case of quantitative observations, baseline characteristics were presented as mean standard deviation (SD) for parameters with normal distribution. The median interquartile range was used for parameters showing no normal distribution. For comparing delays and admission modalities, continuous variables were analyzed using the Student's t-test or Mann-Whitney U test, depending on the data distribution. Categorical variables were compared using the Chi-square test or Fisher's exact test, as appropriate. A P-value <0.05 was considered statistically significant. Multivariable logistic regression models were used to identify independent predictors of delayed admission. All statistical analyses were conducted following ethical guidelines and data protection regulations. Data confidentiality and patient anonymity were maintained throughout the study.

3. Results

During the study period, 273 patients were enrolled, with 65.6% of males (Table 1). Sedentarity was the most prevalent cardiovascular risk factors in 70.3% of cases. Most patients (81.7%) used taxis to reach the point of care. Limited awareness of Emergency Medical Services (EMS) was noted, with only 14% of patients knowing about their existence. Only 1 out of 5 patients (20.5%) reached medical attention within 1 hour after symptoms onset; ECG was performed less than 10 minutes after first medical contact in 39 % of cases.

Table 1. Demographic, clinical, and angiographic characteristics of STEMI patients.

Parameters	Value
Age (Mean value \pm SD)	59 \pm 12.4
Male (%)	65.9

Parameters	Value	Parameters	Value
Emergency Medical Services awareness (%)	14	< 1 hour (%)	20.5
<i>Place of living</i>		1-6 hours (%)	36.2
Urban (%)	93.1	6-12 hours (%)	5.9
Rural (%)	6.9	12 -24 hours (%)	30.4
<i>Work status</i>		>24 hours (%)	7
Self-employed (%)	62.3	<i>Time from First Medical Contact to ECG</i>	
Civil servant (%)	12.8	Within 10 mn (%)	39.0
Unemployed (%)	10.6	>10 mn (%)	61.0
<i>Cardiovascular risk factors</i>		<i>Type of facilities visited.</i>	
Hypertension (%)	44	Health district (%)	47.6
Dyslipidemia (%)	1.8	Public hospital (%)	27.1
Diabetes mellitus (%)	37.7	Private hospital (%)	18.7
Tobacco use (%)	30.8	Others (%)	6.6
Sedentary (%)	70.3	<i>Number of facilities visited before admission</i>	
<i>Clinical data</i>		< 1 (%)	72.2
Typical chest pain (%)	34.8	>2 (%)	28.8
Shortness of breath	23.4		
KILLIP 1 (%)	91.6		
KILLIP 2 (%)	5.9		
KILLIP 3 (%)	2.2		
KILLIP 4 (%)	0.4		
<i>Culprit arteries</i>			
Left anterior Descending Artery (%)	66.7		
Right coronary Artery (%)	39.9		
Circumflex artery	33.7		
<i>Treatment received before referral</i>			
Thrombolysis (%)	4		
Aspirin (%)	70.3		
Clopidogrel (%)	68.9		
Pain Killer (%)	52		
Angiotensin Convertor Inhibitor (%)	5.5		
Beta-blockers (%)	2.6		
Statins (%)	12.1		
<i>Transportation Means</i>			
Taxi (%)	81.7		
Personal car (%)	17.2		
Bus (%)	1.1		
<i>Time to First Medical Contact</i>			

The non-revascularization rate in our population was 37.1%. Primary Percutaneous angioplasty (PCI) was the most common form of revascularization (Figure 1). The thrombolysis success rate was 71.2%.

