

Research Article

Complete Sino Atrial Block in Acute Coronary Syndrome with ST Segment Elevation: Incidence, Predictive Factors and Related Mortality.

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Abstract:

Background: Sino atrial block in acute coronary syndrome with ST segment elevation is not rare and may be dangerous by causing severe bradycardia.

Its incidence was reported in the literature, but no data about its predictive factors or related mortality, also its epidemiological data is lacking in Algeria.

Aims: The main objective of our study is the determination of the frequency of Sino Atrial Block in acute coronary syndrome with ST segment elevation, the secondary objective was the analysis of predictive factors of this Brady 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, χ^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 complete Sino atrial block is 2.6 % (12 patients), CI 95%: [1.2%-4%], multivariate analysis identified the following independent predictors: right ventricular acute coronary syndrome, infero basal acute coronary syndrome, and large right atrium surface.

The risk of mortality expressed by Hazard Ration (HR) is 5.4. (CI95%: [1.2-24], $p = 0.024$); right acute coronary syndrome is the only predictive factor of mortality identified in our study.

Conclusion: Sino atrial block is not rare in acute coronary syndrome with elevated ST segment, its predictive factors according to our study are: right ventricular acute coronary syndrome, infero basal acute coronary syndrome, and large surface of right atrium, its occurrence increases the risk of hospital mortality.

Keywords: Acute Coronary Syndrome, Complete Sino Atrial Block, Right Acute Coronary Syndrome.

Introduction

Sino atrial block (SAB) in acute coronary syndrome with ST segment elevation is not rare, but less frequent than Atrio ventricular block.

Complete SAB may be dangerous by causing severe bradycardia and hemodynamic instability.

Several mechanisms have been proposed to explain Sino atrial conduction disorders like ischemia, necrosis and neurologic reflexes.

Its incidence was reported in the literature, but no data about its predictive factors or related mortality, also its epidemiological data is lacking in Algeria.

The main objective of our study is to determine the frequency of Complete Sino atrial block 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 Sino atrial block was compared to the rest of patients without Sino atrial block.

Statistical analysis

Data are presented as mean \pm SD, median, or frequency (percentage) where appropriate. Continuous variables were compared using the ANNOVA test, or H Kruskal Wallis test. χ^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 complete Sino atrial block 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; Twelve patients had presented complete Sino atrial block at admission or during hospitalization, so its frequency in this present study is 2.6 % (12 patients), CI 95% [1.2%-4%].

This group of patients included one woman and eleven men. The mean age was 63 ± 13 years; the extreme age was 37 and 89 years.

Nine patients had presented complete SAB at admission, and three patients had complete SAB during their hospitalization.

The complete SAB was persistent in five patients, and transient

in seven patients.

The average rate of junctional escape rhythm was 59 ± 14 beats/min, with the extreme rate was 34 beats/min and 86 beats/min. (Figure 1) (Figure 2)

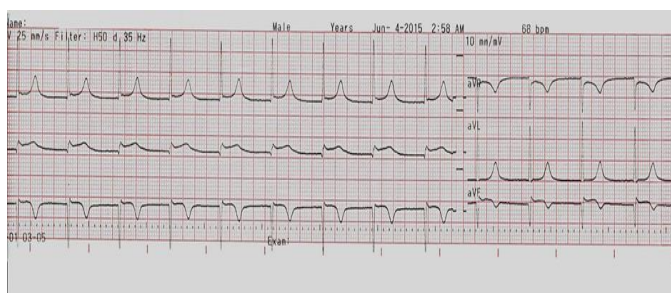


Figure 1: Surface ECG showed complete Sino atrial block in inferior acute coronary syndrome with ST segment elevation, the rate of junctional escape rhythm \approx 68 beats/min.

