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**Research Article**

# Complete Left Bundle Branch Block in Acute Coronary Syndrome with ST Segment Elevation: Epidemiological Features

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## Abstract:

**Background:** Complete left bundle branch in acute coronary syndrome with ST segment elevation is not common, but known as a sign of poor prognosis.

Several international studies had reported its incidence and related mortality, but its epidemiological data is lacking in Algeria.

**Aims:** The main objective of our study is the determination of the frequency of complete left bundle branch block in acute coronary syndrome with ST segment elevation, the secondary objective was the analysis of its predictive factors 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 complete left bundle brunch block is 1.7 % (8 patients), CI 95%: [0.5%-2.9%], multivariate analysis identified the two independent predictors: diabetes type 1, and Angiotensin Receptor-Blockers as current treatment.

Despite the risk of mortality expressed by Hazard Ration (HR) is 4.7, but remains not significant: CI95%: [0.62-36], p = 0.134; however, the risk of ventricular fibrillation occurrence is high, with relative risk (RR) at 7.17, CI 95 %: [2.70-19.03], p = 0.007.

**Conclusion:** Complete left bundle brunch block is not common in acute coronary syndrome with elevated ST segment, its predictive factors according to our study are: Diabetes type 1 and Angiotensin Receptor-Blockers as current treatment.

The high-risk mortality in the left bundle brunch block group isn't significant; however the risk of ventricular fibrillation occurrence is high.

**Keywords: Acute Coronary Syndrome, Complete left bundle brunch Block, Diabetes type 1, Angiotensin Receptor-Blockers.**

## Introduction

Complete left bundle branch block (LBBB) in acute coronary syndrome with ST segment elevation, is not common, but known as sign of poor outcomes. [1][2]

It may reflect the importance of myocardial damage; predict severe ventricular arrhythmias, with poor prognosis.

New LBBB may be considered as equivalent to acute coronary syndrome with ST segment elevation, or may complicate the obvious acute coronary syndrome with ST segment elevation; while old LBBB can make diagnosis difficult, and some scores like Sgarbossa score, Modified Sgarbossa rule or BARCELONA Algorithm, allow the diagnosis of ACS with ST segment elevation. [3]

The left bundle brunch is irrigated by atrioventricular node artery which frequently originates from the right coronary artery, or by the septal branch of the left anterior descending artery, or both. [4]

After acute coronary artery occlusion, ischemia and necrosis are the principal mechanisms of complete LBBB.

Its incidence and prognostic value have been widely reported in the literature, but its epidemiological data is lacking in Algeria.

The main objective of our study is to determine the frequency of complete left bundle branch block which complicates the obvious 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 complete left bundle brunch block was compared to the rest of patients without complete left bundle brunch block

## 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 complete LBBB 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. Eight patients had presented complete LBBB at admission or during hospitalization, so its frequency in this present study is 1.7 % (8 patients), CI 95% [0.5%-2.9%].
This group of patients included two women and six men. The mean age was 67.37 ± 12 years; the extreme age was 45 and 85 years.
Seven patients had developed new complete LBBB at admission and one patient had developed complete LBBB during hospitalization. (Figure 1)
The complete LBBB was persistent in four patients, and transient in four patients.

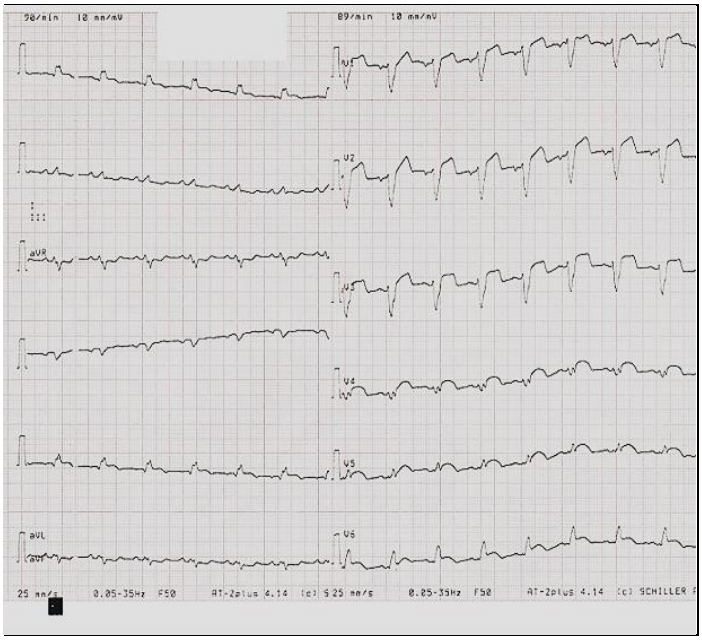

**Figure 1: Surface ECG showed complete left bundle brunch block in extensive anterior acute coronary syndrome with ST segment elevation**

