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THE IMPORTANCE OF EXPANDED SGARBOSSA CRITERIA FOR DIAGNOSIS OF ACUTE CORONARY SYNDROMES IN PATIENTS WITH LEFT BUNDLE BRANCH BLOCK: A CASE SERIES

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ZNAČAJ PROŠIRENIH SGARBOSSA KRITERIJUMA U DIJAGNOZI AKUTNOG KORONARNOG SINDROMA U PACIJENATA SA BLOKOM LEVE GRANE HISS-OVOG SNOPA

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SUMMARY

The occurrence of left bundle branch block (LBBB) significantly deforms the processes of depolarization and repolarization, which decreases the sensitivity of the electrocardiogram (EKG) as a diagnostic method in patients with acute ischemia. The presence of expanded Sgarbossa criteria increases the sensitivity and specificity of the ECG. **Aim:** The objective of this study was to examine the connection of expanded Sgarbossa criteria with acute coronary syndrome (ACS) in patients with LBBB and the intrahospital mortality of these patients with all certain risk factors. **Methodology of the study:** This study included 340 patients hospitalized in the coronary unit of the KC Kragujevac Cardiology Center from 1 January 2008 to 10 January 2008. During this period, 20 patients were diagnosed with left bundle branch block. Patients with LBBB were divided into two sub-groups according to the ranges of cardio-specific enzymes: 14 (70%) had a laboratory confirmed diagnosis of ACS, and 6 (30%) patients did not have a confirmed ACS diagnosis. In this study we observed the presence of the following risk factors: hypertension (HTA), heritage, diabetes mellitus (DM), smoking, hyperlipoproteinemia (HLP), and a previous attack of ischemic heart disease (IHD). Besides the risk factors mentioned above, we observed heart rate, the values of systolic and diastolic blood pressure on admission, the presence of expanded Sgarbossa criteria, the use of medications, and intrahospital mortality. Statistical analysis was performed by Fisher's test or a Student's T-test where appropriate. **Results:** We showed that the expanded Sgarbossa criteria should not be neglected when establishing a diagnosis of acute coronary syndrome. The following criteria were particularly important: positive T wave in leads V_5 or V_6, a sign of Cabrera ascending limb of the S wave in V_3 or V_4, the presence of an S wave in lead V_5 or V_6, the presence of a Q wave in two contiguous precordial leads, and left-axis deviation. We also showed that diabetes mellitus (DM) was the only risk factor linked with ACS with LBBB ($p = 0.018$) because it increased the likelihood of the occurrence of ACS with LBBB (odds ratio [OR] = 42; 95% CI 1.176-1497.973; $p < 0.05$) by 42 times and had a statistically significant influence on the occurrence of ACS with LBBB ($p = 0.04$). We observed that intrahospital mortality was higher if ACS was accompanied by LBBB even though Fisher's test showed no dependency between mortality and patients with ACS and LBBB ($p = 1.00$).

Key words: LBBB, ACS, Sgarbossa criteria, diabetes mellitus, mortality

SAŽETAK

Pojava bloka leve grane (LBBB) Hiss-ovog snopa značajno deformiše proces depolarizacije i repolarizacije miokarda što smanjuje senzitivnost elektrokardiograma (EKG) kao dijagnostičke metode kod pacijenata sa akutnom ishemijom. Prisustvo proširenih Sgarbossa kriterijuma povećava senzitivnost i specifičnost EKG-a.

Cilja rada je da se ispita povezanost proširenih Sgarbossa kriterijuma i akutnog koronarnog sindroma u pacijenata sa LBBB i intrahospitalni mortalitet ovih pacijenata uz prateće faktore rizika.

