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Research Article

Epidemiological Features of Non-Sustained Ventricular Tachycardia in Acute Coronary Syndrome with ST Segment Elevation.

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Abstract:

Background: Non-Sustained Ventricular Tachycardia is the most frequent ventricular arrhythmias in acute coronary syndrome with ST segment elevation, the assessment of its incidence and prognosis have been the subject of several international studies, but its epidemiological data is lacking in Algeria.

Aims: The main objective of our study is the determination of the frequency of Non-Sustained ventricular tachycardia in acute coronary syndrome with ST segment elevation, the secondary objective was the analysis of predictive factors of this arrhythmia, and related mortality.

Methods and materials: In this prospective study, conducted in the cardiology department of Hussein Dey hospital (Algiers-Algeria), 467 patients with acute coronary syndrome with elevated ST segment (87 women and 380 men) were enrolled between 28 February 2014 and 16 July 2015. The average age is 60 ± 13 years; at admission, a Holter recorder was attached for continuous ECG monitoring during 48 hours

Kruskal's ANNOVA or H tests were used for comparison of quantitative variables, $\chi 2$ test or Fisher's exact test, were used for qualitative variables, all tests were performed with 1st species risk of 5%.

Results: The frequency of Non-Sustained Ventricular Tachycardia is 28.3 % (132 patients), CI 95%: [24.2%-32.4%], multivariate analysis identified the following independent predictors: Age ≤ 58 years, current active smoking, presence of akinetic segment in echocardiography, and short time from symptom onset to emergency room.

The risk of in-hospital mortality is low, but not significant (Hazard Ration of 0.156. CI 95%: [0.21-1.177], p = 0.072)

Conclusion: NonSustained Ventricular tachycardia is the most frequent arrhythmias during acute coronary syndrome with elevated ST segment, its predictive factors according to our study are: Age ≤ 58 years, current active smoking, presence of akinetic segment in echocardiography, and short time from symptom onset to emergency room. The risk of in-hospital mortality is low, but not significant.

Keywords: Acute Coronary Syndrome, Non-Sustained Ventricular Tachycardia, current active smoking.

Introduction:

Nonsustained ventricular tachycardia (NSVT) defined as ventricular tachycardia lasting less than 30 seconds; is one of the most frequent ventricular arrhythmias, its prognostic implication is controversial, and the results of some international studies are divergent.

Repetitive Non-Sustained Ventricular tachycardia may induce hemodynamic instability, and promotes the onset of cardiogenic shock during hospitalization.

Its mechanisms are complex and multifactorial; several electrophysiological modifications occur just after coronary artery occlusion, and lead to reentry phenomena, abnormal automatism, and triggered activity.

The main objective of our study is to determine the frequency of nonsustained ventricular tachycardia in acute coronary syndrome with ST segment elevation, during the first 48 hours of hospitalization, while the secondary objective is the analysis of its predictive factors and the related mortality.

Methods and materials:

We prospectively studied a group of 467 consecutive patients (380 men and 87 women; mean age 60 ± 13 years) who presented acute coronary syndrome with ST segment elevation and admitted in cardiology department of Hussein-Dey hospital (Algiers, Algeria), between 28th February 2014 and 16th August 2015.

At emergency department admission, an ECG Holter recorder was attached for continuous ECG monitoring during 48 hours, the 17-leads surface ECG recorded at admission and repeated during hospitalization, Doppler Echocardiography, coronary angiography, and biological assessment were performed in the majority of patients.

The most important rhythm and conduction disorders were identified, the patients with the same type of disorder are grouped together, and the name assigned to each group is that of the disorder that characterizes it; there are overlaps between the groups, so that several disorders may exist in the same patient.

The constitution of each group of the rhythm disorder implies the constitution of the opposite group without the corresponding disorder, the latter group is used for the comparative study; each group is therefore described and then compared to the corresponding opposite group.

In this sub study, the group of patients with nonsustained

ventricular tachycardia was compared to the rest of patients without nonsustained ventricular tachycardia.

Statistical analysis:

Data are presented as mean ± SD, median, or frequency (percentage) where appropriate. Continuous variables were compared using the ANNOVA test, or H Kruskal Wallis test. $\chi 2$ tests and Fisher's exact test were performed to distinguish differences between categorical variables. Statistical significance was defined as $p < 0.05$. In this first step, we used EPI-info version 6.0. A multivariate Binary regression was performed to determine the predictor factors of arrhythmias, and Cox regression was performed to identify the predictor factors of mortality.

