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Cross-sectional Study

Predictive factors of heart failure in acute coronary syndrome: Institutional cross-sectional study

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ABSTRACT

Background: Heart failure complicating acute coronary syndrome (ACS) remains a challenge because it is associated with a high risk of mortality at 1 year.
Our objective is to highlight the factors frequently associated with heart failure following an ACS and thus deduce the predictive factors for the occurrence of heart failure.
Methods: ACS patients who were managed between 01/01/2021 to 06/30/2021 at the authors' institution were included retrospectively in the analysis.
Results: One hundred twenty-one patients (121) included. Eighty-seven were males (72%), and the mean age was 59.4 ± 8.8. Most patients were smokers (58.7%),40% were diabetic, and 40.5% were hypertensive. Dyslipidemia was found in 37.2% of cases. 75% of patients were admitted for STEMI, and 25% for NSTEMI. The majority of patients (67.5%) were admitted out of time. The anterior electrical territory was found as a factor in the occurrence of heart failure (OR = 5.47, 95% CI (2.16–15.26), P = 0.0005). Among the patients who presented a heart failure, 64% had an LVEF <40%, and only 3% with an LVEF >50% (P < 0.001). Also, 76% had a Wall Motion Index Score (WMSI) of 1.5 (P < 0.001). Angioplasty was the treatment of choice in 65%, aortocoronary bypass in 7% of cases, and medical treatment alone, associated or not with ischemia/viability tests in 28% of cases. Patients admitted out of time (>12 h) were found to be a factor in the occurrence of HF (OR = 3.31,95% CI (1.21–10,60), P = 0.02). The outcome was favorable in 93% of cases. We observed 9 cases of complications including 4 deaths from cardiogenic, septic, and hemorrhagic shock.
Conclusions: This study allows us to identify patients at risk of developing heart failure and patients with a more reserved prognosis. Besides, our findings will allow our peers and colleagues to be able to detect early these factors and optimize adequate management to avoid heart failure.

1. Background

Heart failure (HF) and acute coronary syndromes (ACS) are the main causes of death and hospitalization in industrialized countries [1]. Despite the multiple diagnostic and therapeutic advances in STEMI, there remains a marked residual risk that maintains high mortality (2.3).

The delay in care is a determining factor in the occurrence of complications and this problem is still frequent in our context.

This is why it seemed interesting to us to highlight the factors frequently associated with heart failure following an ACS and thus deduce the predictive factors for the occurrence of heart failure.

2. Methods

2.1. Ethics statement

The respect for anonymity and confidentiality were taken into consideration when collecting the data. Also, it only projects questions

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of a general nature or relating to a trial, experiment, or biomedical study relating to human beings examined. Ethics Committee for Biomedical Research of Mohammed V University, Rabat, Morocco. (CERB) http://fmp.um5.ac.ma/sites/fmp.um5.ac.ma/files/docs/rglement_interieur_cerb_2010.pdf.

2.2. Study population

This retrospective single institutional review of patient data was done at a single academic institution. All patients diagnosed with Acute Coronary Syndrome complicated or not by heart failure over a period of 6 months from 01/01/2021 to 06/30/2021, were screened for inclusion. All patients with Acute Coronary Syndrome (ACS) whose diagnosis based on the definition criteria below for ESC [4] complicated or not with heart failure according to the definition of ESC [5] were included in the study. Patients with unstable angina without troponin elevation were excluded. Patients with a long history of heart failure on admission. Patients with severe valve disease on admission or non-ischemic cardiomyopathy. Recurrences of myocardial infarction. Incomplete records. The work has been reported in line with the STROCSS criteria [6].

2.3. Data acquisition and study outcomes

The retrospective analysis was made by collecting data from our institution's health system register and the clinical files of the patients.