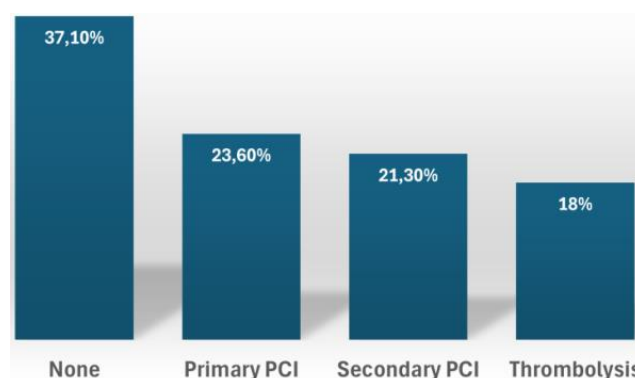


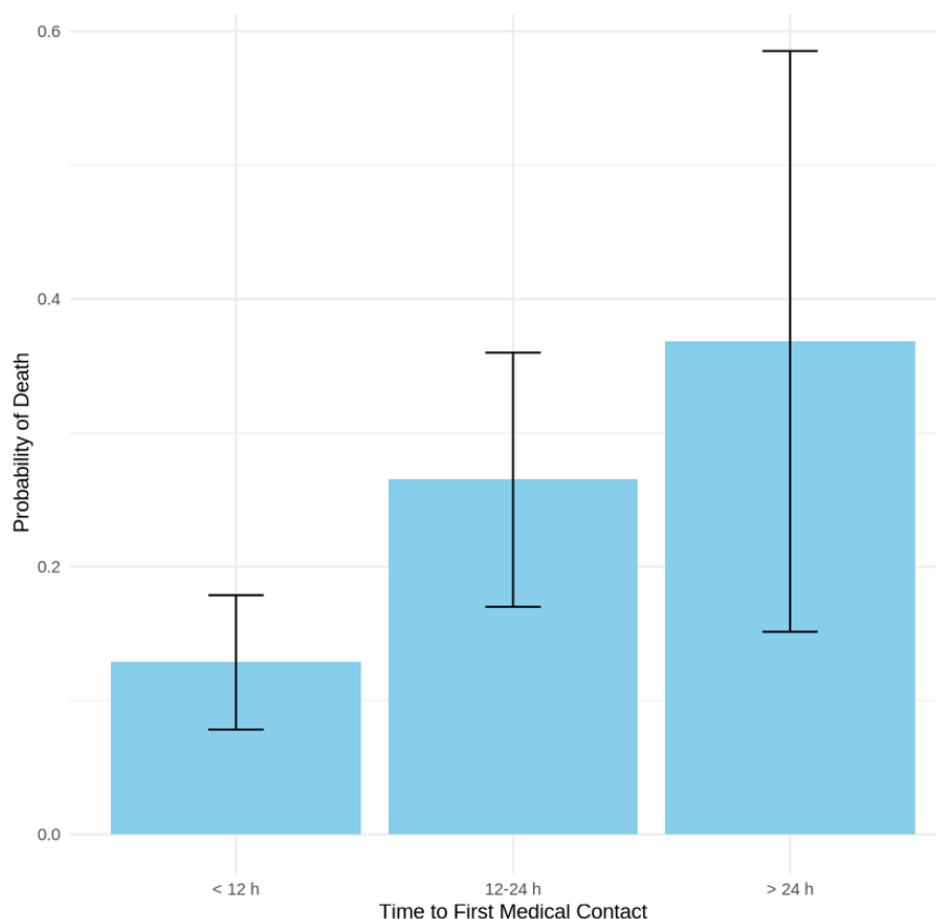
Figure 1. Distribution of patients according to revascularization modality.

In multivariate analysis, significant factors associated with early admission (<12 h) were time to first medical contact < 1 hour, time from FMC to ECG < 10 mn, and less than two facilities visited before admission (Table 2).

Table 2. Drivers of early admission as determined by logistic regression.

Variables	Estimate	P value	95% Confidence Interval	
			Lower	Higher
Intercept	0,09	<0.0001	0,03	0,23
Time to first ECG < 10 mn	2,79	0,002	1,45	5,41
Number of facilities visited < 2	3,4	0,004	1,51	8,22
First medical contact < 1h	4,06	0,0009	1,8	9,64
Patient coming from a rural area	0,65	0,18	0,34	1,23
Non-diabetics patients	1,67	0,14	0,85	3,32

Overall, the 6-month mortality rate was 18.7%. The probability of death was higher when the time to FMC was greater than 24 hours (36.1%, 95% CI [15.1%-58.5%]).