The magnitude of the relationship between nonsustained ventricular tachycardia and their predictive factors is estimated by the Cramer V coefficient, a coefficient lower than 0.2 is in favor of a weak link, between 0.2 and 0.5: moderate link, greater than 0.5: strong link.

The statistical analysis was performed using SPSS Statistics (release 17).

Results

Incidence:

The characteristics of the 467 patients included in our study are shown in Table 1; 132 patients had presented nonsustained ventricular tachycardia at admission or during hospitalization, so its frequency in this present study is 28.3 %, CI 95% [24.2%-32.4%].

This group of patients included 9 women and 123 men. The mean age was 57.08 ± 11 years; the extreme age was 28 and 85 years.

The rate of NSVT varied between 110 and 300 beats/min, the mean rate was 167±35 beats/min;

Monomorphic NSVT was present in all patients (132), polymorphic NSVT was observed in 6 patients, and the number of episodes varied between 1 and 89, the mean number was 16 ± 14 episodes.

Episodes of NSVT were observed more frequently during the first 24 hours, but less frequent after 24 hours, 92 patients had presented more than 10 episodes spread over the recording time (48hours), in 40 patients, the number of episodes varied between 1 and 9.

Cardiovascular risk factors, clinical characteristics, medical history, treatment and evolution are shown in Table 1.

The Surface ECG had shown, extensive anterior ACS in 52 patients, anterior in 8 patients, antero-septal in 3 patients, antero-septo-apical in 2 patients, circumferential in 11 patients, infero-basal in 35 patients, inferior in 18 patients, right ventricular in 11 patients.

The mean heart rate at admission was 82.46 ± 18.18 beats/min, the mean PR interval was 142.41 ± 30.132 msec, the mean duration of the QRS complex was 70.20± 15.24 msec, the mean amplitude of the ST segment elevation was 5.03 ± 3.43 mm, the mean amplitude of the ST segment depression was 1.33 ± 1.41 mm, the mean amplitude of the T wave was 7.56 ± 4.43mm and the mean corrected QT was 416.82 ± 38.85 msec.

3 patients (2.27 %) had persistence of the segment ST elevation during hospitalization.

Treatment at admission and during hospitalization: Metalyse (Tenecteplase) as fibrinolytics treatment were administered in 128 patients (93.93 %).

Aspirin, Clopidogrel and Anticoagulants were administered in 132 patients, beta blockers in 51 patients (38.63 %), ACE inhibitors in 68 patients (51.51 %), sympathomimetic agents in 5 patients (3.78 %), diuretics in 14 patients (10.50 %), external electric shock in 12 patients (9.09 %), Amiodarone in 20 patients (15.15 %), Magnesium and Potassium supplementation at admission in 83 patients (62.87 %), Atropine in 7 patient (5.3 %), Insulin in 33 patients (25 %).

Table 1: Characteristics of the study patients.

	Patients with NSVT (n = 132)	Patients without NSVT (n = 335)	P-value	
Mean age	**57.083**	**61.400**	**0.000**	**S**
Age ≤ 58 years	**70/132**	**124/335**	**0.002**	**S**
Females	**9**	**78**	**0.000**	**S**
Early consultation (within 6 hours)	**110/131**	**233/331**	**0.003**	**S**
Hypertension	51/132	158/335	0.117	NS
Diabetes	37/132	119/335	0.150	NS
Current active smoking	**84/132**	**151/335**	**0.000**	**S**
hyperlipidemia	20/131	47/333	0.863	NS
GRACE score ≥ 155	**35/132**	**132/334**	**0.011**	**S**
Cardiogenic shock	3/132	15/335	0.396	NS
Left ventricular heart failure	17/132	46/335	0.926	NS
Right ventricular heart failure	2/132	9/335	0.356	NS
Persistence of chest pain	6/132	22/335	0.540	NS
Mean SBP	133.333	129.227	0.191	NS
Mean DBP	78.068	77.275	0.638	NS
Hospital mortality (first 48 hours)	1/132	16/335	0.025	NS
Previous myocardial infraction	8/132	13/335	0.437	NS
Electrocardiogram				
Right ventricular ACS	11/132	31/335	0.893	NS
Extensive anterior ACS	52/132	116/335	0.390	NS