The parameters analyzed were as follows: anamnestic data (age, sex, cardiovascular risk factors), clinical presentation (functional signs such as chest pain, dyspnea, and physical sign according to the Killip classification), electrocardiographic abnormalities (territory anterior, extended anterior, inferior, lateral and extended to the RV), biological (troponin, complete blood electrolytes), echocardiographic (kinetic disorder, Wall Motion Score Index, LV systolic function and complications) and coronarographic (coronary involvement) from reports of coronary angiograms, therapeutic modalities and outcomes during hospitalization.

The primary outcome is to highlight the factors frequently associated with heart failure following an acute coronary syndrome and the secondary outcome is to deduce the predictive factors for the occurrence of heart failure.

2.4. Operational definition of terms

ACS includes a continuum of acute manifestations of atherosclerosis: unstable angina, NSTEMI, and STEMI. Acute myocardial infarction (modified from the fourth universal definition of myocardial infarction) is defined by the detection of a rise or fall in cardiac troponin of which at least one value is above the limit 99th percentile baseline and clinical evidence of infarction of at least one of the elements (symptoms of myocardial ischemia, new ischemic electrocardiographic changes, development of pathological Q waves, imaging evidence of new myocardial loss or new regional wall motion abnormality or identification of a coronary thrombus by angiography) [4]. In ACS without ST-segment elevation, two cases must be distinguished: on the one hand unstable angina, characterized by the absence of elevation of biomarkers, and on the other hand, NSTEMI, characterized by the elevation of troponin.

- On the other hand, we also retained the diagnosis of HF based on clinical-echocardiographic criteria, and classified the type of HF according to the degree of LVEF alteration according to the latest ESC 2021 guidelines, as follows: HF with reduced ejection fraction (LVEF< 40%), HF with moderately reduced ejection fraction (LVEF between 40 and 49%) and HF with preserved ejection fraction (LVEF >50%) [5].
- Wall Motion Score Index: Provides a simple alternative to LVEF as a method of quantifying left ventricular systolic function after MI [7]. It is a score that allows for evaluating the different myocardial segments in which a high score indicates a severe alteration of the systolic function of the left ventricle. It better reflects disturbances of kinetics than LVEF, because compensatory hyperkinesis of unaffected walls can compensate for impaired systolic function [8,9].

The diagnosis of heart failure in our study was based on clinical and/or echocardiographic signs. BNP was not taken into account because we do not have this analysis throughout the study.

2.5. Statistical analysis

The data collected was entered using (Excel 2010 software). Statistical analysis was performed using (JAMOVI version 1.6 software).

The quantitative variables were expressed as a mean plus or minus standard deviation if the distribution of the variable is normal (Gaussian) or as the median if the distribution of the variable is asymmetrical (non-Gaussian).

The qualitative variables were expressed in number and percentage. In univariate analysis, the qualitative variables were described in number and percentage and the comparative study was made by the Khi-square or Fischer exact test.

The quantitative Gaussian distribution variables were expressed as mean and standard deviation and were compared by the Student test.

In multivariate analysis, for each variable of interest, we chose variables that have an influence and integrated them into a multivariate model using the R statistical software. The p-value was considered significant for a value less than 0.05.

3. Results

Amongst 175 patients, 54 patients (30.86%) were excluded because of unstable angina without troponin elevation, a previous history of heart failure at admission, severe valvular disease at admission or no ischemic cardiomyopathy, recurrent myocardial infarction and incomplete records. Thus 121 patients (69.14%) were included for analysis.

3.1. Epidemiologic and clinical aspects

Eighty-seven were males (72%), and the mean age was 59.4 ± 8.8. Most patients were smokers (58.7%),40% were diabetic, and 40.5% were hypertensive. Dyslipidemia was found in 37.2% of cases and coronary heredity was 5%.75% of patients were admitted for STEMI, and 25% for NSTEMI. The majority of patients (67.5%) were admitted out of time (Table 1). The diagnosis of heart failure was retained in 33 patients, i.e. 27.3%. According to the classification of Killip, 25% of our patients had heart failure and 2% had presented a state of cardiogenic shock.

