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Comparative Study of Acute Coronary Syndrome with Persistent ST-Segment Elevation (STEMI) between Diabetics and Non-Diabetics in Dakar, Senegal

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Abstract

Introduction: This study aimed to compare the frequency of diabetic and non-diabetic patients admitted for ST-elevation myocardial infarction (STEMI), assess their epidemiological, clinical, and paraclinical profiles, and evaluate their therapeutic strategies and outcomes. **Methodology:** A descriptive, analytical, comparative study with prospective and retrospective data collection was conducted from April 1, 2020, to March 31, 2021. Diabetic and non-diabetic patients with STEMI admitted to a cardiology department were included. STEMI diagnosis was based on clinical and electrocardiographic criteria showing persistent ST-segment elevation in at least two leads. All patients included in the study signed a written, informed consent form. Data analysis was performed using SPSS, with a p-value ≤ 0.05 considered statistically significant. **Results:** STEMI prevalence was 15.27%, with 37.11% of patients being diabetic and 62.89% non-diabetic. Diabetic patients had a mean age of 59.2 ± 10.9 years, while non-diabetics averaged 58 ± 13.4 years. Diabetics were predominantly female (72.2%), whereas non-diabetics were mainly male (83.6%). Smoking was less frequent among diabetics (25% vs. 47.54%), but hypertension, obesity, and sedentary lifestyle were more common. Diabetics had an average of 3.5 ± 1.1 risk factors compared to 2.6 ± 1.2 in non-diabetics. Admission delay was longer for diabetics (34.8 ± 51.6 hours vs. 23.3 ± 52.3 hours). Chest pain was the main symptom in both groups. Electrocardiograms

showed that anterior and inferior infarctions were most frequent. Triple vessel disease and severe complications, such as cardiogenic shock, were more common in diabetics, who also had higher mortality (5.56% vs. 3.28%). **Conclusion:** Diabetic STEMI patients represent a high-risk group with distinct clinical features, longer admission delays, and a greater accumulation of cardiovascular risk factors, emphasizing the need for targeted interventions.

Keywords

Acute Coronary Syndrome with Persistent ST-Segment Elevation, Diabetes, Senegal

1. Introduction

The epidemiological and demographic transitions observed in the 20th century have led to a radical transformation in the global morbidity and mortality profile. Non-communicable diseases are the leading cause of death worldwide, and acute myocardial infarction is one of the main causes of all acute emergencies, becoming a significant public health issue, particularly rising in developing countries [1] [2]. Diabetes is a global problem that is also increasing with advanced age, obesity, and reduced physical activity. It was projected that adult diabetes would increase from 2.8% in 2000 to 4.4% by 2030 [3]. Furthermore, it is indicated that by 2030, the majority of cases will come from India, China, and the United States [4].

The risk of myocardial infarction is 2 to 4 times higher in diabetics [5] [6], leading to higher morbidity and mortality among diabetics [7]. Coronary artery disease is much more severe in diabetics, with morbidity/mortality approximately 4 times higher in men and 8 times in women [6]-[8]. Acute pulmonary edema, cardiogenic shock, arrhythmia, reinfarction, and cerebral infarction are serious complications in diabetics [9].

Indeed, the presence of diabetes contributes to more than three million cardiovascular deaths worldwide each year [10]. About half of diabetic patients die from cardiovascular disease [11] [12]. Given the increasing prevalence of diabetes and coronary diseases, a better understanding of the epidemiology of coronary involvement in diabetics is necessary. However, there is limited data on acute coronary syndromes in diabetic subjects in Africa.

The objectives of this study were to compare the frequency of diabetic and non-diabetic patients admitted for acute coronary syndrome with persistent ST-segment elevation (STEMI), to establish the epidemiological, clinical, and paraclinical profiles, and to evaluate the therapeutic strategy and outcome modalities.

2. Methodology

This was a descriptive, analytical, and comparative study with both prospective and retrospective data collection. The study was conducted over a 12-month period from April 1, 2020, to March 31, 2021. During the study period, we included

all diabetic and non-diabetic patients aged over 18 years, regardless of gender, who were admitted to the cardiology department of Idrissa Pouye General Hospital in Dakar for acute coronary syndrome with persistent ST-segment elevation (STEMI). The diagnosis of acute coronary syndrome with persistent ST-segment elevation (STEMI) was based on a combination of clinical criteria (typical or atypical anginal pain), electrocardiographic criteria with persistent ST-segment elevation localized to a coronary territory in at least 2 leads (≥ 2 mm in precordial leads and ≥ 1 mm in peripheral leads) or recent left or right bundle branch block, and biological criteria (elevated troponin levels).

Diabetes was defined as either a fasting blood glucose level greater than 1.26 g/l (7 mmol/l) on two occasions and/or a random blood glucose level greater than 2 g/l (11.1 mmol/l) associated with cardinal signs and/or a 2-hour blood glucose level after oral ingestion of 75 mg of glucose (oral glucose tolerance test, OGTT) greater than 2 g/l (11.1 mmol/l) and/or a glycated hemoglobin (HbA1c) level greater than 6.5% [13]; or a previously known diabetic patient. We studied sociodemographic aspects, cardiovascular risk factors, clinical, paraclinical, therapeutic, and evolutionary data. The length of hospital stay was expressed in days. Additionally, the type of diabetes, the duration of diabetes, and the treatment were specified. The Killip classification was used to assess the severity of heart failure in our patients with acute myocardial infarction. This classification ranges from Class I (absence of signs of heart failure) to Class IV (cardiogenic shock). It has helped predict prognosis and guide therapeutic decisions.