Anterior ACS	8/132	36/335	0.166	NS
Circumferential ACS	11/132	13/335	0.083	NS
Inferior ACS	18/132	66/335	0.160	NS
Infero-basal ACS	35/132	77/335	0.493	NS
Mean QRS duration	**70.205**	**76.179**	**0.033**	**S**
Mean ST segment elevation at admission	**5.030**	**3.806**	**0.000**	**S**
ST segment elevation ≥ 5 mm	**60/132**	**107/335**	**0.008**	**S**
Persistence of ST segment elevation	**3/132**	**27/333**	**0.035**	**S**
Mean QTc	416.828	418.071	0.641	NS
Other associated arrhythmias				
Complete AVB	**0/132**	**19/335**	**0.011**	**S**
Bursts of PAC	**57/132**	**101/316**	**0.030**	**S**
Bursts of PVC	**126/132**	**79/316**	**0.000**	**S**
Polymorphic PVC	**36/132**	**15/316**	**0.000**	**S**
PVC with R on T phenomenon	**14/132**	**4/316**	**0.000**	**S**
Accelerated idioventricular rhythm	**40/132**	**37/316**	**0.000**	**S**
Medication before ACS				
Beta blockers	6/131	30/335	0.162	NS
ARB	14/131	53/335	0.202	NS
ACE-inhibitor	**4/131**	**31/335**	**0.036**	**S**
Lipid-lowering drugs	7/131	26/335	0.475	NS
Antiplatelet agents	8/131	32/335	0.312	NS
Treatment at admission				
Thrombolysis	**124/132**	**282/335**	**0.007**	**S**
Primary or rescue percutaneous coronary intervention	3/105	11/224	0.294	NS
Beta blockers	51/132	135/335	0.821	NS
ACE-inhibitor	68/132	193/335	0.275	NS
Amiodarone	**20/132**	**24/335**	**0.012**	**S**
Echocardiography				
Ejection fraction of left ventricle < 40	17/130	46/317	0.805	NS
Presence of Akinetic segment	**90/130**	**181/317**	**0.022**	**S**
Coronary angiography				
Severe coronary artery lesions	28/105	75/224	0.299	NS
Left main coronary artery severe lesion	**7/105**	**5/224**	**0.050**	**S**
Left anterior descending artery lesion	64/105	145/224	0588	NS
Left circumflex coronary artery lesion	37/105	81/105	0.946	NS
Right coronary artery lesion	41/105	98/223	0.472	NS
Two-vessel coronary artery disease	39/105	89/224	0.743	NS
Multi-vessel coronary artery disease	**12/105**	**49/224**	**0.033**	**S**

TIMI flow grade 0	19/105	46/224	0.711	NS
Biology				
Average blood glucose	**1.441**	**1.688**	**0.010**	**S**
Average serum potassium	**4.018**	**4.126**	**0.049**	**S**
Serum potassium level ≤ 4 mmol/l	**76/127**	**151/326**	**0.013**	**S**
High-Sensitivity Troponin ≥ 5 ng/ml	**62/123**	**97/295**	**0.001**	**S**
ACS: Acute Coronary Syndrome, ACE inhibitors: Angiotensin-converting enzyme inhibitors ARB: Angiotensin receptor-blocker, DBP Diastolic blood pressure, PVC: Premature ventricular complexes, PAC: Premature Atrial complexes, NSVT: Non Sustained Ventricular Tachycardia, , QTc: Corrected QT interval, SBP: Systolic blood pressure.				

Thrombolysis failure: the persistence of chest pain after thrombolysis was observed in 6 patients, the persistence of ST segment elevation in 3 patients.

Doppler echocardiography was performed in 130 patients, the left ventricular fraction less than 40 % was found in 17 patients (13.07 %), left ventricular hypertrophy in 39 patients (30.70%), the mean area of the left atrium: 16.41 ± 3.52 cm², that of the right atrium: 11.2 ± 2.35 cm², the mean diastolic diameter of the left ventricle: 55 ± 6.35 mm, the mean diastolic diameter of the right ventricle was 24.81±3.14 mm, systolic pulmonary blood pressure: 26.66 ± 5.72 mm Hg, wall akinesia in 90 patients (69.23%), apical thrombus in 2 patient (1.53%), and significant mitral insufficiency in 6 patients (4.68%).