Metod rada. U studiju je uključeno 340 pacijenta hospitalizovanih u Koronarnoj jedinici Centra za kardiologiju KC Kragujevac u periodu od 01.01.2008 godine do 01.10.2008 godine od kojih je 20 pacijenata sa blokom leve grane Hiss-ovog snopa. Pacijenti sa LBBB su podeljeni u dve grupe zavisno od vrednosti kardiospecifičnih enzima: 14 (70%) je imalo laboratorijski potvrđenu dijagnozu akutnog koronarnog sindroma (ACS) a 6 (30%) pacijenata nije imalo. U našim istraživanjima pratili smo zastupljenost sledećih faktora rizika: hipertenzija (HTA), hereditet, diabetes mellitus (DM), pušenje, hiperlipoproteinemija (HLP) i prethodni atak ishemijske bolesti srca (IBS). Pored navedenih faktora rizika pratili smo srčanu frekvencu, vrednost sistolnog i dijastolnog krvnog pritiska na prijemu, prisustvo proširenih Sgarbossa kriterijuma, upotrebu lekova i intrahospitalni mortalitet. Od statističkih metoda koristili smo: Student-ov T-test, Fisher-ov egzaktni test, senzitivnost i specifičnost.

Rezultati. Pokazali smo da proširene Sgarbossa kriterijume ne treba zanemarivati u postavljanju dijagnoze akutnog koronarnog sindroma, a posebno: pozitivan T talas u odvodima V_5,V_6, Cabrera-in znak-nazubljen S zubac u odvodu V_3 ili V_4, prisustvo S zupca u odvodu V_5 ili V_6, prisustvo Q zupca u dva susedna prekordijalna, levogram. Utvrdili smo da od posmatranih faktora rizika jedino je diabetes mellitus povezan sa ACS u LBBB ($p = 0,018$) jer četrdesest i dva puta povećava šansu za nastanak ACS u LBBB (OR=42; CI 1,176-1,297; 0,973) i statistički značajno utiče na pojavu ACS u LBBB ($p = 0,04$). Prmetili smo da je intrahospitalni mortalitet veći ako je ACS udružen sa LBBB, međutim Fisher-ov test je pokazao da ne postoji zavisnost između inrahospitalnog mortaliteta i pojave ACS kod pacijenata sa LBBB ($p = 1,00$).

Ključne reči: LBBB, ACS, Sgarbossa kriterijumi, diabetes mellitus, mortalitet

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INTRODUCTION

Complete left bundle branch block (LBBB) has been defined as a duration of QRS complex longer than 120 msec, Q or rS in V_1, an absence of Q in D_1, aVL, V_5, V_6, peak of R wave on 60 msec in D_1, aVL, V_5, V_6, negative T in D_1, aVL, V_5, V_6, positive T in V_1, V_2. The presence of LBBB significantly deforms the processes of myocardial depolarization and repolarization, which decreases the sensitivity of the electrocardiogram (ECG) as a diagnostic method in patients with acute ischemia. In LBBB, normal septal Q waves disappear, which are present in left precordial leads (V_5, V_6) as well as in the leads D_1 and aVL, where during the regular implementation they have been detected due to initial depolarization of septum from left to right. Instead, septum has been depolarized by impulses that come from the right bundle branch block (RBBB) and therefore its depolarization goes from right to left, providing immediately R wave in the left leads. The presence of a Q wave in leads D_1, aVL, V_5, V_6 in the LBBB, regardless of how small they are, is considered to be pathological and signifies myocardial injury (1). A diagnosis of acute coronary syndrome (ACS) in the presence of LBBB can be obtained using the expanded Sgarbossa criteria (Table 1) (2).

Table 1. Expanded Sgarbossa criteria

AIM

In this study, we evaluated the presence of risk factors within patients, heart rate, values of systolic and diastolic blood pressure on admission, the presence of expanded Sgarbossa criteria, the administration of medications, and intrahospital mortality.

The study was designed to examine the link between expanded Sgarbossa criteria and patients with acute coronary syndrome in the presence of LBBB and intrahospital mortality with the following risk factors: hypertension, heritage, diabetes mellitus, smoking, hyperlipoproteinemia, and a previous attack of ischemic heart disease.