These various parameters were collected using a questionnaire and recorded in an exploitation sheet. The survey form was validated by a committee of experts consisting of three cardiologists and an epidemiologist with at least 4 years of experience. This work was carried out in collaboration with the hospital administration after obtaining approval from the cardiology departments by signing the patient record access form. This study was approved by the ethics committee of Cheikh Anta Diop University in Dakar. All patients included in the study signed a written, informed consent form. For patients in shock, consent was signed by a trusted person.

The data were collected on a pre-established form and entered into Microsoft Excel 2016. Data analysis was performed using SPSS (Statistical Package for Social Sciences). The descriptive study was carried out by calculating frequencies and proportions for qualitative variables and means and standard deviations for quantitative variables.

In the analysis, we considered potential confounding factors, such as age and gender disparities. These variables were analyzed to assess their impact on the study results, ensuring that any differences observed between diabetic and non-diabetic patients were not merely due to these demographic factors but rather to their clinical profiles and risk factors. The analytical study was conducted using cross-tabulations. To compare the frequencies of the parameters, we used Pearson's correlation test with a significance threshold of $p \leq 0.05$.

3. Results

The study involved 635 hospitalized patients, 97 (15.27%) of whom were admitted for acute coronary syndrome with persistent ST-segment elevation (STEMI). Among them, 36 were diabetic, representing a hospital frequency of 5.67% and an incidence of 37.11% of STEMI cases, while 61 were non-diabetic, with a hospital frequency of 9.6% and an incidence of 62.89% of STEMI cases.

The average age of diabetic patients was 59.2 ± 10.9 years (ranging from 32 to 81 years), compared to 58 ± 13.4 years (ranging from 25 to 90 years) for non-diabetic patients (p = 0.573). The most represented age group was 60 - 69 years, with 36.11% of diabetics and 31.15% of non-diabetics (p = 0.615). Figure 1 illustrates the distribution of STEMI patients by age groups, highlighting the age differences between diabetic and non-diabetic patients. A female predominance was observed among diabetics (72.2%, sex ratio of 0.38, p = 0.001), while the male gender predominated among non-diabetics (83.6%, sex ratio of 5.1, p = 0.001) (Figure 2). The majority of patients came from the suburbs of Dakar and were self-employed: 52.78% of diabetics and 54.1% of non-diabetics.

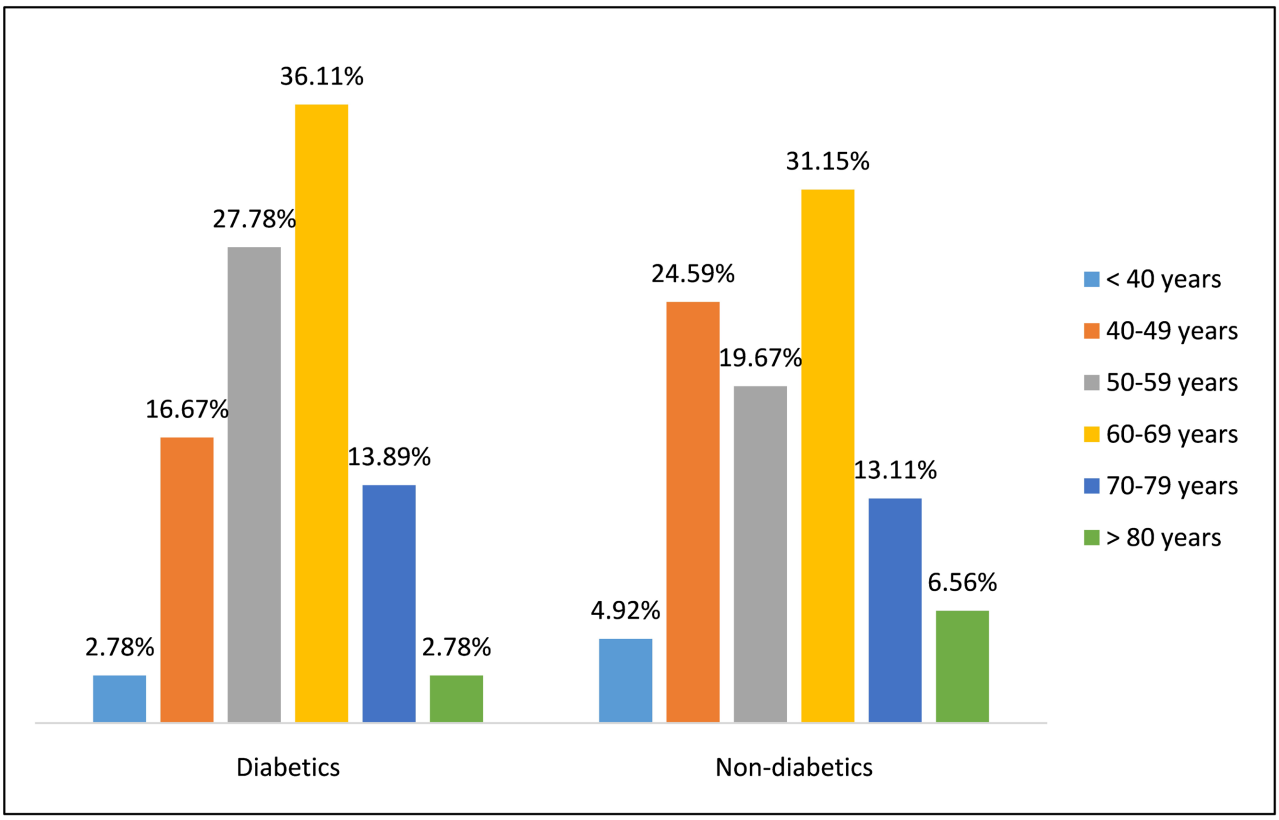

Figure 1. Distribution of STEMI patients by age group.