3.2. Paraclinical aspects

The incidence of LV dysfunction was 56%, of which 27% had an LVEF<40%.

Coronary angiography found single-vessel lesions in 45% of cases, and bi-vessel and tri-vessel lesions in 26% of cases. The anterior interventricular was the culprit lesion in 67% of cases followed by the right coronary artery in 19.8%. Angioplasty was the treatment of choice in 65%, coronary artery bypass grafting (CABG) in 7% of cases, and medical treatment alone, associated or not with ischemia/viability tests in 28% of cases.

The diagnosis of heart failure was retained in 33 patients (27%). The mean age was similar between patients with heart failure and patients without heart failure (61.2 ± 7.1 vs 58.7 ± 9.2) (P = 0.1).

The proportion of men and women was 67% and 33%, respectively, and that of patients without heart failure was 74% and 26%, respectively. No significant difference was found between age groups and gender (P = 0.49) also for cardiovascular risks such as smoking,

Table 1
Distribution of patients according to the characteristics of the general population.

Characteristics	General population
Age	59,4 ± 8,8
Male	87(72%)
Diabetes	48(40%)
HTA	49(40,5%)
Tobacco	71(58,7%)
Dyslipidemia	45(37,2%)
Menopause	30(24,8%)
Coronary heredity	6(5%)
Delays less than 12 h	39(32%)
Heart failure	33(27,3%)
Electrical characteristics	
Extended anterior	36(40%)
Anterior	23(25%)
Inferior	25(28%)
Lateral	3(3%)
Extended to RV	4(4%)
Echocardiography characteristics	
Akinenia	88(50%)
Hypokinesia	81(46%)
Normokinesia	7(4%)
LVEF	
Preserved	53(44%)
Moderately reduced	35(29%)
Reduced	33(27%)
Angiography characteristics	
Monotroncular	59(45%)
Bitroncular	29(26%)
Tritroncular	29(26%)
Normale	4(3%)
Culprit lesion	
Anterior interventricular (IVA)	61(67%)
Right coronary (CD)	18(19,8%)
Circonflex (Cx)	8(8,8%)
Others	4(4,4%)
Treatment	
ATL	79(65%)
CABG	8(7%)
Medical treatment±explorations	34(28%)

dyslipidemia, and diabetes (P = 0.5, P = 0.3, P = 0.7).

However, high blood pressure approaches the significance threshold with a P = 0.07 (Table 2). In the population of patients with Heart Failure, 28 patients (85%) were admitted after 12 h.

Among the patients who presented an HF, 85% were admitted after the delay (>12 h) and 15% within the delay, including 12% between 6 h and 12 h (P = 0.020) (Table 2).

In our study population, among patients with ACS complicated by HF, 91% had STEMI vs 9% NSTEMI with a P < 0.014. Patients who developed heart failure had lower systolic blood pressure (SBP) on admission (114 ± 16 vs 129 ± 22 mmHg; with p = 0.008) and a higher heart rate (89 ± 15 vs 79 ± 17 bpm with P = 0.011).

In the category of patients who presented an ACS complicated by HF, the anterior territory was found in 83.3% of cases and the other territories in 16.7% (P = 0.010). In addition, the patients having presented a lower MI, the proportion of patients having presented an HF was 16% (p = 0.10). These patients were admitted out of time and presented on coronary angiography with multi-vessel damage.

On the echocardiographic level in patients who presented an ACS complicated with HF, 94% had akinetic zones against 6% with a significant P < 0.001 with a predominance of the anterior territory, the apex, and adjacent segments with a p-value respectively at 0.05 and 0.012. The lateral and inferior territory with a non-significant p-value of 0.172 and 0.358 respectively. Among the patients who presented an HF, 64% had an LVEF <40%, and only 3% with an LVEF >50% (P < 0.001). Of the patients with HF, 76% had a Wall Motion Index Score (WMSI) of 1.5 with a significant (P < 0.001) (Table 2).