Holter ECG was performed in all patients (132 patients); this exam had participated in the recording of NSVT, also showed its timing (early or late), morphology (monomorphic or polymorphic), rate (slow or fast), the number of episodes (isolated or recurrent). (Figure 1) (Figure 2) (Figure 3)

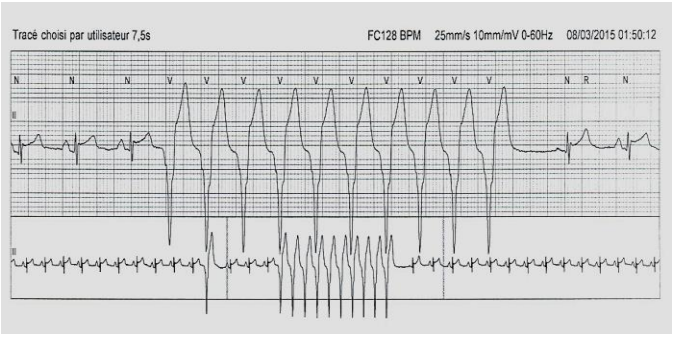

Figure 1: Holter ECG showed acute coronary syndrome with ST segment elevation complicated with monomorphic Non Sustained Ventricular Tachycardia in the first two hours of recording

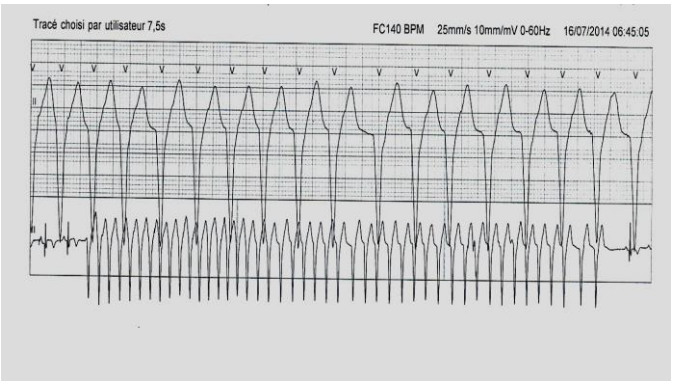

Figure 2: Holter ECG showed acute coronary syndrome with ST segment elevation complicated with monomorphic Non Sustained Ventricular Tachycardia occurred late after 24 hours of recording

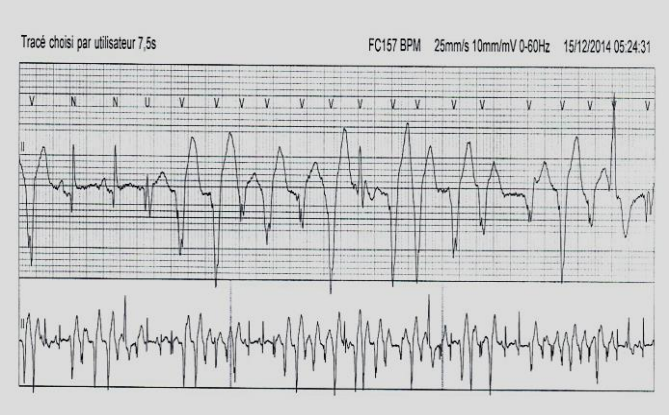

Figure 3: Holter ECG showed acute coronary syndrome with ST segment elevation complicated with polymorphic Non-Sustained Ventricular Tachycardia.

Several arrhythmias were associated with NSVT, ventricular fibrillation had occurred in 11 patients (8.33%), sustained ventricular tachycardia (SVT) in 7 patients (5.30 %), atrial fibrillation in 9 patients (6.81 %), complete Sino atrial block in 6 patients (4.54 %), complete left bundle branch block in 3 patients (2.27 %) and complete right bundle branch block in 8 patients (6.06 %), bursts of premature atrial contraction (PAC) were found in 57 patients (43.18 %), bursts of premature ventricular contraction (PVC) in 126 patients (95.45%), accelerated idioventricular rhythm in 40 patients (30.30 %), polymorphic ventricular premature beats in 36 patients (27.27 %), PVC with R on T phenomenon in 14 patients (10.60%).