Risk factors varied significantly between the groups. Smoking was less frequent among diabetics (25%) than non-diabetics (47.54%) (p = 0.017). Hypertension was more common among diabetics (61.11%) than non-diabetics (36.07%) (p = 0.012). Obesity and sedentary lifestyles were also more prevalent among diabetics.

The majority of diabetics (38.89%) had four cardiovascular risk factors, while the majority of non-diabetics (40.98%) had three. The average number of risk factors was 3.5 ± 1.1 in diabetics and 2.6 ± 1.2 in non-diabetics (p = 0.003) (Table 1).

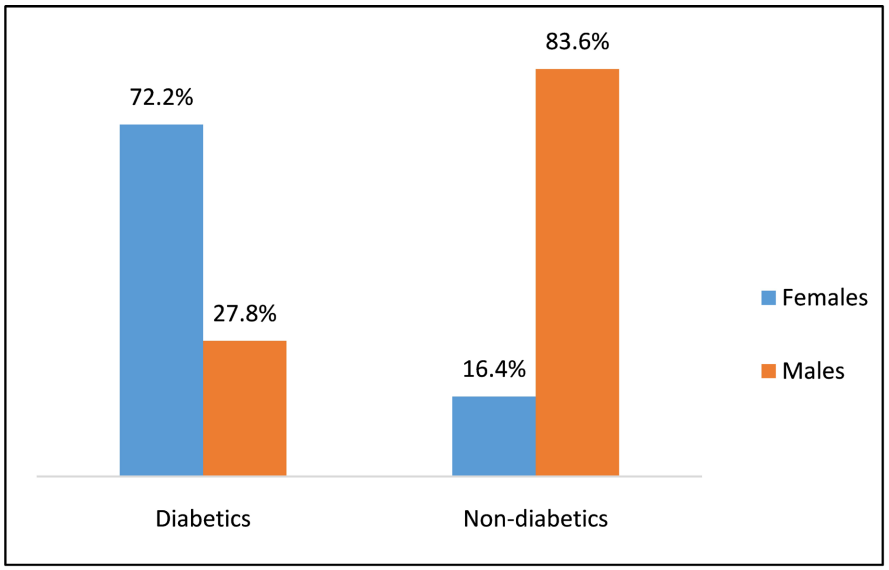

Figure 2. Distribution of STEMI patients by gender.

Table 1. Distribution of STEMI patients by the number of cardiovascular risk factors.

Number of cardiovascular risk factors	Diabetics		Non-diabetics	
	N	%	N	%
0	0	0	4	6.56
1	1	2.78	7	11.48
2	6	16.67	15	2459
3	9	25	25	40.98
4	14	38.89	7	11.47
5	6	16.67	2	3.28
6	0	0	1	1.64
Total	**36**	**100**	**61**	**100**

The average admission time to the Emergency Department (ED) was 34.8 ± 51.6 hours for diabetics (ranging from 4 to 240 hours) and 23.3 ± 52.3 hours for non-diabetics (ranging from 2 to 360 hours) (p = 0.015). Figure 3 shows the distribution of STEMI patients by admission delay, comparing the time to hospital admission between diabetic and non-diabetic groups. More than half of the diabetics (52.8%) were admitted after the 12th hour following the onset of chest pain. No diabetic was admitted within the first three hours, while among non-diabetics, 39.7% were admitted between the 3rd and 6th hours and 37.9% after the 12th hour.

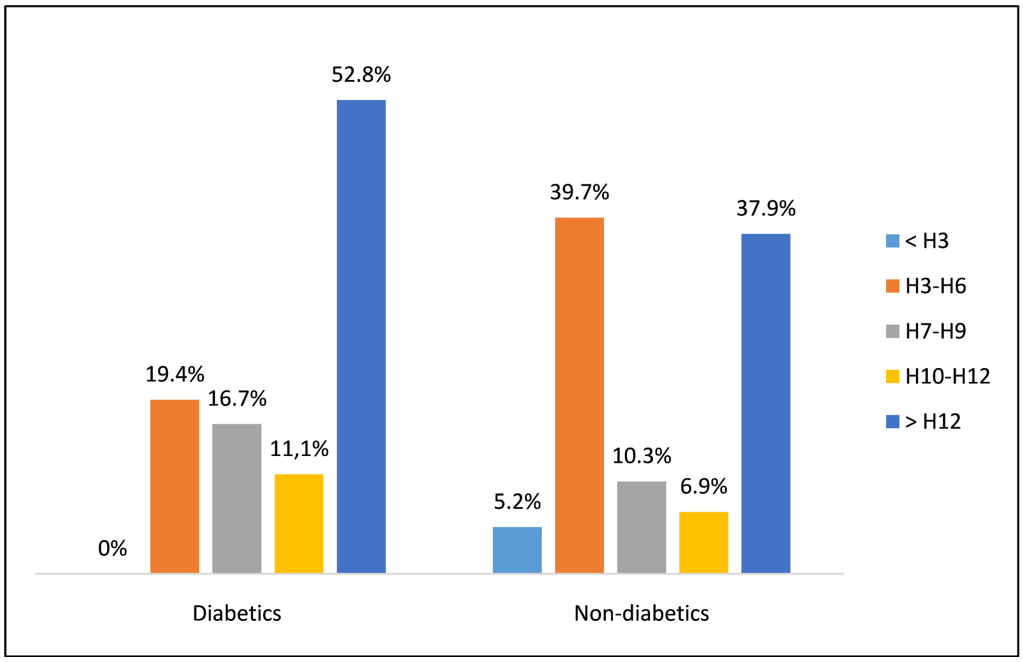

Figure 3. Distribution of STEMI patients by admission delay.