Regarding the coronarography, nearly half of the patients with tri-vessel lesions had presented heart failure with a significant difference (p = 0.05). The anterior interventricular (AIV) is the significant predominant location in the group of patients with heart failure (P = 0.003). The statistical analysis of the guilty lesion found significantly a predominance of AIV (P = 0.034).

3.3. Management and outcomes

From a therapeutic point of view, the delay in treatment has reduced the use of reperfusion therapies in all patients. Although the use of reperfusion angioplasty is lower in the group with heart failure was not significant (p = 0.28) (Table 2).

Angioplasty was the treatment of choice in 65%, aortocoronary bypass in 7% of cases, and medical treatment alone, associated or not with ischemia/viability tests in 28% of cases.

Among the patients admitted for STEMI who underwent angioplasty, only 30 patients (47%) were on time, and 53% were out of time, including 5 dilated just with the balloon. Patients were dilated up to 48 h from the infarction even in the absence of recurrence based on the recommendations.

During our study, the evolution was favorable in the majority of cases (93%). Unfortunately, we observed 9 cases of complications including 4 deaths from cardiogenic, septic, and hemorrhagic shock (Table 2).

Among patients with ACS complicated by HF, in multivariate analysis and after adjustment, STEMI was found as a significant risk factor (OR = 4.43, 95% CI (1.38–20.79) P = 0.02).

Adjusting for cardiovascular risk factors, age is not a risk factor for heart failure (OR = 1.042, P = 0.10). And by adjusting for cardiovascular risk factors, women have 3 times more risk of developing heart failure (P = 0.20), diabetics have 1.6 times more risk of developing HF (P = 0.28) and hypertension is not a risk factor for the occurrence of HF (OR = 0.96 P = 0.06)(Table 3).

The anterior electrical territory was found as a significant factor in the occurrence of HF (OR = 5.47 95% CI (2.16–15.26), P = 0.0005). Patients admitted out of time (>12 h) were found to be a significant factor in the occurrence of HF (OR = 3.31, 95% CI (1.21–10,60), P = 0.02) (Table 3).

4. Discussion

4.1. Key results

In our study, the predictive factors found in our study are STEMI(P = 0.014), the territory of the anterior MI(P = 0.0005), high heart rate(P = 0.011) and low systolic blood pressure on admission(P = 0.008), delay in consultation (out of time:> 12 h) (P = 0.02), LV dysfunction(P = 0.001) and WMSI>1.5(P = 0.001), three-vessel disease (P = 0.034) and in particular the anterior interventricular (AIV)(P = 0.20).

Despite the multiple diagnostic and therapeutic advances in ACS, there remains a marked residual risk that maintains high mortality [2,3]. The incidence of heart failure after myocardial infarction is highest in the first months, then decreases and remains stable at a rate of 1.3–2.2% per year [10]. Patients who have suffered a myocardial infarction represent a group at high risk of developing heart failure, a delay in diagnosis compromises the prognosis of the patient and increases the costs, hence the importance of looking for predictive factors in order to prevent the occurrence of heart failure.

MI that are complicated by heart failure are the prerogative of patients who present to the hospital late [11]. This has been clearly demonstrated in our study where the probability of having an HF is 3 times higher in patients admitted late compared to those admitted on time. This is explained by the fact that in our training, we suffer from a delay in taking charge of the recommended deadlines.

The absence or atypia of clinical symptoms in some patients, and also the inadequacy of the services providing medical transport for patients,

Table 2
Characteristics according to the results of univariate analysis.