Evolution and complications: persistence of chest pain in 6 patients, hypotension with vagal discomfort in 4 patients.

Coronary angiography was performed in 105 patients, severe coronary artery lesions were found in 28 patients (26.26%), Left main coronary artery severe lesion in 7 patients (6.66 %), severe stenosis of the left anterior descending artery in 64 patients (60.95 %), circumflex artery in 37 patients (35.23%), right coronary artery in 41 patients (39.04 %), two-vessel coronary artery lesions in 39 patients (37.14 %), three vessel coronary artery lesions in 12 patients (11.42 %), TIMI flow grade 0 in 19 patients (18.09%).

Mortality: One patient died after 1h15 min of his admission; this patient had presented sustained ventricular tachycardia, cardiogenic shock and ventricular fibrillation.

Biology: the average blood glucose: 1.44±0.50 g/l, average serum potassium 4.01± 0.49 mmol/l, serum Potassium level ≤ 4 mmol/l in 76 patients, average blood urea: 0.33± 0.13 g/l,

blood creatinine: 11.02 ± 3.02 mg/l; High-Sensitivity Troponin (hs-Trop) above or equal 5 ng/ml in 62 patients.

Predictive Factors:

According to the univariate study, several variables had a statistically significant association with the occurrence of NSVT: Age ≤ 58 years, male gender, current active smoking, Early consultation (within 6 hours), thrombolysis, presence of Akinetic segment in echocardiography, Left main coronary artery severe lesion, high ST segment elevation, serum Potassium level ≤ 4 mmol/l, High-Sensitivity Troponin ≥ 5 ng/ml, Bursts of PAC, Bursts of PVC, PVC with R on T phenomenon, Accelerated idioventricular rhythm, vagal discomfort, ACE-inhibitor before ACS (less frequent in NSVT group), Multi-vessel coronary artery disease (less frequent in NSVT group). (Table 2)

Table 2: Univariate study: variables associated with non-sustained ventricular tachycardia (NSVT)

Variables	RR	CI 95%	P
Age ≤ 58 years	1.59	1.19-2.12	0.002
Male gender	3.13	1.66-5.91	0.00006
Current active smoking	1.73	1.27-2.34	0.0004
Early consultation < 6 hours	1.82	1.20-2.76	0.003
Thrombolyse	2.33	1.20-4.52	0.007
Presence of Akinetic segment in echocardiography	1.46	1.06-2.01	0.02
Left main coronary artery severe lesion	1.89	1.14-3.13	0.05
ST segment elevation ≥ 5 mm	1.5	1.13-1.99	0.008
Serum Potassium level ≤ 4 mmol/l	1.48	1.10-2.01	0.01
High-Sensitivity Troponin (hs-Trop) ≥ 5 ng/ml	1.66	1.23-2.22	0.001
Bursts of premature atrial contraction	1.39	1.05-1.85	0.03
Bursts of premature ventricular contraction	24.89	11.21-55.27	10^{-8}
Accelerated idioventricular rhythm	2.09	1.59-2.77	0.000003
PVC with R on T phenomenon	2.83	2.12-3.79	0.00001
GRACE score ≥ 155 (less frequent)	0.65	0.46-0.90	0.01
Persistence of ST segment elevation (less frequent in NSVT group)	0.34	0.11-1	0.03
Persistence of ST segment elevation after thrombolysis (less frequent)	0.35	0.12-1.02	0.03
Vagal discomfort	10.15	1.15-89.99	0.02
ACE-inhibitor before ACS (less frequent in NSVT group)	0.39	0.15-0.99	0.03
Multi-vessel coronary artery disease (less frequent in NSVT group)	0.57	0.33-0.97	0.03

But after the multivariate analysis using binary logistic regression, four predictive factors were identified: Age ≤ 58 years, current active smoking, presence of akinetic segment in echocardiography, and short time from symptom onset to emergency room (Early consultation). (Table3) (Figure4)

Table 3: Predictive factors of non-sustained ventricular tachycardia

Predictive factors	OR	CI 95%	P
Age ≤ 58 years	1.7	1.09-2.58	0.019
Current active smoking	1.9	1.23-2.94	0.004
Presence of Akinetic segment	1.99	1.26-3.15	0.003
Early consultation < 6 hours	2.3	1.33-4.01	0.003

