Incidence prevalence and management of different types of arrhythmia in patients with ischemic heart disease in Taif city

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Abstract

Background: Despite considerable progress in management over the recent years, coronary artery disease (CAD) remains the leading cause of death.
Objectives: to assess the different types of arrhythmias in patients with ischemic heart diseases in Taif city.

Methods: A retrospective study was done on 529 patients from Taif, Saudi Arabia aged 30 to >75 years, of both genders and who had CAD, through the review of medical records of cardiac patients in AL Hada armed forces hospital. A checklist was used that included demographic features and risk factors for ischemic heart disease, symptoms of heart failure, medications that patients who had CAD used and types of arrhythmias.

Results: All patients had a type of arrhythmia during their hospital stay. The main types of arrhythmias were AF (26.8 %), conduction disturbance (38.2%) and first-degree heart block (9.1 %). Patients who had STEMI with symptoms of heart failure and arrhythmias had a significantly higher percentage for the need of DC shock compared to other patients. Patients with UA who developed low EF were shown to be significant as regards arrhythmias rather than normal EF. The number of affected vessels had no effect on the development of arrhythmias during the acute stage. The development of arrhythmia that required DC shock was more common in STEMI patients especially those who developed heart failure symptoms.

Conclusion: The need of assessment of heart failure symptoms and EF in patients with UA is essential to determine the need for implantable device insertion. Also, early administration of b-blocker decreases the risk of development of arrhythmia during an acute ischemic event.

Key words: arrhythmias, patients, ischemic, heart, disease, Taif

Introduction

Arrhythmias are an unwanted cardiac event that increases mortality and morbidity in patients with underlying heart illness as well as in healthy people (1,2). Despite recent advances in care, coronary artery disease (CAD) continues to be the major cause of death (3). The development of ventricular tachyarrhythmias during periods of myocardial ischemia or infarction is blamed for many of these deaths. Ionic and metabolic changes characterize myocardial ischemia, resulting in an unstable electrical substrate capable of causing and maintaining arrhythmias, while infarction causes electrical inactivity and prevents conduction (4). The use of device therapy to prevent sudden cardiac death, particularly in individuals with coronary artery disease, has a clear recommendation (5). It is believed that any type of arrhythmia counts as an independent major risk factor with severe LV systolic dysfunction (6,7).

In middle and low-income countries, cardiovascular disease (CVD) accounts for 80% of deaths; this is predicted to rise rapidly, particularly in the Arabian Gulf region's Kingdom of Saudi Arabia (KSA). CVD is also said to be the leading cause of death in Saudi Arabia (8). The single nationally representative study undertaken in Saudi Arabia found a crude prevalence of CVD of 5.5 percent among the Saudi population (9).

A study conducted in 2012 in Saudi Arabia to assess the incidence of ventricular arrhythmia (VA) and associated outcomes in patients with acute coronary syndrome found 5,055 (3.3%) were diagnosed with VA, (98.8%) occurred in-hospital, males were twice as likely to develop VA than females, and systolic blood pressure less than 90 mm Hg was positively associated with VA. The adverse in-hospital outcomes including re-myocardial infarction, cardiogenic shock, congestive heart failure, major bleeding, and stroke were higher for patients with VA (10).

In 2019 a study was done to assess risk factors, etiologies, comorbidities, and outcome of AF. The study found that AF was more prevalent among females in Saudi Arabia. HTN, valvular heart disease, and T2DM were the most prevalent risk factors of AF in Saudi Arabia. Valvular heart disease was more prevalent among older patients and significantly associated with CAD. HTN, CAD, and CKD were the most significant risk factors for HF in patients with AF (11).

In 2019, research was performed in KSA to evaluate the frequency, predictors, and short-term and long-term findings associated with in-hospital sustained ventricular tachycardia (VT) and ventricular fibrillation (VF) in patients with heart failure, collectively referred to as ventricular arrhythmias (VA). The study found that HF in-hospital VA incidence was 4.2%. Men were more likely to have VA, and their average age was younger than non-VA patients. Significant risk factors for VA were smoking and a family history of cardiomyopathy. Arrhythmia, ST-elevated myocardial infarction, infections, and hypotension all remained significant predictors of in-hospital VA, with three to seven times higher risk. When compared to those without VA, patients with VA had greater incidence of in-hospital events such as recurrent HF, haemodialysis, shock, sepsis, major bleeding, intra-aortic balloon pump, and stroke, all of which were very significant (12). The aim of our study was to assess the different types of arrhythmias in patients with ischemic heart diseases in Taif city, KSA.