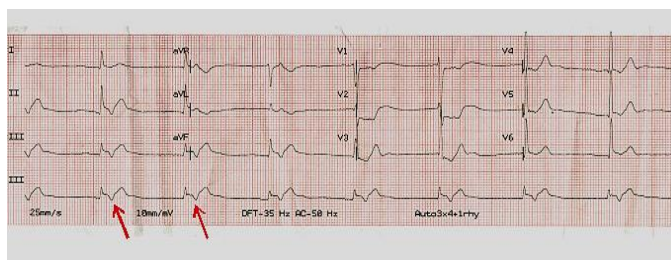


Figure 2: Surface ECG showed complete Sino atrial block in infero-basal acute coronary syndrome with ST segment elevation, with retrograde atrial conduction

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

The Surface ECG had shown, anterior ACS in two patients, inferior in five patients, inferobasal in six patients, right ventricular in five patients.

The mean heart rate at admission was 59.16 ± 14.03 beats/min, the mean PR interval after regression of complete SAB was 160 ± 56.56 msec, the mean duration of the QRS complex was 68.33 ± 13.37 msec, the mean amplitude of the ST segment elevation was 3.33 ± 1.23 mm, the mean amplitude of the ST segment depression was 1.08 ± 0.66 mm, the mean amplitude of the T wave was 5.50 ± 1.88 mm and the mean corrected QT was 411 ± 35.35 msec.

Two patients had persistence of the segment ST elevation during hospitalization.

Table 1: Characteristics of the study patients.				
	Patients with complete SAB (n = 12)	Patients without complete SAB (n = 455)	P-value	
Mean age	63.083	60.103	0.420	NS
Females	1	86	0.312	NS
Early consultation (within 6 hours)	7	336	0.170	NS
Hypertension	4/12	205/455	0.608	NS
Diabetes	3/12	153/455	0.752	NS
Current smoking	6/12	229/455	0.787	NS
hyperlipidemia	1/12	66/452	0.463	NS
GRACE score ≥ 155	5/12	162/455	0.912	NS
Cardiogenic shock	2/12	16/455	0.073	NS
Left ventricular heart failure	0/12	63/455	0.171	NS
Right ventricular heart failure	2/12	9/455	0.029	NS
Persistence of chest pain	2/12	26/455	0.157	NS

Mean SBP	109.167	130.947	0.014	S
SBP ≤120 mmHg	10/12	199/455	0.015	S
Mean DBP	68.750	77.730	0.273	NS
Hospital mortality (first 48 hours)	2/12	15/455	0.066	S
Previous myocardial infraction	0/12	21/455	0.571	NS
Electrocardiogram				
Right ventricular ACS	5/12	37/455	0.002	S
Anterior ACS	2/12	42/455	0.314	NS
Extensive anterior ACS	0/12	168/455	0.004	S
Inferior ACS	5/12	79/455	0.046	S
Infero basal ACS	6/12	106/455	0.043	S
Heart Rate at admission	59.167	83.275	0.000	S
Heart rate < 60 beats /min	5/12	43/455	0.004	S
Average QTc	411.126	417.894	0.597	NS
Persistence of ST segment elevation	2/12	28/453	0.177	NS
Other associated arrhythmias				
Atrial tachycardia	1/12	0/455	0.025	S
Bursts of PAC	0/12	158/428	0.012	S
Bursts of PVC	6/10	199/438	0.275	NS
Medication before ACS				
Beta blockers	0/12	36/454	0.376	NS
ARB	1/12	66/454	0.465	NS
ACE-inhibitor	1/12	34/454	0.612	NS
Lipid-lowering drugs	0/12	33/454	0.409	NS
Antiplatelet agents	1/12	39/454	0.724	NS
Treatment at admission				
Thrombolysis	10/12	396/455	0.479	NS
Primary or rescue percutaneous coronary intervention	0/7	14/322	0.735	NS
Beta blockers	1/12	185/455	0.018	S
ACE-inhibitor	5/12	256/455	0.477	NS
Echocardiography				
Ejection fraction of left ventricle < 40 %	0/10	63/437	0.215	NS
Mean right atrium surface	14.800	11.190	0.000	S
Right atrium surface ≥ 14cm ²	6/10	60/416	0.001	S
Mean Diastolic diameter of right ventricle	29.778	24.645	0.000	S
Diameter of right ventricle ≥ 28 mm	5/9	59/394	0.006	S
Coronary angiography				
Severe coronary artery lesions	3/7	99/322	0.375	NS
Left main coronary artery severe lesion	0/7	12/322	0.769	NS
Left anterior descending artery lesion	2/7	207/322	0.063	NS
Left circumflex coronary artery lesion	3/7	115/322	0.490	NS
Right coronary artery lesion	5/7	134/322	0.118	NS
Two-vessel coronary artery disease	3/7	125/322	0.557	NS
Multi-vessel coronary artery disease	0/7	61/322	0.234	NS
TIMI flow grade 0	3/7	62/322	0.141	NS
ACS: Acute Coronary Syndrome, ACE inhibitors: Angiotensin-Converting Enzyme inhibitors ARB: Angiotensin Receptor-Blocker, DBP Diastolic Blood Pressure, PAC: Premature Auricular Complexes, PVC: Premature Ventricular Complexes, QTc: Corrected QT interval, SAB: Sino Atrial Block, SBP: Systolic Blood Pressure.				