Symptoms were dominated by chest pain: 41.67% of diabetics and 60% of non-diabetics presented with typical anginal pain (p = 0.571). Cardio-pulmonary examination was normal in 91.67% of diabetics and 75.41% of non-diabetics, with 8.33% of diabetics in Killip class 2 compared to 16.39% of non-diabetics.

Biologically, the average troponin level was 403 ± 942 in diabetics compared to 1453 ± 2677 N in non-diabetics (p = 0.292). The average capillary blood glucose at admission was 2.25 ± 0.8 g/l in diabetics and 1.35 ± 0.36 g/l in non-diabetics (p = 0.001). The average fasting venous blood glucose was 1.86 ± 0.92 g/l in diabetics and 0.92 ± 0.24 g/l in non-diabetics (p = 0.001). The average glycated hemoglobin was 10 ± 3.7% in diabetics and 5.57 ± 0.31% in non-diabetics (p = 0.001). The average LDL cholesterol was 1.47 ± 0.47 g/l in diabetics and 1.34 ± 0.48 g/l in non-diabetics (p = 0.506). The average triglyceride level was 1.32 ± 0.54 g/l in diabetics and 0.95 ± 0.52 g/l in non-diabetics (p = 0.001) (Table 2).

Table 2. Description of patient characteristics and clinical outcomes.

Characteristics	Diabetics (n = 36)	Non-diabetics (n = 61)	p-value	OR (IC a 95%)
Average age (years)	59.2	58	0.573	
Age group 60 - 69 years (%)	36.11	31.15	0615	
Female sex (%)	72.2	16.4	0.001	13.26 (4.90 – 35.89)
Male sex (%)	27.8	83.6	0.001	0.08 (0.03 – 0.20)
Origin (Suburb)	52.78	54.1	0.832	
Liberal activity (%)	51.85	45.45	0542	
Smoking	25%	47.54	0.017	0.35 (0.14 – 0.89)
Hypertension	61.11%	36.07%	0.012	2.81 (1.23 – 6.41)

Continued

Obesity	Most frequent	Least frequent	-	-
Sedentarism	Most frequent	Least frequent	-	-
Average number of risk factors	3.5	2.6	0.003	-
Average time to amission (hours)	34.8	23.3	0.015	
Abmission > 12 hours	52.8	37.9	-	
Admission 3 - 6 hours	0	39.7	-	
Admission < 3 hours	0	0	-	
Typical angina pain	41.67	60	0.571	0.47 (0.19 – 1.16)
Atypical angina pain	58.33	40	-	-
Normal cardiopulmonary examination	91.67	75.41	0.042	3.73 (1.01 – 13.75)
Killip 2	8.33	16.39	0.263	0.47 (0.12 – 1.84)
Average troponin	403	1453	0.292	-
Average capillary glucose	2.25	1.35	0.001	-
Average venous glucose	1.86	0.92	0.001	-
Average glycated hemoglobin	10	5.57	0.001	-
Average LDL cholesterol (g/l)	1.47	1.34	0.506	-
Average triglycerides (g/l)	1.32	0.95	0.001	-
Anterior and inferior territory	52.78	70.77	0.061	0.46 (0.20 – 1.05)
Q wave necrosis	61.11	42.62	0.073	2.13 (0.93 – 4.87)
Abnormal systolic function	41.18	50	0.452	0.71 (0.31 – 1.62)
Hypokinesia	85.29	68.5	0.113	2.56 (0.82 – 8.59)
Three-vessel involvement	40	23.92	0.118	2.13 (0.83 – 5.48)
Cardiogenic shock	13.89	8.2	-	
Conduction disorders	11.11	1.64	-	
Mortality	5.56	3.28	-	

On the electrocardiogram, the anterior and inferior territories were the most affected in both groups (52.78% in diabetics and 70.77% in non-diabetics) (**Figure 4**). Q waves indicating necrosis were present in 61.11% of diabetics and 42.62% of non-diabetics. Left ventricular systolic function was abnormal in 41.18% of diabetics and 50% of non-diabetics (p = 0.62). Segmental kinetic disorders were more frequent in diabetics (85.29%) than in non-diabetics (72.22%). Hypokinesia was the most common kinetic abnormality in diabetics (85.29%) compared to 68.5% in non-diabetics (p = 0.77). On coronary angiography, triple-vessel disease was more frequent among diabetics (40%) compared to non-diabetics (23.92%). **Figure 5** illustrates the types of coronary involvement (lesions in one, two, or three vessels) in diabetic and non-diabetic patient groups.