Methodology

Study design: This is a Retrospective cohort study, conducted in Taif, Saudi Arabia, through review of medical records of cardiac patients in AL Hada armed forces hospital.

Study subjects: The study's population consisted of 30 to >75year old , male and female ischemic cardiac patients including all the patients in cardiology department except those who did not have complete information as well as patients younger than 30 years and those who are not ischemic cardiac patients.

Sample size: Estimated sample size was 529 patients. Systematic random technique was applied, Confidence level was 95%, margin of error 5%.

Method for data collection and instrument: A checklist was used to collect data from medical records. The checklist included demographic features such as age and gender, as well as risk factors for ischemic heart disease,

List of abbreviations

CAD	Coronary Artery Disease
LV	Left ventricle
KSA	Kingdom of Saudi Arabia
VA	Ventricular arrhythmia
AF	Atrial fibrillation
T2DM	Type 2 diabetes mellitus
HTN	Hypertension
CKD	Chronic Kidney disease
VT	Ventricular tachycardia
VF	Ventricular fibrillation
HF	Heart failure

symptoms of heart failure, medications that patients used, types of arrhythmia, and ischemic heart diseases.

Analysis and entry method: Data were analyzed using the (SPSS) statistical program version 25 (IBM SPSS Statistics for Windows, Version 20.0. Armonk, NY: IBM Corp.). Qualitative data was expressed as numbers and percentages, and Chi- squared test ($\chi 2$) was applied to test the relationship between variables. A p-value of <0.05 was considered as statistically significant.

Results

In our study, we succeeded in collecting data of 529 patients with a response rate of 52.9 %. In Table 1, we showed the baseline characters of the patients where most of patients were males (76.2 %) while 50.5 % of patients were between 60-74 years old. Moreover, we found that 12.5 % of patients had more than three risk factors such as smoking, DM, hypertension or family history of ischemic cardiac conditions. Furthermore, 42.9 % of patients had a history of single vessel coronary artery disease, while 62.2 % of them indicated that they did not use B blocker before the current event. Moreover, 30.6 % of patients indicated having symptoms of heart failure, mainly shortness of breath (27.4%).

All patients in our study had a type of arrhythmia during their hospital stay where the main types of arrhythmia were AF (26.8 %), conduction disturbance (38.2%) and first degree Heart block (9.1 %). Moreover, 35.9 % of patients had previous arrhythmia prior to the event and 62.9 % of patients showed ECHO ejection fraction of more than 45. Moreover, 90.9 % of patients did not need an implantable device and almost 85 % of patients needed modification of their medications (Table 2).

Table 3 - patients who had STEMI with symptoms of heart failure and developed arrhythmias showed higher significant percentage for the need of DC shock compared to the others (p=0.001). On the other hand, patients who had UA with symptoms of heart failure and developed arrhythmias and low EF showed significant higher percentage for the need of an implantable device ($\chi 2$=8.6, p-value = 0.014)(Figure 1).

Table 4 shows a non-significant relationship between ACS (STEMI, NSTEMI, UA) with single or multiple vessel diseases and type of arrhythmias (p=> 0.05). This gives an indication of a non-significant effect of number of affected vessels on type of arrhythmia.

Figure 2 shows that patients who had NSTEMI and developed wide complex tachycardia were in needif ICD insertion rather than other complex tachycardia (p=0.045) Table 5 shows that patients who had UA and developed low EF had a significant relationship in development of arrhythmias rather than patients who had UA with normal EF (p=0.03).

Table 6 shows that early initiation of B-blocker in ACS patients showed a significant difference as regards development of arrhythmia when compared to patients without early initiation of B-blocker.

Table 1: Patients' characteristic baseline (N=529).