Cardiovascular risk factors, clinical characteristics, medical history, treatment and evolution are shown in Table 1.
The Surface ECG had shown, extensive anterior ACS in 4 patients, infero-basal in 2 patients, antero-septal in 1 patient and antero-septo-apical in 1 patient.
The mean heart rate at admission was 83.12 ± 13.44 beats/min, the mean PR interval was 145.71 ± 29.92 msec, the mean duration of the QRS complex at admission was 102.50 ± 24.92 msec, complex QRS duration ≥ 100 msec in 5 patients, the mean amplitude of the ST segment elevation was 4.62 ± 1.40 mm, the mean amplitude of the ST segment depression was 1.75 ± 1.75 mm, the mean amplitude of the T wave was 9.12 ± 5.27 mm and the mean corrected QT was 428 ± 55.11 msec.

**Table 1: Characteristics of the study patients.**

| | Patients with complete LBBB (n = 8) | Patients without complete LBBB (n = 459) | P-value | |
|---|---|---|---|---|
| Mean age | 67.375 | 60.054 | 0.104 | NS |
| Females | 2 | 85 | 0.456 | NS |
| Early consultation (within 6 hours) | 5 | 338 | 0.339 | NS |
| Hypertension | **7/8** | **202/459** | **0.016** | **S** |
| Diabetes type 1 | **2/8** | **12/459** | **0.021** | **S** |
| Diabetes type 2 | 2/8 | 140/459 | 0.541 | NS |
| Diabetes | 4/8 | 152/459 | 0.258 | NS |
| Current smoking | **0/8** | **235/459** | **0.003** | **S** |
| hyperlipidemia | 1/8 | 66/456 | 0.674 | NS |
| GRACE score ≥ 155 | 4 | 163 | 0.579 | NS |
| Cardiogenic shock | 2/8 | 16/459 | 0.034 | NS |
| Left ventricular heart failure | 1/8 | 62/459 | 0.705 | NS |
| Right ventricular heart failure | 1/8 | 10/459 | 0.174 | NS |
| Persistence of chest pain | 1/8 | 27/459 | 0.392 | NS |

| | | | | |
|---|---|---|---|---|
| Persistence of chest pain after thrombolysis | 1/7 | 25/399 | 0.373 | NS |
| Mean SBP | 125.000 | 130.481 | 0.615 | NS |
| Mean DBP | 73.750 | 77.564 | 0.515 | NS |
| Hospital mortality (first 48 hours) | 1/8 | 16/459 | 0.258 | NS |
| Previous myocardial infraction | 0/8 | 21/459 | 0.690 | NS |
| **Electrocardiogram** | | | | |
| Right ventricular ACS | 0/8 | 42/459 | 0.467 | NS |
| Extensive Anterior ACS | 4/8 | 164/459 | 0.313 | NS |
| Antero-septal ACS | 1/8 | 10/453 | 0.176 | NS |
| Antro-septo-apical ACS | 1/8 | 18/453 | 0.287 | NS |
| Inferior ACS | 0/8 | 84/459 | 0.201 | NS |
| Infero basal ACS | 2/8 | 110/459 | 0.608 | NS |
| Heart Rate at admission | 83.647 | 82.647 | 0.949 | NS |
| Mean QRS duration at admission | **102.500** | **74.002** | **0.001** | **S** |
| QRS duration ≥ 100 msec | **5/8** | **59/459** | **0.001** | **S** |
| Mean ST segment elevation | 4.625 | 4.144 | 0.602 | NS |
| Average QTc | 428.114 | 417.539 | 0.499 | NS |
| Persistence of ST segment elevation | 0/8 | 30/458 | 0.625 | NS |
| Persistence of ST segment elevation after thrombolysis | 0/6 | 27/398 | 0.658 | NS |
| **Other associated arrhythmias** | | | | |
| Ventricular fibrillation | 3/8 | 24/459 | 0.007 | S |
| Bursts of PAC | 5/7 | 153/441 | 0.055 | NS |
| Bursts of PVC | 3/7 | 202/441 | 0.592 | NS |
| Polymorphic PVC | 1/7 | 50/441 | 0573 | NS |
| PVC with R on T phenomenon | 1/7 | 17/441 | 0.251 | NS |
| **Medication before ACS** | | | | |
| Beta blockers | 0/8 | 36/458 | 0.522 | NS |
| ARB | **5/8** | **62/458** | **0.002** | **S** |
| ACE-inhibitor | 1/8 | 34/458 | 0.467 | NS |
| Lipid-lowering drugs | 1/8 | 32/458 | 0.446 | NS |
| Antiplatelet agents | 1/8 | 39/458 | 0.515 | NS |
| **Treatment at admission** | | | | |
| Thrombolysis | 7/8 | 399/459 | 0.609 | NS |
| Primary or rescue percutaneous coronary intervention | 0/4 | 14/325 | 0.839 | NS |
| Beta blockers | 1/8 | 184/459 | 0.106 | NS |
| ACE-inhibitor | 3/8 | 258/459 | 0.241 | NS |
| External electric shock | **3/8** | **29/459** | **0.012** | **S** |
| **Echocardiography** | | | | |
| Ejection fraction of left ventricle < 40 % | 2/7 | 61/440 | 0.257 | NS |