Characteristics	General population	Univariate					
		No Heart failure	Heart failure	P value	OR	IC 95% Min	IC 95% Max
	Total number = 121	Total number = 88	Total number = 33				
Age[a]	59,4 ± 8,8	587 ± 92	61,2 ± 7,1	0,1	1,03	0,9	1,084
Gender(M/F)[b]	87(72)/34(28)	65(73,9)/23(26,1)	22(667)/11(333)	0,49	0,7	0,29	1,68
Hypertension(Yes/No)[b]	49(40,5)72(59,5)	40(45,5)/48(54,5)	9(27,3)/24(72,7)	0,07	0,75	0,18	1,08
Diabetes(Yes/No)[b]	48(40)73(60)	34(39,1)/54(60,9)	14(42,4)/19(57,6)	0,7	1,15	0,50	2,59
Tobacco(Yes/No)[b]	71(58,7)/50(41,3)	53(60,2)/35(39,8)	18(54,5)/15(45,5)	0,5	0,79	0,35	1,78
Dyslipidemia(Yes/No)[b]	45(37,2)/76(62,8)	35(39,8)/53(60,2)	10(30,3)/23(69,7)	0,3	0,65	0,28	1,55
Time delay (<12/>12 h)[b]	39(32,2)/82(67,8)	34(38,7)/54(61,3)	5(13,2)/28(84,8)	**0,014**	**3,53**	1,24	10
STEMI(Yes/No)[b]	91(75,2)/30(24,8)	61(69,3)/27(30,7)	30(90,9)/3(9,1)	**0,014**	**4,43**	1,24	15,8
Systolic blood pressure[a]	126 ± 21,2	129 ± 22,1	114 ± 15,8	**0,008**	0,96	0,94	0,99
Heart rate[a]	81,8 ± 17,4	79.3 ± 17,4	89 ± 15,8	**0,011**	**1,031**	1,006	1,059
Anterior electrical territory(Yes/No)[b]	59(64,8)/32(35,2)	34(55,7)/27(44,3)	25(83,3)/5(16,7)	**0,010**	**4,96**	2,01	12,3
Inferior electrical territory (Yes/No)[b]	25(27,5)/66(72,5)	20(32,8)/41(67,2)	5(16,7)/25(83,3)	0,10	0,41	0,13	1,23
Akinesia(Yes/No)[b]	88(72.7)/33(27.3)	57(64.8)/31(35.2)	31(93.9)/2(6.1)	**0,001**	8,4	1,89	37,6
Hypokinesia(Yes/No)[b]	81(66.9)/40(33.1)	56(63.6)/32(36.4)	25(75.8)/8(24.2)	0,207	1,79	0,72	4,42
LVEF<50%(Yes/No)[b]	68(56.2)/53(43.8)	38(43,2)/50(56,8)	30(90,9)/3(9,1)	**0,001**	13,15	4,27	28,78
WMIs>1,5 (Yes/No)	62(51)/59(49)	37(42)/51(58)	25(76)/8(24)	**0,0015**	4,3	1,81	11,19
Monotroncular (Yes/No)[b]	59(48,8)/62(51,2)	46(52,3)/42(47,7)	13(39,4)/20(60,6)	0,20	0,59	0,26	1,34
Bitroncular(Yes/No)[b]	29(24)/92(76)	21(23,9)/67(76,1)	8(24,2)/25(75,8)	0,96	1,02	0,40	2,60
Tritroncular (Yes/No)[b]	29(24)/92(76)	17(19,3)/71(80,7)	12(36,4)/21(63,6)	**0,05**	2,39	0,98	5,78
Anterior interventricular (Yes/No)[b]	90(74,4)/31(25,6)	59(67)/28(33)	31(93,9)/2(6,1)	**0,003**	7,62	1,70	34,1
Circonflex (Yes/No)[b]	38(31,4)/83(68,6)	28(31,8)/60(68,2)	10(30,3)/23(69,7)	0,87	0,93	0,39	2,22
Right coronary (Yes/No)[b]	50(41,3)/71(58,7)	37(42)/51(58)	13(39,4)/20(60,6)	0,79	0,89	0,39	2,03
Culprit lesion							
IVA (Yes/No)[b]	73(60,3)/48(39,7)	48(54,5)/40(45,5)	25(75,8)/8(24,2)	**0,034**	2,60	1,06	6,40
Cx (Yes/No)[b]	14(11,6)/107(88,4)	11(12,5)/87,5)	3(9,1)/30(90,9)	0,6	0,70	0,18	2,69
CD (Yes/No)[b]	23(19)/98(81)	20(22,7)/68(77,3)	3(13)/30(90.9)	0,089	0,34	0,09	1,23
Evolution (favorable/complicated)[b]	112(92,6)/9(7,4)	82(93,2)/6(6,8)	30(90,9)/3(9,1)	0,67	1,37	0,32	5,81

[a] Mean ± standard deviation.
[b] Number (percentage %).