**Figure 2.** Probability of death depending on time to first medical contact.

4. Discussion

The present study reveals persisting suboptimal management delays in STEMI patients in Senegal, with delayed first

medical contact, systemic healthcare shortcomings, high non-revascularization rate, and a high 6-month mortality rate increasing with delays in FMC. Factors associated with delayed admission were first medical contact < 1h, time to first ECG < 10 mn, and number of facilities visited < 2.

As STEMI care involves multiple steps and healthcare providers, it is highly vulnerable to being affected by external factors. [1]. The pandemic struck hard on all STEMI care systems worldwide [1]. Numerous reports worldwide, especially in the early phase of the COVID-19 pandemic, showed a reduction in STEMI diagnoses, admissions, catheterization laboratory activation, and primary PCI. [15-24].

Several studies reported that the lack of an organized EMS system strongly contributed to pre-hospital delay time [25-28]. Senegal has been recently equipped with a national EMS, but in our study, only 14% were aware of it, and all the patients used non-medical transports to get to the points of care. This emphasizes the critical need to establish a comprehensive standard of care for ST-elevation myocardial infarction (STEMI) in Senegal by developing a good connection between all the health system actors to ensure timely consultation and pre-hospital thrombolysis and primary angioplasty. It also highlights the importance of effective communication with the public regarding STEMI management and prevention measures in our settings.

Late admission drastically affects the time to revascularization, a critical prognostic factor in STEMI patients. Furthermore, implementing primary PCI in sub-Saharan Africa (SSA) remains challenging. In our study, PCI was performed in over half of our patients, but only 23.5% within the first 24 hours. South Africa has the shortest time, between 2.3 and 3.6 hours, for patients with STEMI, which means that primary PCI or thrombolysis is performed more often than in other SSA countries. [10]. In Côte d'Ivoire, there has been an encouraging reduction of more than 50% in the time to admission from 44.7 to 20 hours within four years. [10].

Study Limitations

Our study has several limitations. The lack of reliable data in our country during the pre-COVID era makes it challenging to compare management delays. Prospective cohorts and robust surveillance systems are mandatory to understand better the healthcare shortcomings affecting STEMI management in Senegal. This will help inform proper strategies to improve the management of our STEMI patients.

5. Conclusion

Based on our comprehensive study, persistent delays in the management of ST-elevation myocardial infarction (STEMI) cases and greater probability of death correlated with these delays are noted in Senegal. Implementing a standardized care protocol for STEMI in Senegal is imperative to effectively address the deficiencies within the healthcare system and ultimately elevate the treatment outcomes for our STEMI patients. This standardized protocol can potentially optimize the response time, treatment procedures, and overall quality of care for individuals suffering from STEMI in Senegal.

Abbreviations

ECG	Electrocardiogram
EMS	Emergency Medical Services
FMC	First Medical Contact
LDL Cholesterol	Low Density Level Cholesterol
LMICs	Low and Middle-Income Countries
PCI	Percutaneous Coronary Intervention
STEMI	ST-Elevation Myocardial Infarction

Author Contributions

Abdoul Kane: Supervision, Writing - review & editing

Alassane Mbaye: Writing - review & editing

Aliou Alassane Ngaide: Conceptualization, Investigation, Methodology, Resources, Supervision, Validation, Writing - review & editing

Ameth Ngnig: Data curation, Formal analysis, Investigation, Visualization

Joseph Salvador Mingou: Writing - review & editing

Mouhamadou Bamba Ndiaye: Writing - review & editing

Ngone Diaba Gaye: Data curation, Formal analysis, Investigation, Methodology, Visualization, Writing - original draft

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Data Availability Statement

The data supporting the outcome of this research work has been reported in this manuscript.

Conflicts of Interest

The authors declare no conflicts of interest.

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