| | | | | |
|---|---|---|---|---|
| Mean left atrium surface | 18.714 | 16.672 | 0.159 | NS |
| Mean Diastolic diameter of left ventricle | 54.857 | 54.120 | 0.760 | NS |
| Akinetic segment | 6/7 | 265/440 | 0.164 | NS |
| Significant mitral insufficiency | 2/7 | 32/434 | 0.094 | NS |
| **Coronary angiography** | | | | |
| Severe coronary artery lesions | 1/4 | 101/325 | 0.634 | NS |
| Left main coronary artery severe lesion | 0/4 | 12/325 | 0.861 | NS |
| Left anterior descending artery lesion | 1/4 | 208/325 | 0.139 | NS |
| Left circumflex coronary artery lesion | 3/4 | 115/325 | 0.134 | NS |
| Right coronary artery lesion | 2/4 | 137/325 | 0.566 | NS |
| Two-vessel coronary artery disease | 2/4 | 126/325 | 0.506 | NS |
| Multi-vessel coronary artery disease | 1/4 | 60/325 | 0.561 | NS |
| TIMI flow grade 0 | 1/4 | 64/325 | 0.587 | NS |
| ACS: Acute Coronary Syndrome, ACE inhibitors: Angiotensin-Converting Enzyme inhibitors ARB: Angiotensin Receptor-Blocker, DBP Diastolic Blood Pressure, LBBB: Left Bundle Brunch Block PAC: Premature Auricular Complexes, PVC: Premature Ventricular Complexes, QTc: Corrected QT interval, , SBP: Systolic Blood Pressure. | | | | |

Treatment at admission and during hospitalization: Metalyse (Tenecteplase) as fibrinolytics treatment, were administered in 7 patients (87.5 %), 6 patients among them had presented complete LBBB at admission before any therapy. (Figure 2)