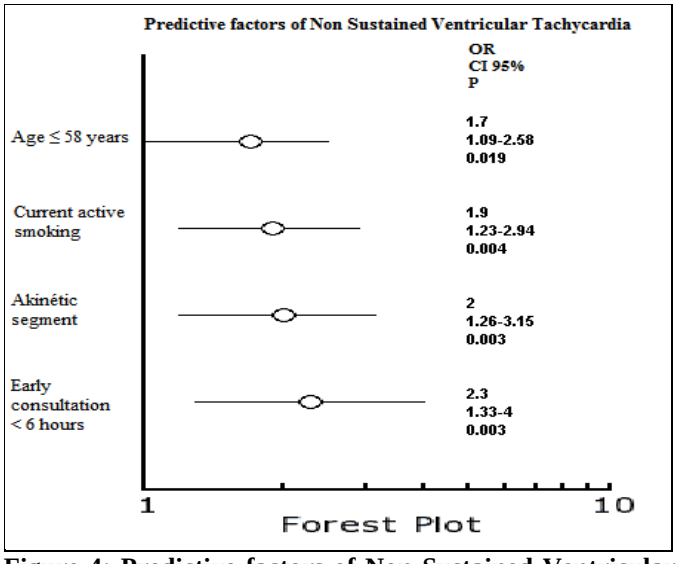

Figure 4: Predictive factors of Non-Sustained Ventricular Tachycardia

The magnitude of the relationship between NSVT and its predictive factors is low; the Cramer V coefficient does not exceed 0.2. (Table 4)

Table 4: Magnitude of the relationship between Non-Sustained Ventricular Tachycardia and its predictive factors

Predictive factors of Non-sustained ventricular tachycardia	Cramer V coefficient	P
Age ≤ 58 years	0.146	0.002
Current active smoking	0.167	0.000
Presence of Akinetic segment	0.113	0.017
Early consultation < 6 hours	0.140	0.003

Mortality:

Hospital mortality (first 48 hours), in the NSVT group is lower compared to the opposite group without NSVT, the percentage mortality in the NSVT is about 0.75 % while it exceeds 4.77 % in the group without NSVT, p = 0.024. (HR at 0.156, CI 95% [0.21-1.177], p = 0.072. (Figure 5)

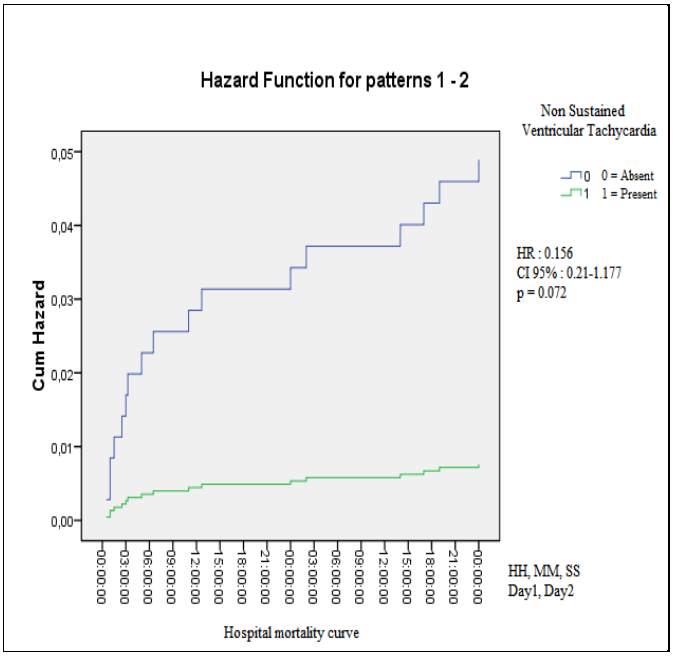

Figure 5: Hospital mortality curve (48h) in Non-Sustained Ventricular Tachycardia (NSVT) group versus group without NSVT

Discussion

Non-sustained ventricular tachycardia (NSVT) defined as ventricular tachycardia lasting less than 30 seconds; is one of the most frequent ventricular arrhythmias, Repetitive Non-Sustained Ventricular tachycardia may induce hemodynamic instability, and promotes the onset of cardiogenic shock during hospitalization.