METHODS

Three hundred forty patients entered this study. All were hospitalized at the Coronary unit of the Cardiology Center, Clinical Center "Kragujevac". The mean follow-up was nine months (starting from 1 Jan 2008 to 10 Jan 2008). A total of 20 patients had LBBB. LBBB of the His bundle was diagnosed based on standard electrocardiographic criteria. A diagnosis of ACS was established by the presence of typical precordial pain for a duration longer than 20 minutes and the presence of electrocardiographic expanded Sgarbossa criteria and was confirmed by a finding of high cardio-specific markers (creatine kinase double reference ranges, troponin >0,1 μg/l). LBBB was assumed to be de novo in the absence of anamnestic data or previously documented LBBB. Patients with LBBB were divided into two subgroups according to ranges of cardio-specific enzymes: 14 (70%) had a laboratory confirmed diagnosis of ACS (ranges of cardio-specific markers above the reference ranges), and 6 (30%) patients did not have diagnosed ACS (cardio-specific markers in the reference range).

In this study we observed the presence of the following risk factors: hypertension (HTA), heritage, diabetes mellitus (DM), smoking, hyperlipoproteinemia (HLP), and a previous attack of ischemic heart disease (IHD). Besides the risk factors mentioned above, we observed heart rate, the values of systolic and diastolic blood pressure on admission, the presence of expanded Sgarbossa criteria, the use of medications, and intrahospital mortality. Distribution data were performed using the Shapiro-Wilk test. Statistical analysis was performed by Fisher's exact test or Student's T-test where appropriate.

RESULTS

The average age of patients with LBBB was 60 years, and the sex of observed patients with LBBB was as follows: 14 of the (70%) male sex (11 patients with ACS and 3 without ACS) and 6 of the (30%) female sex (3 patients with ACS and 3 without ACS).

The rate of the following risk factors are shown in figures 1 and 2: hypertension (HTA), heritage, diabetes mellitus (DM), smoking, hyperlipoproteinemia (HLP), and a previous attack of ischemic heart disease (IHD) related to the sex of patients with or without ACS and LBBB.

p values were 1.00 (HTA), 0.336 (Heritage), 0.018 (DM), 1.00 (Smoking), 0.325 (HLP), and 1.00 (Previous attack of IHD) (Fisher Exact´s Test).

The systolic blood pressure of all patients with LBBB was 128.28 ± 30.96 (ACS) and 148 ± 29.2 (without ACS) (p = 0.202; Student's T-test). The diastolic blood pressure of all patients with LBBB was 79.5±14.88 (ACS) and 79.6±11.94 (without ACS) (p = 0,981; Student's T-test). The results are summarized in figure 4.

Figure 1. Prevalence of risk factors according to sex in patients with ACS and LBBB

Figure 2. Prevalence of risk factors according to sex in patients without ACS and LBBB

Figure 3. Mean heart rate on admission in patients with LBBB

Figure 4. Mean values of systolic and diastolic blood pressure of all patients with LBBB

Table 2. Sensitivity and specificity of expanded Sgarbossa criteria in patients with ACS and LBBB (1, 2).

Different groups of medications administered in patients with LBBB and with or without ACS are shown in table 3.

Table 3. Use of medications in patients with LBBB and with or without ACS

Intrahospital mortality in patients with LBBB was estimated using the number of patients who survived, 12 (ACS) and 6 (without ACS), and the number of patients

who died during the study, 2 (ACS) and 0 (without ACS) ($p = 1.00$; Fisher's exact test).

DISCUSSION

For the last 50 years, numerous studies have been devoted to the problem of recognizing acute coronary syndrome in the left bundle branch block of the His bundle; however, the most prominent study was performed in 1996 by Elena Sgarbossa. Based on the above mentioned study, Sgarbossa criteria were formulated and have played an indisputable role in establishing the diagnosis of acute coronary syndrome in patients with left bundle branch block of the His bundle. This is based on the fact that early establishment of the diagnosis and application of this therapy with these patients has contributed to better prognosis.