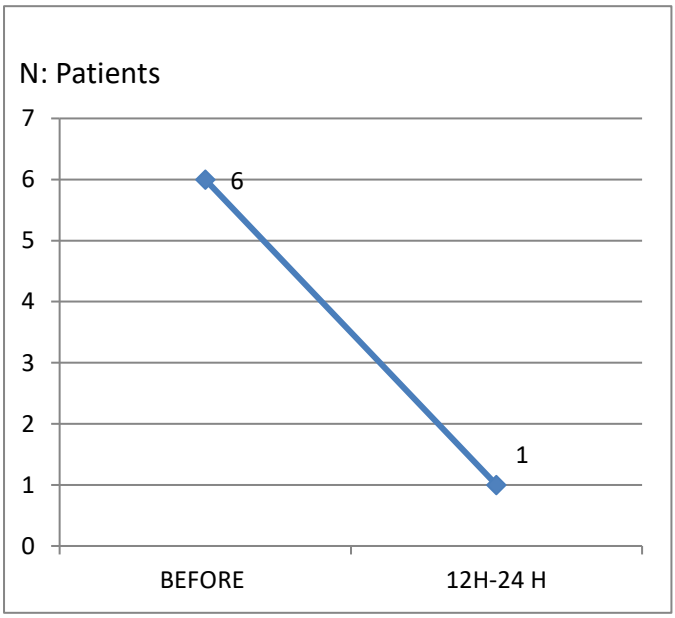


**Figure 2: Complete Left bundle brunch block onset delay as a Function of Fibrinolytics treatment**

Aspirin, Clopidogrel and Anticoagulants were administered in 8 patients (100 %), beta blockers in 1 patient (12.5 %), ACE inhibitors in 3 patients (37.5 %), sympathomimetic agents in 2 patients (25 %), external electric shock in 3 patients (37.5 %), Amiodarone in 2 patient (25 %), Magnesium and Potassium supplementation at admission in 4 patients (50 %), Insulin in 4 patients (50 %).

**Thrombolysis failure:** the persistence of chest pain after thrombolysis was observed in 1 patient, who had LBBB at admission.

**Doppler echocardiography** was performed in 7 patients, the left ventricular fraction less than 40 % was found in 2 patients (28.57%), the mean area of the left atrium: 18.71 ± 2.69 cm², the mean area of the right atrium: 11.28 ± 2.05 cm², the mean diastolic diameter of the left ventricle: 54.85 ± 5.0 mm, the mean diastolic diameter of the right ventricle was 23.66±3.38 mm, the systolic pulmonary blood pressure: 29.16 ± 3.37 mm Hg, wall akinesia in 6 patients (85.71%), and significant mitral insufficiency in 2 patients (28.57%).

**Holter ECG** was performed in 7 patients; this exam had participated in the monitoring of complete LBBB, also showed its character (transient or persistent), and detected associated arrhythmias. (Figure 3) (Figure 4)

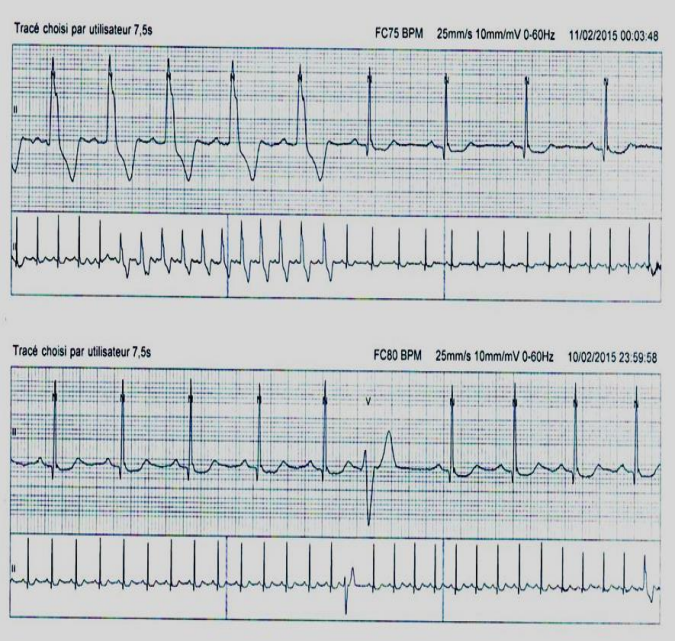


**Figure 3: Holter ECG showed intermittent complete left bundle branch block in patient with extensive anterior acute coronary syndrome with ST segment elevation**