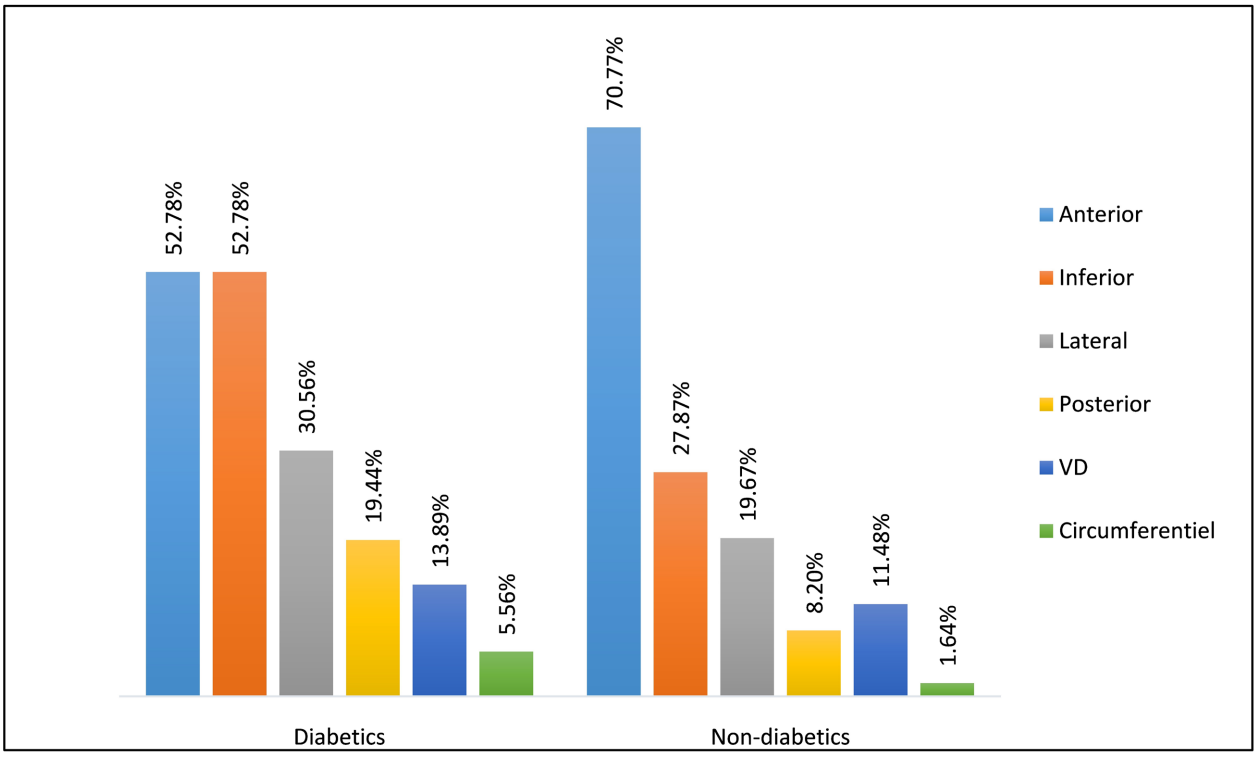

Figure 4. Distribution of STEMI patients by ST+ territories.