Its mechanisms are complex and multifactorial; several electrophysiological modifications occur just after coronary artery occlusion, and lead to reentry phenomena, abnormal automaticity, and triggered activity.

In acute coronary syndrome, ischemia and reperfusion, cause profound ionic and metabolic changes in intra and extracellular. Ischemia causes alterations of the resting membrane potential and the action potential, these electrophysiological changes, induce arrhythmias by abnormal automaticity or reentry phenomena. [1][2]

Biochemical and metabolic changes in reperfusion depend on the duration of ischemia; the mechanism of reperfusion arrhythmias is mainly the triggered activity. [2]

Several international studies have reported the incidence of NSVT in acute coronary syndrome, this incidence varied between 1 to 7 %, [3][4][5] and be higher than 75 %. [6]

According to Tatli et al, incidence of NSVT is about 57.5 %, [7]; in another study, the incidence of NSVT is 25.84 %, in patients treated by Primary Percutaneous Coronary Intervention (PCI) for ST-Segment Elevation Myocardial. [8]

The incidence of NSVT in our study was 28.3 % (132 patients), CI 95% [24.2-32.4]. This incidence is within the range of that reported in the literature, and similar to that reported in study that exclusively uses primary angioplasty, which proves that fibrinolytics are as effective as primary angioplasty, in coronary artery reperfusion.

Several studies have reported predictive factors of severe ventricular arrhythmias, but there are no specific studies about predictors of NSVT.

According to the Thai registry, predictive factors of ventricular arrhythmias are cardiogenic shock, tobacco, and elevated troponin levels [9]

For the PAMI study, the predictors of severe ventricular arrhythmias are tobacco, TIMI flow 0, the right territory of the ACS, early consultation time, and non-administration of beta blockers early on admission [10]

In another study published in 2012, the predictive factors of severe ventricular arrhythmias are the following: tobacco, taking beta blockers, digitalis and significant left main coronary artery disease [11]

In our study, predictive factors of NSVT were studied separately, after multivariate analysis using binary logistic regression, the following predictive factors of NSVT are: Age ≤ 58 years, current active smoking, presence of akinetic segment, early consultation < 6 hours.

The age of 58 years or younger, increases the risk NSVT (OR: 1.7), the occurrence of NSVT, assumes the absence of a permanent substratum like fibrosis, which may participle in the maintenance of ventricular tachycardia, so myocardium without pre-existing lesions, is the situation that frequently encountered in young subjects.

Current active smoking, increases the risk of NSVT (OR: 1.9), an exclusively male risk factor in our population, nicotine stimulates the release of catecholamine, increased carbon monoxide, reduces the release of oxygen to cells, in addition to the abrasion of the endothelium and the reduction of prostaglandin production, all these effects contribute to artery coronary spasm and promote acute thrombosis causing severe electrophysiological changes.

The Akinetic segment of myocardial walls, increases the risk of NSVT (OR: 2), reflects the significant damage caused by ACS, and allows initiation of NSVT.

Short time from symptom onset to emergency room (Early consultation < 6 hours) (OR: 2.3), allows the administration of reperfusion treatment as soon as possible, and also start arrhythmias recording earlier.

We can therefore assume that NSVT is primarily related to reperfusion and triggered activity.

There have been some controversies about the risk of mortality associated with NSVT in ACS; in some studies, occurrence of NSVT is not associated with high risk mortality or sudden cardiac death, especially when NSVT occurred within the first 48 hours of ACS. [12][13][14]

According to another study, only NSVT occurred late, after the first 12 hours in ACS, were associated with high risk of mortality. [15]
In our study, in-Hospital mortality (first 48 hours), in the NSVT group is lower compared to the opposite group without NSVT, the percentage mortality in the NSVT is about 0.75 % while it exceeds 4.77 % in the group without NSVT, p = 0.024. (HR at 0.156, CI 95% [0.21-1.177], p = 0.072.
Our results support the conclusions of most studies, which assume the benign character of these arrhythmias.