Treatment at admission and during hospitalization: Metalyse (Tenecteplase) as fibrinolytics treatment were administered in 10 patients (83.33 %), 9 patients had presented complete SAB at admission before any therapy, 1 patient had presented complete SAB after thrombolysis. (Figure 3)

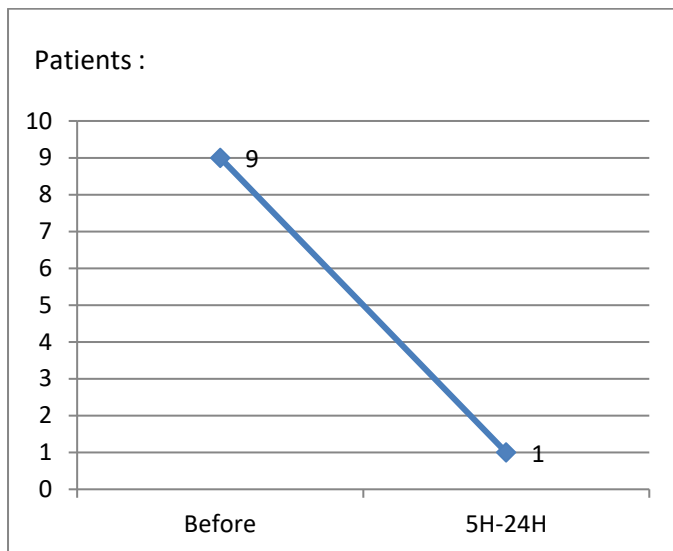


Figure 3: Complete Sino atrial block onset delay as a Function of Fibrinolytics treatment

Aspirin, Clopidogrel and Anticoagulants were administered in 12 patients (100 %), beta blockers in one patient (8.33 %), ACE inhibitors in 5 patients (41.66 %), sympathomimetic agents in one patient (8.33 %), diuretics in one patients (8.33 %), Amiodarone in one patient (8.33 %), Magnesium and Potassium supplementation at admission in 8 patients (66.66 %), Atropine in 4 patients (33.33 %), Insulin in 3 patients (25 %).

Thrombolysis failure: the persistence of chest pain and ST segment elevation after thrombolysis was observed in 1 patient.

Doppler echocardiography was performed in 10 patients, the left ventricular fraction above than 40 % was found in 10 patients (100%), left ventricular hypertrophy in 3 patients (30 %), the mean area of the left atrium: $18.10 \pm 4.20 \text{ cm}^2$, that of the right atrium: $14.80 \pm 3.67 \text{ cm}^2$, surface of right atrium above or equal 14 cm^2 in 6 patients, the mean diastolic diameter of the left ventricle: $51.60 \pm 7.48 \text{ mm}$, the mean diastolic diameter of the right ventricle was $29.77 \pm 5.91 \text{ mm}$, diastolic diameter of right ventricle above or equal 28 mm in 5 patients, the systolic pulmonary blood pressure: $23.66 \pm 4.41 \text{ mm Hg}$, wall akinesia in 4 patients (40%) and significant mitral insufficiency in 2 patients (22.22%).