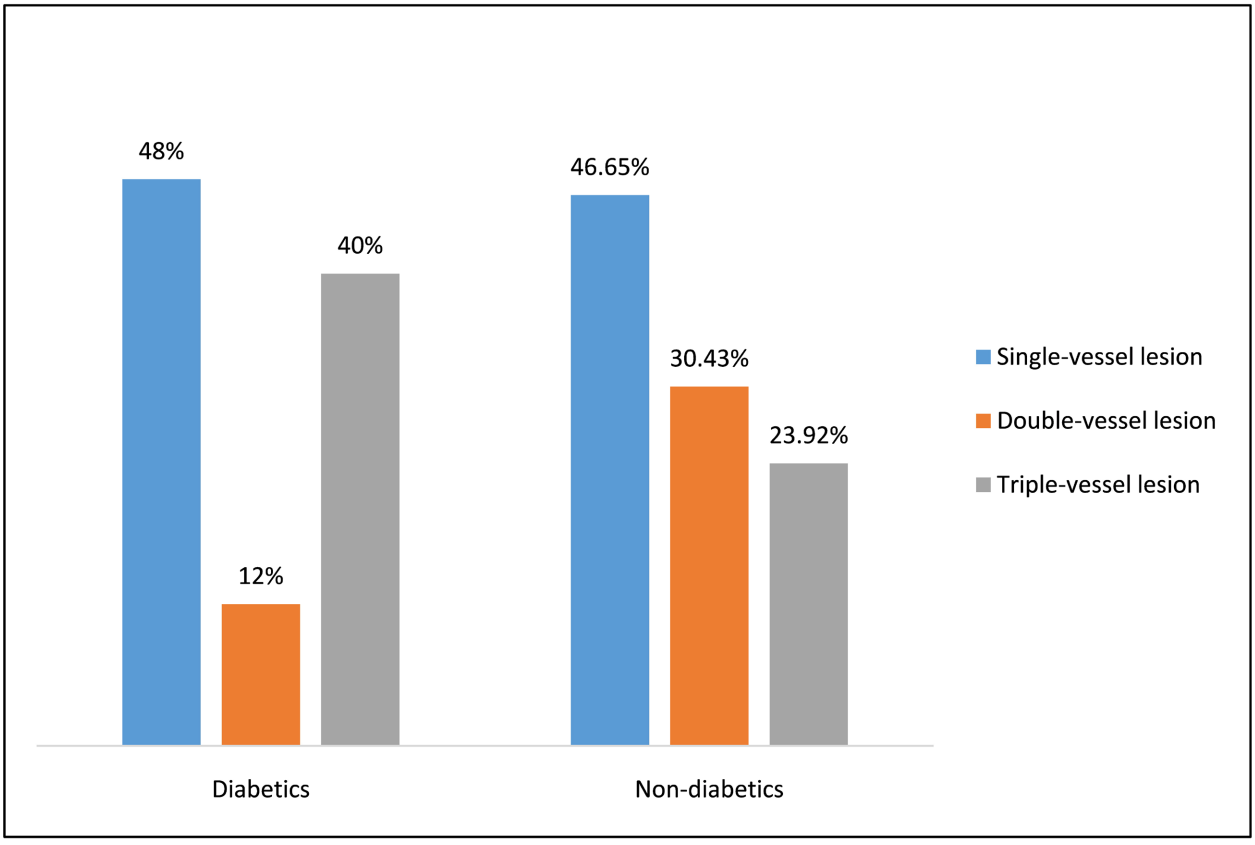

Figure 5. Distribution of STEMI patients by type of coronary artery involvement.

Treatment and interventions also varied between the groups. Diabetic patients were less often subjected to thrombolysis compared to non-diabetics, and the time to treatment was longer in diabetics, which negatively impacted their clinical outcomes. Figure 6 shows the distribution of STEMI patients based on the delay in thrombolysis relative to the onset of chest pain.

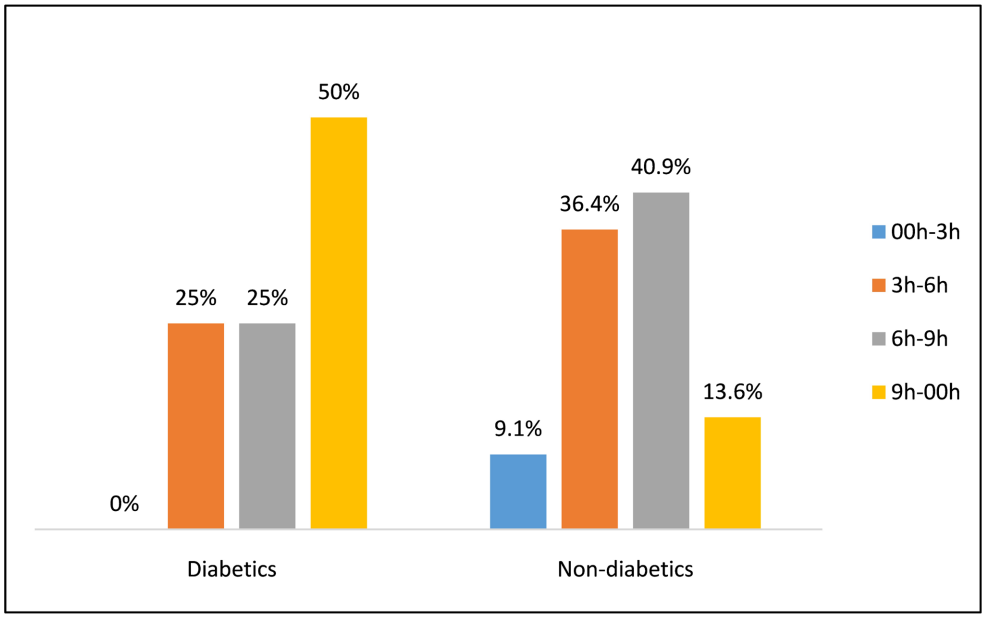

Figure 6. Distribution of STEMI patients based on the thrombolysis time relative to the onset of chest pain.

The evolution showed more severe complications in diabetics, such as acute pulmonary edema, cardiogenic shock (13.89% vs. 8.2%), conduction disorders (11.11% vs. 1.64%), and cerebral infarction (5.56% vs. 4.92%). Mortality was also higher in diabetics (5.56%) compared to non-diabetics (3.28%).

4. Discussion

The main limitation of our study is the small sample size, which is attributed to the study being monocentric, conducted in a hospital on the outskirts of Dakar that had only recently acquired a coronary angiography room. A larger sample size would have provided more robust data and potentially more significant results.

The study shows that 37.11% of patients with acute coronary syndrome with persistent ST-segment elevation (STEMI) were diabetic. This prevalence is consistent with rates observed in other studies. For example, Iqbal in Pakistan [2] reported a prevalence of 32%, and the international GRACE registry reported a prevalence of diabetes among STEMI patients ranging from 20% to 30% [14].

The female predominance observed among diabetic patients (72.2%) contrasts with most studies, which report a male predominance in the general population of diabetic STEMI patients, as seen in studies conducted in England and Karachi

[15], and in Pakistan [2] with a male/female ratio of 1.5 (P = 0.02) among diabetics and 5.8 (P = 0.001) among non-diabetics. This result suggests a possible geographic or sociocultural variation in the profile of diabetic patients with STEMI.

Diabetic patients in the study had a higher average number of cardiovascular risk factors than non-diabetic patients (3.5 ± 1.1 vs. 2.6 ± 1.2, p = 0.003), with more frequent hypertension (61.11% vs. 36.07%, p = 0.012) and more prevalent obesity and sedentary lifestyles. These observations are consistent with the literature, which shows that diabetic patients often have an accumulation of cardiovascular risk factors [16]-[18]. Additionally, smoking was less frequent among diabetics (25% vs. 47.54%, p = 0.017), a finding also reported by Iqbal, who found a higher number of smokers among non-diabetics (p = 0.000003) [2]. This could be related to greater awareness of the dangers of smoking in this population.