Variable	No. (%)
Age	
30-54	149 (28.2)
60-74	267 (50.5)
>74	113 (21.4)
Gender	
Male	403 (76.2)
Female	126 (23.8)
Tradition riskfactors (smoking, family history , D.M, HTN)	
2<	263 (49.7)
3	200 (37.8)
>3	66 (12.5)
History of coronary artery disease	
single Vessel disease	227 (42.9)
2 vessel disease	105 (19.8)
3 vessel disease	197 (37.2)
Presence of any symptoms of heart failure (shortness of breath, lower limb edema, admitted with pul. edema)	
Yes	162 (30.6)
No	367 (69.4)

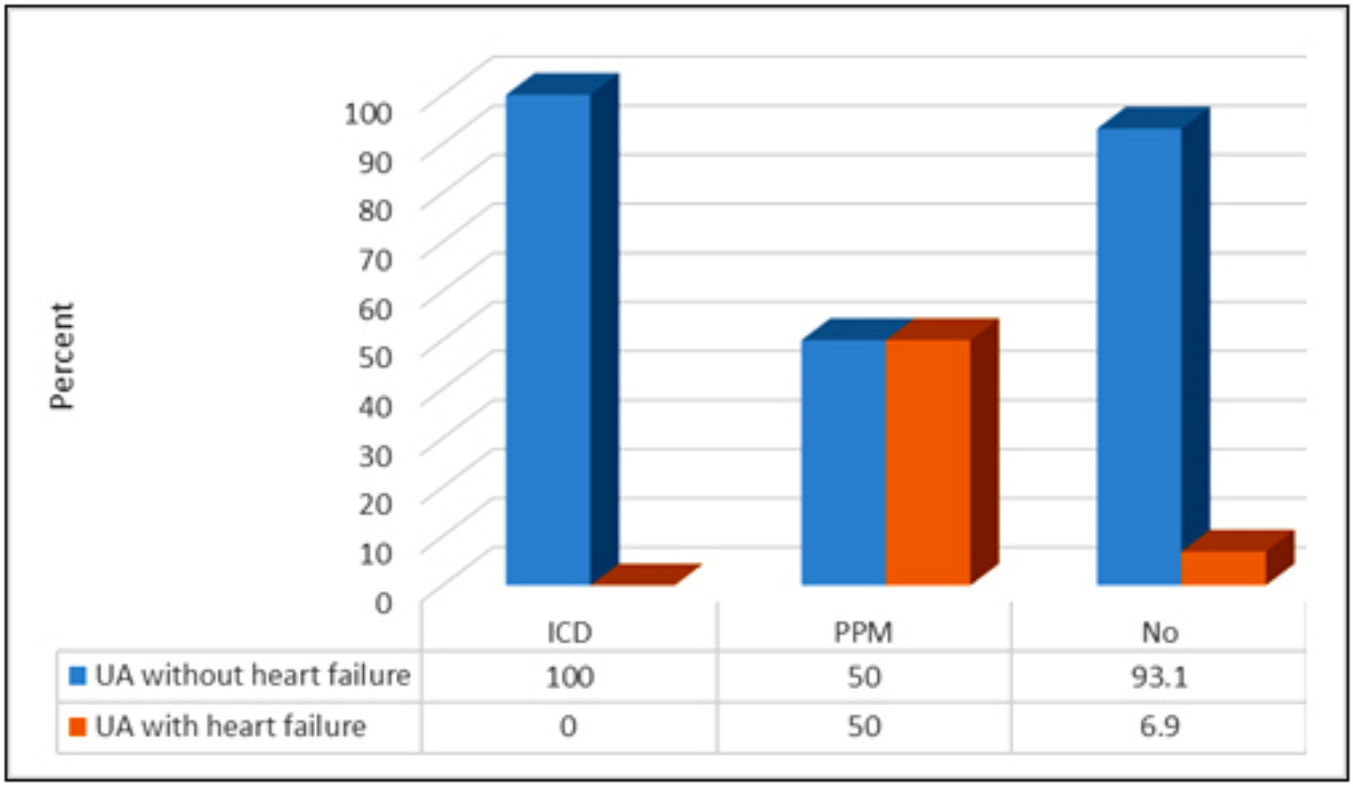
Table 2: Distribution of studied patients according to type of arrhythmia, presence of arrhythmia prior to event, ECHO parameters, need for coronary angiography, implantable device, arrhythmia requiring DC shock (no. 529).