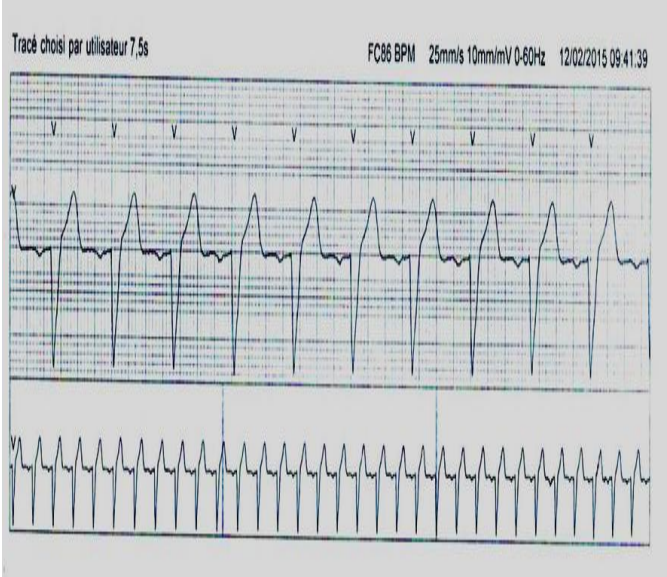


**Figure 4: Holter ECG showed complete left bundle branch block which becomes persistent after 24 hours of recording in the same patient of Figure 3.**

Several arrhythmias were associated with complete LBBB, ventricular fibrillation (VF) in 3 patients, sustained ventricular tachycardia (SVT) in 1 patient, non-sustained ventricular tachycardia (NSVT) in 3 patients, atrial fibrillation (AF) in 2 patients, bursts of atrial premature beats in 5 patients, bursts of ventricular premature beats in 3 patients, polymorphic ventricular premature beats in 1 patient, PVC with R on T phenomenon in 1 patient.

**Evolution and complications:** persistence of chest pain in 1patient, cardiogenic shock in one patient.

**Coronary angiography** was performed in 4 patients, severe coronary artery lesions were found in 1 patient (25 %), severe stenosis of the left anterior descending artery in 1 patient (25 %), circumflex artery in 3 patients (75 %), right coronary artery in 2 patients (50 %), two-vessel coronary artery lesions in 2 patients (50 %), Multi-vessel coronary artery lesions in 1 patient (25 %), TIMI flow grade 0 in 1 patient (25 %).

**Mortality:** one patient died 30 minutes after admission; he had presented cardiogenic shock with shock-resistant ventricular fibrillation.

**Biology:** the average blood glucose: 1.51±0.87 g/l, average serum potassium 4.18 ± 0.58 mmol/l, average blood urea: 0.37± 0.12 g/l, blood creatinine: 11.57 ± 1.98 mg/l; High-Sensitivity Troponin (hs-Trop) above or equal 5 ng/ml in 3 patients (42.85 %).

**Predictive factors**

According to the univariate study, four variables had a statistically significant association with the occurrence of complete LBBB: Hypertension, Diabetes type 1, cardiogenic shock, and Angiotensin Receptor-Blockers as current treatment. (Table 2)

**Table 2: Univariate study: variables associated with complete left bundle brunch block (LBBB)**

| Variables | RR | CI 95% | P |
|---|---|---|---|
| Hypertension | 8.64 | 1.07-69.68 | 0.016 |
| Diabetes type 1 | 10.79 | 2.38-48.79 | 0.02 |
| Cardiogenic shock | 8.1 | 1.80-38.38 | 0.03 |
| Angiotensin Receptor-Blockers as current treatment | 9.93 | 2.43-40.56 | 0.002 |

But after the multivariate analysis using binary logistic regression, two predictive factors were identified: Diabetes type 1, and Angiotensin Receptor-Blockers as current treatment. (Table 3) (Figure 5)

**Table 3: Predictive factors of complete left bundle branch block**

| Predictive factors | OR | CI 95% | P |
|---|---|---|---|
| Diabetes type 1 | 8.96 | 1.447-55.50 | 0.018 |
| Angiotensin Receptor-Blockers as current treatment | 9.5 | 2.17-42.30 | 0.003 |