The admission time to the Emergency Department (ED) was longer for diabetics (34.8 ± 51.6 hours) compared to non-diabetics (23.3 ± 52.3 hours). More than half of the diabetics were admitted after the 12th hour following the onset of chest pain, a critical delay with prognostic implications. The literature shows that delays in the management of STEMI are associated with increased mortality and complications [2] [19]. Diabetics were also less likely to receive thrombolysis, which could partly explain the more unfavorable clinical outcomes observed in this study.

Chest pain, the dominant symptom, was less typical among diabetics (41.67% vs. 60%, p = 0.571), an observation often reported in the literature [2] [20]. Diabetic patients tend to present with atypical or less intense symptoms, delaying diagnosis and treatment. Biologically, diabetics had significantly higher levels of blood glucose and glycated hemoglobin, which is expected and well documented in the literature [2]. However, the average troponin level was paradoxically lower in diabetics (403 ± 942 ng/L vs. 1453 ± 2677 ng/L). This difference could be explained by biological variability or differences in clinical presentation and initial management.

On the electrocardiogram, anterior and inferior infarctions occurred at a higher percentage in both diabetic and non-diabetic patients, compared to infarctions in other territories, consistent with the literature [2] [15] [21].

Complications were more severe and more frequent in diabetics, with higher rates of cardiogenic shock, conduction disorders, and cerebral infarction. These results were almost similar to an earlier study from Pakistan, suggesting their importance among people in Pakistan [17].

Mortality was also higher among diabetics. These results align with the literature [19] [22]. A study from Greece reported higher in-hospital mortality in diabetics [7]. Another study had similar results of higher mortality in diabetic patients [18]. These results show that diabetic patients have a less favorable prognosis after STEMI due to factors such as the presence of comorbidities, the severity of coronary involvement, and delays in management.

5. Conclusion

This study confirms that diabetic patients with STEMI represent a high-risk population with distinct clinical characteristics, longer admission delays, and a greater accumulation of cardiovascular risk factors. The less favorable clinical outcomes observed in diabetic patients highlight the importance of prompt and tailored management, as well as targeted prevention strategies for this population. Compared to the literature, this study provides additional evidence on the specific challenges faced by diabetic patients in the context of acute coronary syndromes. Interventions aimed at improving early detection and management of risk factors in diabetics are crucial for enhancing their prognosis.

Trial Registration

Retrospectively and Prospectively Registration.

Article Type

Original Investigation.

Ethics Approval and Consent to Participate

This study was approved by the ethics committee of Cheikh Anta Diop University of Dakar. All patients included in the study signed a written informed consent. For patients who were in shock, the consent was signed by a trusted person.

Consent for publication

Not Applicable.

Availability of data and Materials

The data and materials of this study are available upon request and ready to be shared. For further information, please contact the corresponding author, Aliou Alassane NGAIDE.

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The study did not receive any funding.

Authors and Contributors

Aliou Alassane NGAIDE, and Abdoul KANE designed the study protocol, participated in the data collection and writing of the draft manuscript.

Ngone Diaba GAYE and Momar DIOUM oversaw the execution of the study, participated in data analysis and critically revised the manuscript for important intellectual content.

Massar WAGUE and Aliou Alassane NGAIDE participated in study design and in data analysis.

Joseph Salvador MINGOU and Alassane MBAYE participated in statistical

analysis and interpretation of results.

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Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

References

[1] Hampton, J. and Gray, A. (1998) The Future of General Medicine; Lesson from an Admission Ward. *The Journal of the Royal College of Physicians*, **32**, 39-43.

[2] Iqbal, M.J., Azhar, M., Javed, M.T. and Tahira, I. (2008) Study on ST-Segment Elevation Acute Myocardial Infarction (STEMI) in Diabetic and Non-Diabetic Patients. *Pakistan Journal of Medical Sciences*, **24**, 786-791.

[3] Wild, S., Roglic, G., Green, A., Sicree, R. and King, H. (2004) Global Prevalence of Diabetes: Estimates for the Year 2000 and Projection for 2030. *Diabetes Care*, **27**, 1047-1053. https://doi.org/10.2337/diacare.27.5.1047

[4] Boyle, J.P., Honeycutt, A.A., Narayan, K.M.V., Hoerger, T.J., Geiss, L.S., Chen, H., *et al*. (2001) Projection of Diabetes Burden through 2050: Impact of Changing Demography and Disease Prevalence in the US. *Diabetes Care*, **24**, 1936-1940. https://doi.org/10.2337/diacare.24.11.1936

[5] Tschöpe, D. (2006) Diabetiker in der Sekundärprävention. *Clinical Research in Cardiology*, **95**, vi23-vi27. https://doi.org/10.1007/s00392-006-1805-5

[6] Dirkali, A., van der Ploeg, T., Nangrahary, M., Cornel, J.H. and Umans, V.A.W.M. (2007) The Impact of Admission Plasma Glucose on Long-Term Mortality after STEMI and NSTEMI Myocardial Infarction. *International Journal of Cardiology*, **121**, 215-217. https://doi.org/10.1016/j.ijcard.2006.08.107