	Variable	No. (%)
Arrhythmias	A. tachycardia	32 (6)
	complete heart block	4 (0.8)
	VT Rt side	3 (0.6)
	VT Lt side	10 (1.9)
	VF	15 (2.8)
	junctional escape	2 (0.4)
	AF	142 (26.8)
	Conduction disturbances	254 (48.1)
	First degree heart block	48 (9.1)
	Second degree heart block Mobitz I	1 (0.2)
	Second degree heart block Mobitz II	1 (0.2)
Presence of arrhythmia prior to event	Yes	190 (35.9)
	No	339 (64.1)
ejection fraction(EF)	<40	196(37.1)
	>40	333 (62.9)
Acute coronary syndrome	STEMI	165 (31.2)
	NSTEMI	287 (54.3)
	UA	77 (14.6)
implantable device	ICD	7 (1.3)
	PPM	41 (7.8)
	No	481 (90.9)
Arrhythmia requiring DC shock	Yes	18 (3.4)
	No	511 (96.6)

Table 3: Relationship between (STEMI) with and without heart failure and types of arrhythmias, DC shock, Implantable device and EF

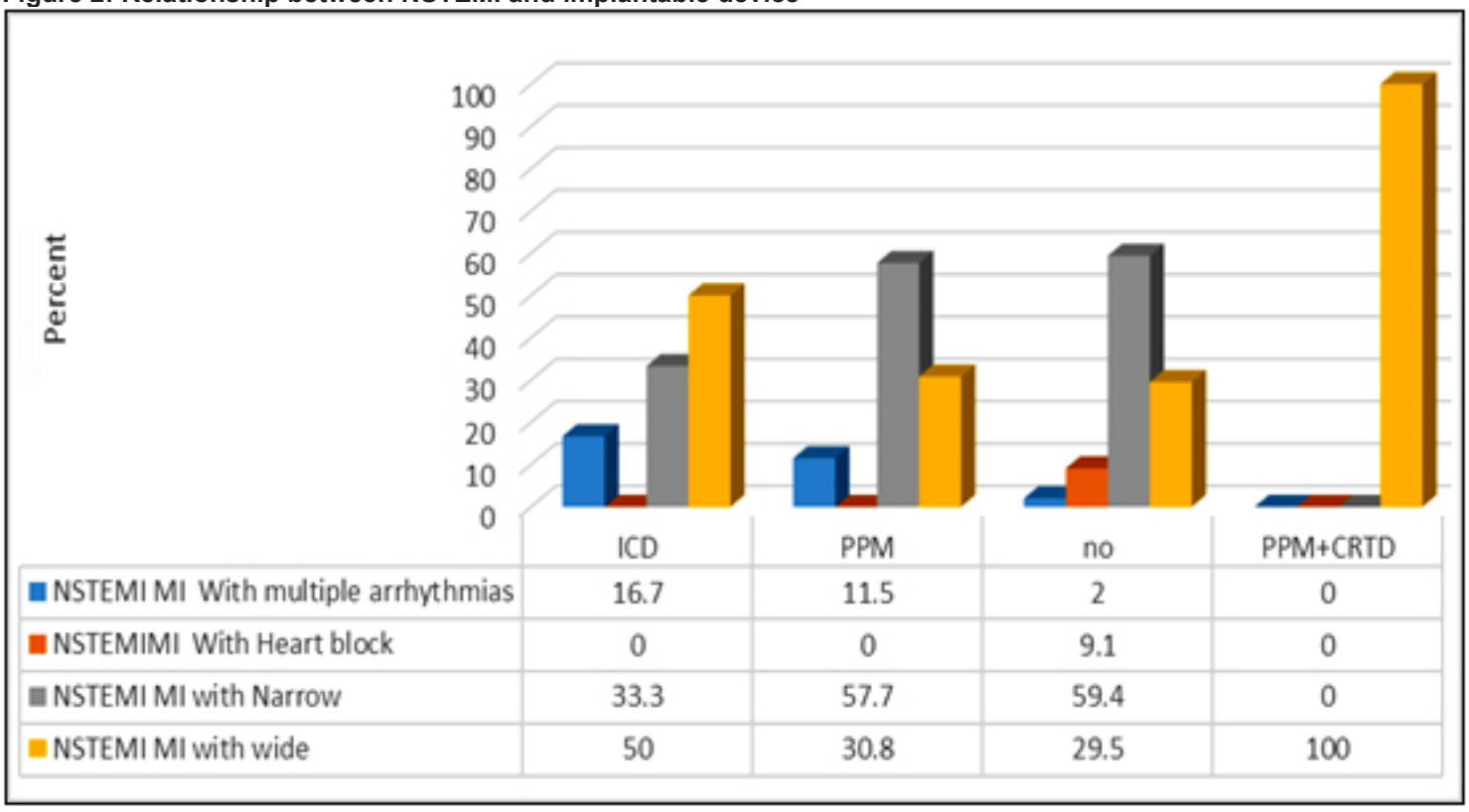
	Variable	STEMI		χ^2	p-value
		STEMI with heart failure (no.:12)	STEMI without heart failure (no. 153)		
Arrhythmias	Wide Complex (VT/VF / junction ectopic)	5 (9.6)	47 (90.4)	2.81	0.421
	Narrow complex (AF/AT)	4 (4.5)	84 (95.5)		
	Heart block	2 (10)	18 (90)		
Medication	Present	12 (8.4)	131 (91.6)	1.99	0.158
	Absent	0 (0.0)	22 (100)		
Arrhythmia requiring DC shock	Yes	4 (30.1)	9 (69.2)	11.55	0.001
	No	8 (5.3)	144 (94.7)		
Implantable device	PPM	0 (0.0)	10 (100)	0.83	0.361
	No	12 (7.7)	143 (92.3)		
	ICD	0(0.0)	(10)100		
EF	EF<40	9 (11.4)	70 (88.6)	3.81	0.051
	EF>40	3 (3.5)	83 (96.3)		