As indicated by the results from previous studies, acute LBBB in ACS occurs in 0.5% - 9% of patients, has a sensitivity of 42%, a specificity of 65%, and is three times more likely to indicate acute ischemia than an old LBBB (3, 9).

According to the results of our study, the presence of acute coronary syndrome of the left bundle branch block of the His bundle in comparison to total number of patients with acute coronary syndrome was 4.2%, which correlates well with research conducted thus far (3). The average age of our patients was 60. According to foreign studies, LBBB occurs in 2.7% of patients with acute coronary syndrome in populations younger than 65 years of age and in 10.5% of the population above 75 years of age (5). Judging by the data from currently available literature, ACS is present in 25% of patients with previous or newly arisen LBBB. It is well known that in the subgroup of patients younger than 65 years of age, chest pain appears in 37% of patients, whereas among the population above 75 years of age, 50% of patients have no chest pain but have ACS (5). Our study did not involve observation of all examined patients with LBBB but only investigated those patients who had LBBB accompanied by chest pain, which was the reason why they were hospitalized at the Coronary unit. Consequently, the incidence of ACS was significantly higher (70%). In our study the leading risk factor in patients with left bundle branch block and acute coronary syndrome was hypertension, immediately followed by heredity and diabetes mellitus, principally in patients of the male sex. The other studies had similar results (8, 17). Fisher's exact test showed the only link between DM and ACS in patients with LBBB ($p = 0.018$). When binary logistic regression was used (with DM, sex, HTA, HLP, and smoking as confounding variables), DM had a statistically significant influence on the occurrence of ACS in LBBB; it increased the likelihood of development of ACS in patients with LBBB by 42 times (odds ratio ŠORĆ 42; 95% CI, 1.176 to 1497.973; $p < 0.05$). Our study indicated that patients with acute coronary syndrome and LBBB had high heart frequency compared to those without ACS. High heart frequency is a prognostic index for cardiovascular risk. The relationship between heart frequency and mortality of coronary and cardiovascular diseases was proved in various studies. The risk of death increased as much as five-fold in men whose heart rate was higher than 88 beats per minute compared to men who had heart frequency range lower than 65 beats per minute (8, 16). The mean heart rate in a group of patients with ACS and LBBB was 82.5 beats per minute while in a group of patients without ACS, the heart rate was 75.6 beats per minute. The difference between those two values had no statistical significance (Student's T-test) ($p = 0.447$) due to the small size of the sample group; however, there was an increase in heart rate in the group with ACS and LBBB. The ranges of systolic blood pressure were lower in patients with acute coronary syndrome due to their antihypertensive treatment while the ranges of diastolic blood pressure were the same in both subgroups of patients. There were no significant differences between mean values of systolic blood pressure ($p = 0.202$) and diastolic blood pressure ($p = 0.981$).

Framingham's study showed that in patients suffering from hypertension, heart frequency range was related to various types of mortality regardless of other risk factors such as mortality for any other reason, due to coronary disease or cardiovascular disease.

Two of our male patients with ACS, with hypertension and heart rate on admission higher than 90 beats per minute died. This result was in concordance with CORDIS (Community Research and Development Information Service) (16) research that has indicated that cardiovascular death is two times higher in patients with heart frequency range above 90 beats per minute (8). In all studies performed up to this point in patients with LBBB, the three most significant criteria, concordant with QRS complex ST segment elevation $\geq$ 1mm, disconcordant with QRS complex ST segment elevation $\geq$ 5mm, and depression of ST segment in the leads V_2, V_3 $\square$ 1mm, were observed along with the additional criteria that, when associated, could point to acute coronary syndrome in certain number of cases (1, 2).