Holter ECG was performed in 10 patients; this exam had participated in the recording of complete SAB, also showed its duration (transient or persistent), the rates of junctional escape rhythm, and detected associated arrhythmias. (Figure 4)

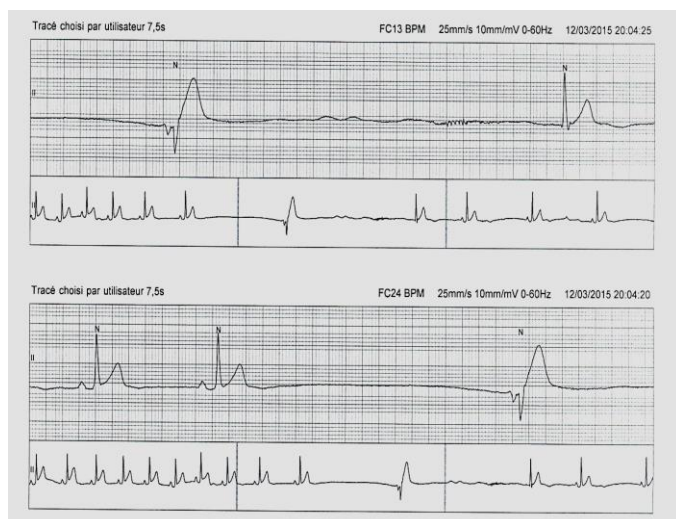


Figure 4: Holter ECG showed inferior acute coronary syndrome with ST segment elevation complicated with transient complete Sino atrial block

Several arrhythmias were associated with complete SAB, non-sustained ventricular tachycardia (NSVT) in 6 patients, atrial fibrillation in 2 patients, bursts of ventricular premature beats in 6 patients, accelerated idioventricular rhythm in 2 patients, polymorphic ventricular premature beats in 2 patients.

Evolution and complications: hypotension with vagal discomfort in 1 patient.

Coronary angiography was performed in 7 patients, severe coronary artery lesions were found in 3 patients (42.87%), severe stenosis of the left anterior descending artery in 2 patients (28.57%), circumflex artery in 3 patients (42.87%), right coronary artery in 5 patients (71.42 %), two-vessel coronary artery lesions in 3 patients (42.87%), TIMI flow grade 0 in 3 patients (42.87 %).

Mortality: Two patients died during the first 48 hours of their hospitalization; 1 patient died 3 hours 15 min after admission and the other patient after 11 hours.

Biology: the average blood glucose: $1.92 \pm 1.23 \text{ g/l}$, average serum potassium $3.95 \pm 0.79 \text{ mmol/l}$, average blood urea: $0.38 \pm 0.10 \text{ g/l}$, blood creatinine: $12.72 \pm 3.77 \text{ mg/l}$; High-Sensitivity Troponin (hs-Trop) above or equal 5 ng/ml in 2 patients (16.66 %).

Predictive factors

According to the univariate study, several variables had a statistically significant association with the occurrence of complete SAB: Right ventricular heart failure, low systolic blood pressure, atrial tachycardia, right atrium surface $\geq 14 \text{ cm}^2$, right acute coronary syndrome, inferior acute coronary syndrome, and infero-basal acute coronary syndrome. (Table 2)

Variables	RR	CI 95%	P
Right ventricular heart failure	8.29	2.05-33.47	0.02
Systolic blood pressure $\leq 120 \text{ mmHg}$	6.17	1.37-27.86	0.015
Atrial tachycardia	42.36	23.63-75.96	0.02
Right atrium surface $\geq 14 \text{ cm}^2$	8.18	2.37-28.21	0.001
Right ventricular diameter $\geq 28 \text{ mm}$	6.62	1.83-23.99	0.006
Right acute coronary syndrome	7.23	2.40-21.78	0.002
Inferior acute coronary syndrome	3.26	1.06-10.01	0.04
Infero-basal acute coronary syndrome	3.17	1.04-9.63	0.04