Table 3
Characteristics according to the results of multivariate analysis.

Characteristics	Heart failure	number (%)	P value	OR ajusté	IC
Âge[a]			0,10	1,042	IC95%= (0,972–1,099)
Female gender[b]	Yes	11 (33%)	0,21	OR:3,8	IC95%= (0,397–3,685)
	NO	23 (26%)		OR:1,00 (ref)	
Diabetes****	Yes	14 (42,4%)	0,28	OR:1,62	IC95%= (0,66–4,02)
	NO	54 (60,9)		OR:1,00 (ref)	
Hypertension****	Yes	9(27,3)	0,06	OR:0,96	IC95%= (0,93–0,98)
	NO	48 (54,5)		OR:1,00 (ref)	
STEMI[c]	Yes	30 (90,9%)	0,02	OR: 4,54	IC95%= (1,38–20,79)
	NO	27 (30,7%)		OR: 1,00 (ref)	
Inferior electrical territory[a]	Yes	5 (16,7%)	0,008	OR: 0,34	IC95%= (0,097–1,07)
	NO	41 (67,2%)		OR: 1,00 (ref)	
Anterior electrical territory[a]	Yes	25 (83,3%)	0,0005	OR: 5,47	IC95%= (2,16–15,26)
	NO	27 (44,3%)		OR: 1,00 (ref)	
Time delay (>12 h) ****	Yes	28 (84,8%)	0,02	OR: 3,31	IC95%= (1,21–10,60)
	NO	34 (38,7%)		OR: 1,00 (ref)	

[a] OR ajusté (Hypertension, diabetes, dyslipidemia, tobacco) **** OR ajusté (age, gender, diabetes).
[b] OR ajusté (Menopause, hypertension, diabetes, dyslipidemia) ***** OR ajusté (Hypertension/Diabetes, dyslipidemia, age).
[c] OR ajusté (age, gender, hypertension, diabetes, dyslipidemia, tobacco).

are factors that explain the delay in the management of these patients.

Age and female sex have been found in the literature [10,12,13] as being a factor in the occurrence of heart failure. In our study, by adjusting for cardiovascular risk factors, women have 3 times more risk of developing HF compared to men (P = 0.20) and for each increase of one year, the probability of an HF is multiplied by 1.042 (P = 0.10). This could be explained by the small size and a low number of elderly people in our study population and the significance could change with a larger sample. Also, the probability in diabetics of developing HF is multiplied by 1.6 times (P = 0.28). On the other hand, hypertension was not found as a predictive factor for the occurrence of heart failure in our study, contrary to what is found in the literature [11,14–16]. It is likely that the small size of our population does not allow us to achieve the necessary statistical power.

From a hemodynamic point of view, several studies have demonstrated that a higher heart rate on admission was a risk factor for heart failure after an acute infarction [3,12,17–19]. This agrees with the results of our study.

Furthermore, studies that have dealt with NSTEMI have not demonstrated this type of correlation. This result is explained by the fact that the heart rate reflects the size of the infarction, and the infarctions with an elevation of the ST segment are more extensive than the NSTEMI [20].

We demonstrated in our study such as O'Connor and colleagues in 2006 that the decrease in blood pressure at admission is linked to early hemodynamic changes predisposing to the development of heart failure and death [21,22].

Prior myocardial infarction is associated with a high risk of remodeling and heart failure [23,24].

The high risk of heart failure associated with anterior MI is due to the large myocardial territory affected, unlike other MI territories [25]. This was demonstrated in our study where the probability of developing HF is 5.4 times higher in patients with a previous MI than in patients with other territories.