ST elevation > 1mm concordant with QRS complex has a sensitivity of 73%, which signifies that out of 100 patients with ACS and LBBB, 73 of them have this EKG change whereas 27 of them do not possess this EKG change. A specificity of 92% means that out of 100 individuals with LBBB and without ACS, eight of them had this change (false-positive), while 92 of them did not have this change present.

In our study group of 20 patients, there were 14 patients with elevated levels of cardio-specific enzyme, which served as a confirmation for ACS. We have shown that the expanded Sgarbossa criteria should not be neglected when establishing a diagnosis of ACS, particu-

larly when the following criteria are present: negative T wave in the leads V_5, V_6, a sign of Cabrera- ascending limb of the S wave in V_3 or V_4, the presence of an S wave in lead V5 or V6, the presence of a Q wave in two contiguous precordial leads, and left-axis deviation (Table 2).

Due to differences between practical recommendations from the AHA (American Heart Association, 2004) (19) and ECS (European Heart Association of Cardiology, 2008) (20) thrombolytic therapy has become justified in all patients with chest pain and (probably) de novo LBBB (7, 12). Consequently, our patients without presence of Sgarbossa criteria (1-3) did not receive thrombolytic therapy.

However, there are studies that suggest that the administration of thrombolytic therapy in patients who have LBBB and are older than 75 years is less successful (three vessel disease is more common) and related to side effects of thrombolytic treatment (stroke, haemorrhage, myocardial rupture) (10, 14, 15).

Administration of often drugs in patients with ACS (acetic acid, clopidogrel, heparin, nitrates, beta blockers, ACE inhibitors and statins) was considerably higher than in the foreign studies (Table 3) (5).

The occurrence of LBBB in AMI is related to increased mortality during hospitalization and one month and one year after hospitalization; however, if the left ventricular ejection fraction (LVEF) and comorbidity are taken into account, the difference in mortality between patients with and without LBBB disappears (4, 9), a finding that has been shown in an investigation by Stenestrand et al. (9).

In our investigations we have shown that intrahospital mortality is higher if ACS is associated with LBBB; however, Fisher's exact test showed no significant dependence between ACS and mortality ($p = 1.00$).

It is well known that intrahospital mortality increases with severity of heart failure (4). LBBB is more common in older male patients and is very often connected to anterior wall myocardial infarction with the presence of heart failure and comorbidity. Therefore, the mortality of these patients was found to be as high as 22% (5) or to range from 18% to 27% depending on whether chest pain was present or not (6).

None of our patient had 1-3 Sgarbossa criteria for ACS and anterior wall myocardial infarction, thus there was no difference in intrahospital mortality between patients with and without ACS and LBBB.