Figure 1: Relationship between UA with and without heart failure and implantable device



	ICD	PPM	No
UA without heart failure	100	50	93.1
UA with heart failure	0	50	6.9

Figure 2: Relationship between NSTEMI and implantable device



	ICD	PPM	no	PPM+CRTD
NSTEMI MI With multiple arrhythmias	16.7	11.5	2	0
NSTEMIMI With Heart block	0	0	9.1	0
NSTEMI MI with Narrow	33.3	57.7	59.4	0
NSTEMI MI with wide	50	30.8	29.5	100

Table 4: Relationship between ACS (STEMI,NSTEMI,UA) with single or multiple vessel diseases and type of arrhythmias

Variable	STEMI		χ2	p-value
	STEMI with single vessel (N0.:63)	STEMI with 2 or multiple vessels (NO.:101)		
Arrhythmias Wide Complex (VT/VF/ junction ectopic) Narrow complex (AF/AT) Heart block	17 (32.7) 34 (39.1) 10 (50)	35 (67.3) 53 (60.9) 10 (50)	1.87	0.599
	NSTEMI		χ2	p-value
	NSTEMI with single vessel	NSTEMI with 2 or multiple vessels		
Arrhythmias Wide Complex (VT/VF/ junction ectopic) Narrow complex (AF/AT) Heart block	34 (39.1) 77 (45.8) 7 (30.4)	53 (60.9) 91 (54.2) 16 (69.6)	4.62	0.202
	UA with single vessel (no.:42)	UA with 2 or multiple vessels (no.:35)		
Arrhythmias Wide Complex (VT/VF/ junction ectopic) Narrow complex (AF/AT) Heart block	13 (56.5) 21 (53.8) 8 (61.5)	10 (43.5) 18 (46.2) 5 (38.5)	2.7	0.44

Table 5: Relationship between UA and implantable device and EF

Variable	UA			χ2	p-value
	UA with wide	UA with Narrow	UA With Heart block		
Implantable device ICD PPM no	 0 (0.0) 2 (50) 21 (29.2)	 0 (0.0) 1 (25) 38 (52.8)	 1 (100) 1 (25) 11 (15.3)	6.44	0.376
EF EF<40 EF>40	 9 (47.4) 14 (24.1)	 4 (21.1) 35 (60.3)	 5 (26.5) 8 (13.8)	8.96	**0.03**

Table 6: Relationship between ACS (STEMI,NSTEMI,UA) with medication and type of arrhythmias