[7] Pitsavos, C., Kourlaba, G., Panagiotakos, D.B. and Stefanadis, C. (2007) Characteristics and In-Hospital Mortality of Diabetics and Nondiabetics with an Acute Coronary Syndrome; the GREECS Study. *Clinical Cardiology*, **30**, 239-244. https://doi.org/10.1002/clc.20078

[8] Laing, S.P., Swerdlow, A.J., Slater, S.D., Botha, J.L., Burden, A.C., Waugh, N.R., *et al*. (1999) The British Diabetic Association Cohort Study, II: Cause-Specific Mortality in Patients with Insulin-Treated Diabetes Mellitus. *Diabetic Medicine*, **16**, 466-471. https://doi.org/10.1046/j.1464-5491.1999.00076.x

[9] Lindeman, R.D., Romero, L.J., Hundley, R., Allen, A.S., Liang, H.C., Baumgartner, R.N., *et al*. (1998) Prevalences of Type 2 Diabetes, the Insulin Resistance Syndrome, and Coronary Heart Disease in an Elderly, Biethnic Population. *Diabetes Care*, **21**, 959-966. https://doi.org/10.2337/diacare.21.6.959

[10] Danaei, G., Lawes, C.M., Vander Hoorn, S., Murray, C.J. and Ezzati, M. (2006) Global and Regional Mortality from Ischaemic Heart Disease and Stroke Attributable to Higher-Than-Optimum Blood Glucose Concentration: Comparative Risk Assessment. *The Lancet*, **368**, 1651-1659. https://doi.org/10.1016/s0140-6736(06)69700-6

[11] Zhou, C. and Byard, R.W. (2017) An Analysis of the Morbidity and Mortality of Diabetes Mellitus in a Forensic Context. *Journal of Forensic Sciences*, **63**, 1149-1154. https://doi.org/10.1111/1556-4029.13674

[12] Einarson, T.R., Acs, A., Ludwig, C. and Panton, U.H. (2018) Prevalence of Cardiovascular Disease in Type 2 Diabetes: A Systematic Literature Review of Scientific Evidence from across the World in 2007-2017. *Cardiovascular Diabetology*, **17**, Article No. 83. https://doi.org/10.1186/s12933-018-0728-6

[13] Punthakee, Z., Goldenberg, R. and Katz, P. (2018) Definition, Classification and Diagnosis of Diabetes, Prediabetes and Metabolic Syndrome. *Canadian Journal of Diabetes*, **42**, S10-S15. https://doi.org/10.1016/j.jcjd.2017.10.003

[14] Byrne, R.A., Rossello, X., Coughlan, J.J., Barbato, E., Berry, C., Chieffo, A., *et al*. (2023) 2023 ESC Guidelines for the Management of Acute Coronary Syndromes. *European Heart Journal*, **44**, 3720-3826. https://doi.org/10.1093/eurheartj/ehad191

[15] Tipoo, F.A., Quraishi, A.R., Najaf, S.M., Kazmi, K.A., Jafary, F., Dhakam, S., *et al*. (2004) Outcome of Cardiogenic Shock Complicating Acute Myocardial Infarction. *Journal of College of Physicians and Surgeons Pakistan*, **14**, 6-9.

[16] Esteghamati, A., Abbasi, M., Nakhjavan, M., Yousefizadeh, A., Basa, A.P. and Afshar, H. (2006) Prevalence of Diabetes and Other Cardiovascular Risk Factors in an Iranian Population with Acute Coronary Syndrome. *Cardiovascular Diabetology*, **5**, Article No. 15.

[17] Abid, A.R., Malick, N.H., Shahbaz, A. and Tarin, S.M.A. (2005) In-Hospital Outcome of Acute Myocardial Infarction (ST Segment Elevation Type) in Diabetics and Non-Diabetics. *Journal of College of Physicians and Surgeons Pakistan*, **15**, 524-527.

[18] Atmaca, A., Gogan, S., Dagdele, S., Kabakci, G., Kes, S., Nazli, N., *et al*. (2006) Management and In-Hospital Outcome of Patients with First Episode of Acute Myocardial Infarction: Impact of Diabetes Mellitus. *Journal of the National Medical Association*, **98**, 1752-1757.

[19] Iqbal, M.J., Javed, M.T. and Tahira, I. (2011) Complication and Mortality in ST-Segment Elevation Acute Myocardial Infarction in Diabetic and Non-Diabetic Patients. *Medical Journal of Islamic World Academy of Sciences*, **19**, 87-94.

[20] Comtois, R., Lemay, C. and Laliberte, A. (1995) Coexistence of Hypothyroidism and Myocardial Infarction. *Canadian Journal of Cardiology*, **11**, 37-42.

[21] Čulić, V., Mirić, D. and Jukić, I. (2003) Acute Myocardial Infarction: Differing Pre-Infarction and Clinical Features According to Infarct Site and Gender. *International Journal of Cardiology*, **90**, 189-196. https://doi.org/10.1016/s0167-5273(02)00563-6

[22] Jaski, B.E., Cohen, J.D., Trausch, J., Marsh, D.G., Bail, G.R., Overlie, P.A., *et al*. (1992) Outcome of Urgent Percutaneous Transluminal Coronary Angioplasty in Acute Myocardial Infarction: Comparison of Single-Vessel versus Multivessel Coronary Artery Disease. *American Heart Journal*, **124**, 1427-1433. https://doi.org/10.1016/0002-8703(92)90053-x