Conclusion:

Non-Sustained Ventricular Tachycardia (NSVT) is one of the most frequent ventricular arrhythmias in acute coronary syndrome with ST segment elevation.
Its predictive factors according to our study are: Age ≤ 58 years, current active smoking, presence of akinetic segment in echocardiography, and early consultation.
The occurrence of NSVT doesn't increase the risk of hospital mortality, this result support the conclusions of most studies.
To our knowledge, predictors of non-sustained ventricular tachycardia were reported for the first time.

Bibliography

1. A V Ghuran , A J Camm. Ischaemic heart disease presenting as arrhythmias. British Medical Bulletin 2001; 59: 193–210.
2. Bulent Gorenek, Carina Blomstrom Lundqvist, Josep Brugada Terradellas. Cardiac arrhythmias in acute coronary syndromes position paper from the joint EHRA, ACCA, and EAPCI task force. Europace 2014 16, 1655-1673.
3. Eldar M, Sievner Z, Goldbourt U. Primary ventricular tachycardia in acute myocardial infarction: clinical characteristics and mortality. Ann Intern Med. 1992; 117:31–36.
4. Campbell R, Murray A, Julian D. Ventricular arrhythmias in the first 12 hours of acute myocardial infarction. Br Heart J. 1981;46: 351–357.
5. De Soyza N, Bissett J, Kane J, Murphy M, Doherty J. Ectopic ventricular prematurity and its relationship to ventricular tachycardia in acute myocardial infarction in man. Circulation. 1974; 50:529 –533.
6. Heidbuchel H, Tack J, Vanneste L, Ballet A, Ector H, VandeWerf F. Significance of arrhythmias during the first 24 hours of acute myocardial infarction treated with alteplase and effect of early administration of a b-blocker or a bradycardiac agent on their incidence. Circulation. 1994; 89:1051–1059.
7. Tatli E, Alicik G, Buturak A. Arrhythmias following revascularization procedures in the course of acute myocardial infarction: are they indicators of reperfusion or ongoing ischemia? Scientific World J. 2013; 2013.
8. QAMAR ZAMAN QAIM KHANI, ZUHAIB ZAHOOR SOOMRO, KANWAL NAZ. Ventricular Arrhythmias in Patients Undergoing Primary Percutaneous Coronary Intervention (PCI) for ST-Segment Elevation Myocardial Infarction (STEMI). P J M H S Vol. 16, No. 09, September, 2022 667. DOI: https://doi.org/10.53350/pjmhs22169667
9. Tachapong Ngarmukos, Charn Sriratanasthavorn, Buncha Sansaneevithayakul. Cardiac Arrhythmias in Thai Acute Coronary Syndrome Registry. J Med Assoc Thai 2007; 90 (Suppl 1): 58-64.
10. Rajendra H. Mehta, Kishore J. Harjai, Lorelei Grines, Gregg W. Stone, Judy Boura, David Cox, MD, William O'Neill, Cindy L. Grines, Sustained Ventricular Tachycardia or Fibrillation in the Cardiac Catheterization Laboratory Among Patients Receiving Primary Percutaneous Coronary Intervention Incidence, Predictors, and Outcomes. J Am Coll Cardiol 2004;43:1765–72
11. Marina M Demidova, J Gustav Smith, Carl-Johan Höijer, Prognostic impact of early ventricular fibrillation in patients with ST-elevation myocardial infarction treated with primary PCI. European Heart Journal. Acute Cardiovasc Care. 2012 Dec; 1(4): 302–311.
12. Hiratzka L, Rapaport E, Riegel B, Russell R, Smith E, Weaver W. ACC/AHA guidelines for the management of patients with acute myocardial infarction: a report of the American College of Cardiology/American Heart Association Task Force on Practice Guidelines (Committee on Management of Acute Myocardial Infarction). J Am Coll Cardiol. 1996;28: 1328 –1428.
13. Peterson E, Shaw L, Califf R. Risk stratification after myocardial infarction. Ann Intern Med. 1997;126:561–582.
14. Bigger JT Jr, Dresdale FJ, Heissenbuttel RH. Ventricular arrhythmias in ischemic heart disease: mechanism, prevalence, significance, and management. Prog Cardiovasc Dis. 1977;19: 255-300.
15. Cheema AN, Sheu K, Parker M. Nonsustained ventricular tachycardia in the setting of acute myocardial infarction: tachycardia characteristics and their prognostic implications. Circulation. 1998;98: 2030-2036.