REFERENCES

1. Ostojić M, Vukčević V, Grujić M, Matić M, Orlić D, Potpara T, Ristć A, Seferović P, Stanojević-Radmili M, Vujsić-Tešić B. Zamke u čitanju EKG-a Medicinski fakultet, Beograd, 2002, 1-32.
2. Sgarbossa EB, Pinski PL, Barbagelata A, Underwood DA, et al. The GUSTO-1 (Global Utilization of Streptokinase and, for Tissue Plasminogen Activator for Occluded Coronary Arteries) Investigators. Electrocardiographic Diagnosis of Evolving Acute Myocardial Infarction in the Presence of Left Bundle-Branch Block. N Engl J Med 1996;334(8):481-487.
3. Lanoix R. AMI In Patients with LBBB. Literature Review: Which patients with suspected myocardial ischemia and left bundle branch block should receive thrombolytic agents? http://www.slred.org/index.cfm/fuseaction/feature.display/feature_id/50/.htm, 2002.
4. Mijailović V, Mrdović I, Ilić M, Peruničić J, et al. Prognostički značaj akutnog bloka grane kod pacijenata sa infarktom miokarda. ABC - časopis urgentne medicine 2007; VII(2-3):104-108.
5. Friesinger G, Smith RF. Old age, left bundle branch block and acute myocardial infarction: a vexing and lethal combination. J Am Coll Cardiol 2000; 36(3):713-716.
6. Shlipak MG, Go AS, Frederick PD, Malmgren J, et al. Investigator Treatment and outcomes of left bundle-branch block patients with myocardial infarction who present without chest pain. J Am Coll Cardiol 2000; 36:706-712.
7. Evans C, Tippins E. Acute coronary syndromes focusing on left bundle branch block. Int Emerg Nurs 2008; 16:109-118.
8. Goran Davidović. Patofiziološke osnove savrtemene terapije srčane insuficijencije. 2008,
9. Stenestrand U, Tabrizi F, Lindbäck J, Englund A, et al. Comorbididity and Myocardial Dysfunction Are the Main Explanations for the Higher 1-year mortalitity in Acute Myocardial Infarction With Left Bundle Branch Block. Circulation 2004; 110(14):1892-1902.
10. Thiemann DR, Coresh J, Schulman SP, Gerstenblith G, et al. Lack of benefit of intravenous thrombolysis in patients with myocardial infarction who are older than 75 years. Circulation 2000; 101(19):2239-2246.
11. Reuben AD, Mann CJ. Simplifying thrombolysis decisions in patients with left bundle branch block. Emerg Med J 2005;22(9):617-620.
12. Van de Werf F. Current Challenges and Directions in Antithrombotic Therapy. Timely Top Med Cardiovasc Dis 2008;(12):E2.
13. Maggioni AP, Granzosi MG, Santoro E, et al. the Gruppo Italiano per lo Studio Della Sopravvivenza nell'Infarto Miocardico II (GISSI-2) and the International Study Group. The risk of stroke in patients with acute myocardial infarction after thrombolytic and antithrombotic treatment. N Engl J Med 1992;327:1-6.
14. Berkowitz SD, Granger CB, Pieper KS, et al, for the Global Utilization of Streptokinase and Tissue Plasminogen Activator for Occluded Coronary Arteries (GUSTO) Investigators. Incidence and predictors of bleeding after contemporary thrombolytic therapy for myocardial infarction. Circulation. 1997;95:2508-2516.
15. Maggioni AA, Maseri A, Fresco C, Franzosi MG, et al., for the Investigators of the Gruppo Italian per lo Studio della Sopravvivenz nell'Infarto Miocardico (GISSI-2). Age-related increase in mortality among patients with first myocardial infarctions treated with thrombolysis. N Engl J Med 1993;329(20):1442-1448.
16. Benetos A, Rudnichi A, Thomas F, Safar M, et al. Infuence of heart rate on mortality in a French population: role of age, gender and blood pressure. Hypertension 1999; 33(1):44-52.
17. Kristal-Boneh E, Silber H, Harari G, Froom P. The association of resting heart rate with cardiovascular, cancer and all-cause mortality. [Eight year follow-up of 3527 male Israeli employees (the CORDIS Study)]. Eur Heart J 2000;21(2):116-124.
18. Kontos MC, McQueen RH, Jesse RL, Tatum JL, et al. Can Myocardial Infarction Be Rapidly Identified in Emergency Department Patients Who Have Left Bundle-Branch Block? Ann Emerg Med 2001; 37:5.

19. Antman EM, Anbe DT, Armstrong PW, Bates ER, et al. ACC/AHA Guidelines for the Management of Patients With ST-Elevation Myocardial Infarction: A Report of the American College of Cardiology/American Heart Association Task Force on Practice Guidelines (Committee to Revise the 1999 Guidelines for the Management of Patients With Acute Myocardial Infarction). J A Coll Cardiology 2004; 44(3):e1-e211.

20. [Task Force Members]. Management of acute myocardial infarction in patients presenting with persistent ST-segment elevation. Eur Heart J 2008; 29:2909-2945.