Variable	STEMI		χ^2	p-value
	Early B.B initiation	Late B.B initiation		
Arrhythmias				
Wide Complex (VT/VF/ junction ectopic)	45 (31.5)	6 (27.3)	13.61	0.003
Narrow complex (AF/AT)	82 (57.3)	7 (31.8)		
Heart block	13 (9.1)	7(31.8)		
	NSTEMI & UA		χ^2	p-value
	Early B.B initiation	Late B.B initiation		
Arrhythmias				
Wide Complex (VT/VF/ junction ectopic)	18(32.7)	5(22.7)	9.14	0.027
Narrow complex (AF/AT)	31(56.4)	8(36.4)		
Heart block	5(9.1)	8(36.4)		

Discussion

Arrhythmia is very common in IHD, with high morbidity and mortality. Development of arrhythmias (VAs) in the setting of an acute myocardial infarction (MI) is one of the most common causes of death. However, advancements in arrhythmia detection and treatment have a significant positive impact on the outcome of arrhythmias associated with acute MI, resulting in a better patient prognosis (13). In our study, we aimed to assess the different types of arrhythmias in patients with ischemic heart diseases in Taif city, KSA. This topic is under discussion in the literature review. In our study, the main types of arrhythmia were AF (26.8 %), conduction disturbance (38.2%) and first degree Heart block (9.1 %). Patients with ischemic heart disease were found to have the most VT/VF and AF arrhythmias in another study (14). Atrial fibrillation (AF) is one of the most common arrhythmias, according to Wang TJ (15) and Yong F. (16) who both published similar findings. AF is normal in DCM, and it reduces cardiovascular ability, lowers quality of life, and has been linked to a deteriorating outcome in patients with CHF of various etiologies, including ischemic and non-ischemic CHF (17). Furthermore, the prevalence of patients with STEMI was only 29%, which is significantly lower than M Alassouli's study, which found a prevalence of 70.9 percent (18). Our study found that 3.4 percent of patients need DC shock, which is lower than other studies such as Goldberg RJ's (19) study, which found a prevalence of 7.1 percent, and Holmes DR Jr's (20) study, which found a prevalence of 7.1 percent (20).

A decline in coronary perfusion occurs during ischemia, resulting in muscle hypoxia and necrosis, as well as a reduction in myocardial contractility, which leads to a decrease in cardiac output and a drop in arterial blood pressure. The body responds to this decrease by raising vasoconstriction in order to raise blood pressure; however, this process is only temporary, and coronary perfusion is further disrupted, resulting in myocardiac death (21). As a result, it's not surprising that the need for DC shock is substantially higher in STEMI patients who have experienced heart failure symptoms. However, there was no discernible difference in the types of arrhythmias between STEMI patients.

In our study, we found that the need for implantable device insertion is higher in UA patients who developed symptoms of heart failure. We recommended that patients with UA should be given more attention especially those who are at higher risk to develop heart failure symptoms.

Furthermore, we found that the number of affected vessels did not have an impact on type of arrhythmias in all patients considering patients of STEMI, NSTEMI and UA. This suggests that the number of affected vessels is unrelated to the type of arrhythmias and may be used as an indicator of the type of arrhythmias. This matches the findings of A Miller (22) and a report by P Brezinov (23).
In the present work, it was found that patients who received early B-blocker had a lower risk in developing arrhythmia during acute ischemic event.

Limitations

The main limitation of this study was the absence of control group therefore it is difficult to compare and ensure the reliability of the results. Moreover, this was a retrospective study which possesses some limitations including inability to determine causation of arrhythmias in different populations and un-avoided bias toward some populations. On the other hand, this study represents to our knowledge, the first study that deals with type of arrhythmias in Saudi Arabia.

Conclusion

In this retrospective study, the main types of arrhythmia were AF (26.8%), conduction disturbance (38.2%) and first-degree Heart block (9.1%). Moreover, the prevalence of patients represented with STEMI was 29 %. Development of arrhythmia that required DC shock is more common

in STEMI patients especially those who developed heart failure symptoms. The need for assessment of heart failure and EF in patients with UA is essential to determine the need for implantable device insertion while the number of affected vessels had no effect on the development of arrhythmias during the acute stage. Also early administration of b-blocker decreases the risk of development of arrhythmia during an acute ischemic event. Treating patients who are at high risk of atherosclerotic cardiovascular events with BB, needs further investigation and the outcome predicting factors of these patients may help in the identification of the best management. Until this issue is clarified, there is a need for more randomized clinical trials that will focus on the prognostic factors of early administration of BB as secondary preventive measure.

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