Reduced left ventricular ejection fraction (LVEF) is associated with a risk of developing heart failure [12,18,26]. The wall motion score index (WMSI) reflects disturbances in kinetics better than LVEF because compensatory hyperkinesis of unaffected walls can compensate for impaired systolic function 7.8. In a study of 144 patients with a heart attack, WMSI $\geq$1.5 identified those at increased risk of death and heart failure, independent of LVEF. There is a significant correlation between LV dysfunction and/or WMSI $\geq$1.5 at the onset of heart failure in our study.

Multivessel coronary disease reflects a high atherosclerotic burden with endothelial dysfunction and significant systemic inflammation [27].

Patients with multivessel coronary disease are usually older and have diabetes and renal failure as co-morbidities [17,27]. Multivessel coronary disease is associated with a lower ejection fraction [17,27] and an increased risk of major adverse cardiovascular events, including HF, of 80% [27].

5. Limitations

There were several limitations in our study. First, this was a retrospective study that included a small population in a single center. Although we have used a multivariable model to adjust for potential confounders, there may remain unmeasured or residual confounding. Second, we do not have data about biomarkers with utility in HF, such as B-type natriuretic peptide.

6. Conclusions

Heart failure complicating acute coronary syndrome (ACS) remains a challenge because it is associated with a high risk of mortality at 1 year.

This study is on the one hand beneficial because alongside other studies that go in the same direction, allows us to identify patients at risk of developing heart failure and patients with a more reserved prognosis. And on the other hand, it highlights the weakness of our health system where the deadlines are far from the recommended deadlines.

Ethical approval

Not Applicable; It was not required.

The respect for anonymity and confidentiality were taken into consideration when collecting the data. Also, it only projects questions of a general nature or relating to a trial, experiment, or biomedical study relating to human beings examined.

Ethics Committee for Biomedical Research of Mohammed V University, Rabat, Morocco. (CERB) http://fmp.um5.ac.ma/sites/fmp.um5.ac.ma/files/docs/rglement_interieur_cerb_2010.pdf.

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Author contribution

AB: Conceptualization; Methodology; Data collection; Data synthesis; data analysis; writing original draft of manuscript; writing and editing**; FAB:** validation; data curation; supervision; writing; reviewing and editing; **DA**: data collection; reviewing and editing; **FH**: data collection; reviewing and editing; **AEH**: data curation; data analysis; **LO**: Conceptualization; Methodology; validation; supervision; writing and editing; **MC:** validation; supervision; writing and editing. All authors have read and approved the manuscript.

Registration of research studies

Not Applicable, it was not required.

Name of the registry:

Unique Identifying number or registration ID:

Hyperlink to your specific registration (must be publicly accessible and will be checked):

Guarantor

Abakar Bachar MD.
Fatima Azzahra Benmessaoud MD.
Diatta Abdoulaye MD.
Fadoum Hassan MD.
Abbas Ermilo Haroun MD.
Latifa Oukerraj MD.
Mohammed Cherti MD.

Consent

Not Applicable; it was not required; any personal files; images; or identity were not including in our manuscript.

Provenance and peer review

Not commissioned, externally peer reviewed.

Declaration of competing interest

Not applicable; the authors declare that they have no competing interests.

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List of Abbreviations

ACS	Acute Coronary Syndrome
AIV	Anterior Interventricular
BNP	Brain Natriuretic Peptide
CI	Confidence Interval
CABG	Coronary Artery Bypass Grafting
ESC	European Society of Cardiology
HF	Heart failure
LV	Left Ventricular
LVEF	Left Ventricular Ejection Fraction
MI	Myocardial Infarction
OR	Odds Ratio
RV	Right Ventricular
STEMI	ST-Elevation Myocardial Infarction
NSTEMI	No ST-Elevation Myocardial Infarction
SBP	Systolic Blood Pressure
WMSI	Wall Motion Score Index

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