But after the multivariate analysis using binary logistic regression, three predictive factors were identified: right acute coronary syndrome, infero-basal acute coronary syndrome, right atrium surface above or equal 14 cm^2 . (Table 3) (Figure 5)

Table 3 : Predictive factors of complete Sino atrial block

Predictive factors	OR	CI 95%	P
Right acute coronary syndrome	5.509	1.138-26.665	0.034
Infero-basal acute coronary syndrome	5.965	1.400-25.419	0.016
Right atrium surface ≥ 14 cm ²	8.779	2.055-37.496	0.003

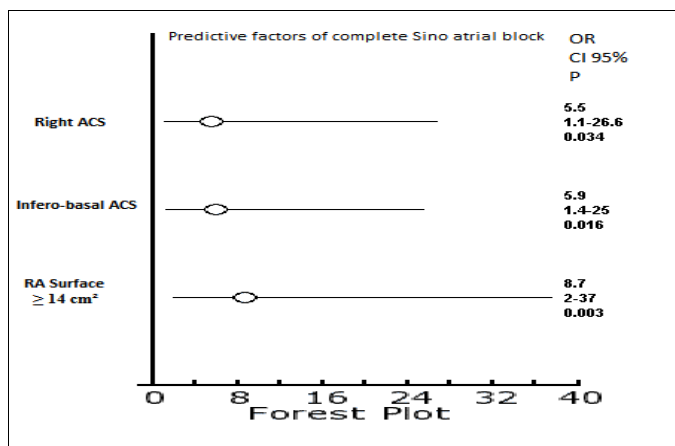


Figure 5: Predictive factors of complete Sino atrial block

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

Table 4: Magnitude of the relationship between complete Sino atrial block and its predictive factors

Predictive factors of complete Sino atrial block	Cramer V coefficient	P
Right acute coronary syndrome	0.185	0.000
Infero-basal acute coronary syndrome	0.099	0.032
Right atrium surface ≥ 14 cm ²	0.191	0.000

Mortality

Hospital mortality (first 48 hours), in the complete SAB group is 16.66 % while it does not exceed 3.3% in the group without complete SAB, (HR at 5.4, CI 95% [1.2-24], p = 0.024. (Figure 6)

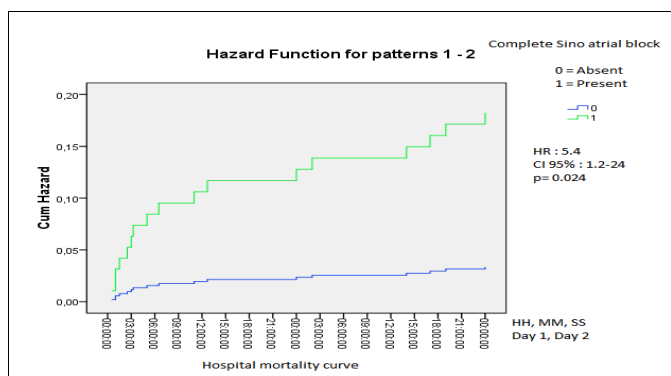


Figure 6: Hospital mortality curve (48h) in complete Sino auricular block (SAB) group versus group without complete SAB

Cox regression was used for univariate and multivariate studies of mortality predictors.

According to the univariate study, some factors have a statistically significant association with the occurrence of mortality in the complete SAB group. (Table 5)

Table 5: Univariate analysis, Factors related to mortality in group of complete Sino Atrial Block

Factors	OR	IC95%	P
Age ≥ 65 years	8.7	2.5-30	0.001
Right heart failure	59.9	21.7-164.9	0.000
Left heart failure	7.4	2.7-20.5	0.000
Cardiogenic shock	198.5	55.7-707.6	0.000
Right ventricle acute coronary syndrome	7	3.1-19	0.003
Persistence of ST segment elevation	53.3	16.9-168	0.000
Persistence of chest pain	34	12.3-94	0.000
Diastolic blood pressure ≤ 60 mm Hg	3.7	1.3-10	0.009
Systolic blood pressure ≤ 100 mm Hg	9.5	3.6-25.21	0.000
Blood creatinine ≥ 17 mg/l	8.2	2.6-25	0.000
GRACE Score	7.8	2.2-27	0.001