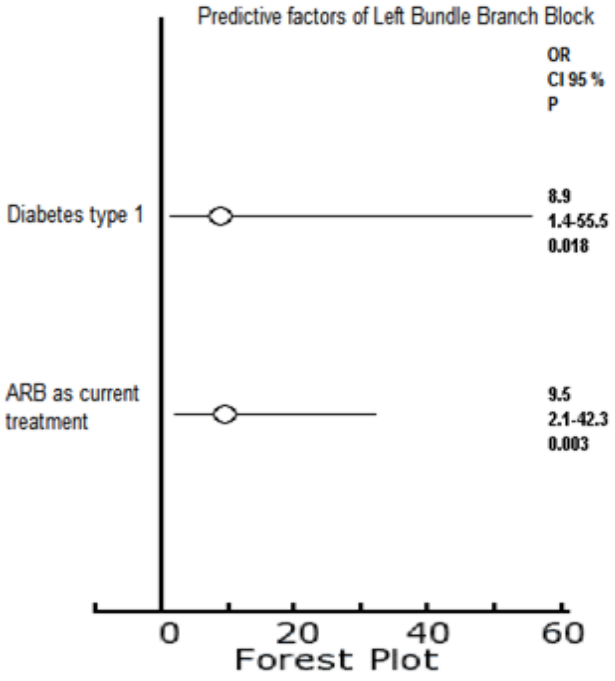


**Figure 5: Predictive factors of complete left bundle branch block**
**ARB: Angiotensin Receptor-Blocker**

The magnitude of the relationship between complete LBBB and its predictive factors is low; the Cramer V coefficient doesn't exceed 0.2. (Table 4)

**Table 4: Magnitude of the relationship between complete left bundle brunch block and its predictive factors**

| Predictive factors of complete left bundle brunch block | Cramer V coefficient | P |
|---|---|---|
| Diabetes type 1 | 0.170 | 0.000 |
| Angiotensin Receptor-Blockers as current treatment | 0.186 | 0.000 |

**Mortality**

Hospital mortality (first 48 hours), in the complete LBBB group is 12.5 % while it does not exceed 3.48 % in the group without complete LBBB, but this difference isn't significant (p=0.258), and when using Cox regression, the risk of in-hospital mortality is high with HR at 4.7, but not significant CI 95% [0.620-36.215], p = 0.134. (Figure 6)

But the risk of ventricular fibrillation is high with relative risk (RR) at 7.17, CI 95% [2.70-19.03], p = 0.007.

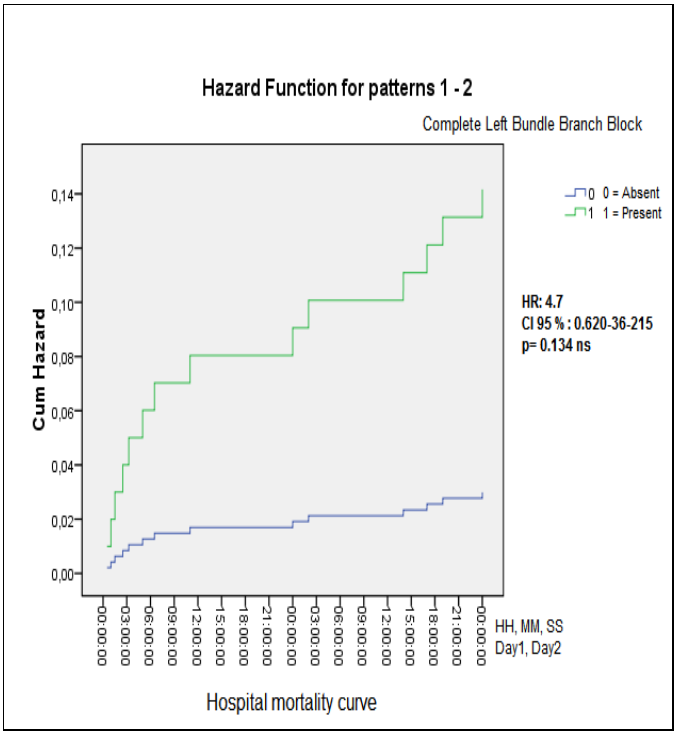


**Figure 6: Hospital mortality curve (48h) in complete left bundle branch block (LBBB) group versus group without complete LBBB**

## Discussion

Complete left bundle branch block (LBBB) in acute coronary syndrome with ST segment elevation, is not common, but known as sign of poor prognosis. [1][2]

New LBBB may be considered as equivalent to acute coronary syndrome with ST segment elevation, or may complicate the obvious acute coronary syndrome with ST segment elevation; while old LBBB can make diagnosis difficult, and some scores, like Sgarbossa score, Modified Sgarbossa rule or BARCELONA Algorithm, allow the diagnosis of ACS with ST segment elevation. [3]

Acute occlusion of coronary arteries induces ischemia and necrosis, both of these consequences are the main mechanisms of conduction disorders; the left bundle branch is irrigated by atrioventricular node artery which frequently originates from the right coronary artery, or by the septal branch of the left anterior descending artery, or both. [4], so development of LBBB assumes the occlusion of these two arteries.