According to multivariate analysis, right acute coronary syndrome was identified as predictive factor of mortality. (Table 6)

Table 6: Predictive factor of mortality in complete Sino Atrial Block group

Predictive factor of mortality in Complete Sino Atrial Block group	OR	CI95%	P
Right acute coronary syndrome	5	1.7-14.4	0.002

The magnitude of the relationship between mortality and its predictive factor was not significant in the complete SAB group. (Table 7)

Table 7: The magnitude of the relationship between mortality and its predictive factors

Predictive factors of mortality in Complete Sino Atrial Block group	Cramer V Coefficient	P
Right acute coronary syndrome	0.529	0.067

Discussion

Sino atrial block (SAB) in acute coronary syndrome with ST segment elevation is not rare, but less frequent than Atrio ventricular block (AVB), according to the literature, its incidence in acute coronary syndrome with ST segment elevation is between 0.5 and 4 %. [1] [2]

SAB is due to failed propagation of pacemaker impulses beyond the SA node, complete (third degree) is characterized by complete absence of P waves, and may produce long sinus pauses, but the rhythm may be maintained by a junctional escape rhythm.

Complete SAB may be dangerous by causing severe symptomatic bradycardia, and leading to hemodynamic

instability.

The diagnosis of persistent Complete SAB is usually obvious, but for intermittent and short term episodes the diagnosis may be difficult, so Holter ECG may be useful in those cases.

The sinus node is irrigated by the right coronary artery in 63%, and by branch of the left coronary artery or one of its branches, in 37%. [3]

Several mechanisms have been proposed to explain Sino atrial conduction disorders during acute coronary syndrome, including ischemia or necrosis of sinus atial node, just after occlusion of sinus node artery, electrophysiological and morphological disorders were observed but generally reversible, this observation suggests sinus node resistance to infarction. [4][5]

Because of the high density of cholinergic ganglia in the right atrium, reflexes causes are common, and the vagus nerve may play a significant role. [2]

The incidence of complete SAB in our study was 2.6 % (12 patients), CI 95% [1.2%-4%]. This incidence is within the range of that reported in the literature.

According to our study three predictive factors were identified: right acute coronary syndrome, infero-basal acute coronary syndrome, right atrium surface above or equal 14 cm².

The right or the infero-basal acute coronary syndrome, involve right or circumflex coronary artery occlusion, and consequently occlusion of the artery supplies blood to Sino atrial region.

The large right atrium could be related to right atrium wall necrosis and also bradycardia which contribute to chamber dilation.

Only one study reported hospital mortality rate in patients with myocardial infarction complicated of sino atrial dysfunction, in this study, 9 patients died out of 32 patients, so the percentage is about 28.12 %. [6]

In our study, hospital mortality (first 48 hours), in the complete SAB group is about 16.66 %, with HR at 5.4, so occurrence of complete SAB increases mortality.

The right acute coronary syndrome is the predictive factor of mortality, which could be related to hemodynamic instability, acute right ventricular failure, and severe bradycardia.

Conclusion

Complete Sino atrial block (SAB) in acute coronary syndrome with ST segment elevation is not rare, but less frequent than Atrio ventricular block.

Its incidence was reported in the literature, but no data available about its predictive factors.

In our study we reported incidence of complete SAB and also

its predictive factors of and related mortality.

Its predictive factors according to our study are: right acute coronary syndrome, infero-basal acute coronary syndrome, and large right atrium.

The occurrence of complete SAB increases the risk of hospital mortality, related to hemodynamic instability, acute right ventricular failure, and severe bradycardia.

To our knowledge, predictive factors of complete SAB were reported for the first time.

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