Thus, occurrence of LBBB may reflect the importance of myocardial damage; predict hemodynamic instability with poor prognosis.

According to several international study, the incidence of LBBB, varied between 2 and 7 %, [1][2][5], in one another study, published in 2013, incidence of LBBB is about 3 % [6]

The incidence of complete LBBB in our study was 1.7 % (8 patients), CI 95% [0.5%-2.9%], this incidence is low, when compared to that of reported in the literature, probably because of our strict requirements, and exclusion of some patients in whom the diagnosis of new left bundle brunch block is uncertain.

Predictors of complete left bundle brunch block have not been reported in the literature.

According to our study two predictive factors were identified: Diabetes type 1 and Angiotensin Receptor-Blockers as current treatment.

Diabetes increases the risk of developing a complete left branch block, this risk related to the microangiopathy of diabetes type 1, inducing ischemia and fibrosis.

Angiotensin Receptor-Blockers as current treatment reflects the heavy medical history of the patient already treated for hypertension and diabetes

Several international studies have reported risk of mortality related to complete LBBB,

In ACS, mortality related to left or right bundle brunch block is 23.6% without thrombolysis and 18.7% with thrombolysis. [7]

According to another study, the rate mortality related to LBBB in ACS with ST segment elevation, is about 16 % if LBBB % is present at admission (p=0.001) and 32 % if LBBB occurred 60 min after thrombolysis (p= 0.001). [8]

In our study, the risk of in-hospital mortality in LBBB group is high with HR at 4.7, but not significant CI 95% [0.620-36.215], p = 0.134.

In our study, the high risk of in-hospital mortality in the BBGC group is not significant, there are two possible hypotheses: the first hypothesis is that pre-hospital mortality is very high before the diagnosis of ACS, and the second hypothesis is related to our strict requirements, and exclusion of some patients in whom the diagnosis of new left bundle brunch block is uncertain.

## Conclusion

Complete left bundle branch block in acute coronary syndrome with ST segment elevation is not common, but known as sign of poor prognosis, its predictive factors according to our study are: Diabetes type 1, and Angiotensin Receptor-Blockers as current treatment.

The high risk of in-hospital mortality in the BBGC group is not significant; however the risk of ventricular fibrillation occurrence is high.

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

## Bibliography

1. Klein RC, Vera Z, Mason DT. Intraventricular conduction defects in acute myocardial infarction: incidence, prognostic, and therapy.Am Heart J 1984;108:1007-1013.
2. Hollander G, Nadimiti V, Lichstein E, Greegart A, Sanders M. Bundle branch block in acute myocardial infarction.Am Heart J 1983.105/738-743.
3. Andrea Di Marco; Marcos Rodriguez; Juan Cinca. New Electrocardiographic Algorithm for the Diagnosis of Acute Myocardial Infarction in Patients With Left Bundle Branch Block. J Am Heart Assoc. 2020; 9:e015573. DOI: 10.1161/JAHA.119.015573.
4. RICHARD J. FRINK, THOMAS N. JAMES. Normal Blood Supply to the Human His Bundle and Proximal Bundle Branches. Circulation. 1973;47: 8–18.
5. Hindman MC, Wagner GS, JaRo M, et al. The clinical significance of bundle branch complicating acute myocardial infarction: 1. Clinical characteristics, hospital mortality, and one year follow-up. Circulation 1978; 58:679-688.
6. Winkler C, Funk M, Schindler DM, Hemsey JZ, Lampert R, Drew BJ. Arrhythmias in patients with acute coronary syndrome in the first 24 hours of hospitalization.2013 Aug 22. Heart lung S0147-9563(13)00250-1.
7. Fibrinolytic Therapy Trialists' (FTT) Collaborative Group. Indications for fibrinolytic therapy in suspected acute myocardial infarction: collaborative overview of early

mortality and major morbidity results from all randomised trials of more than 1000 patients. Lancet 1994;343:311–322

8. Wong C-K, Stewart RAH, Gao W, French JK, Raffel C, White HD. Prognostic differences between different types of bundle branch block during the early phase of acute myocardial infarction: insights from the Hirulog and Early Reperfusion or Occlusion (HERO)-2 trial. Eur Heart J. 2006;27:21-8.