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Azotemia, Pre-Renal Azotemia and Decreased Glomerular Filtration Rate in Patients with Unstable Angina and Left Bundle Branch Block

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Abstract: The aim of the study was to evaluate renal function in patients with unstable angina and left bundle branch block. 56 patients with left bundle branch block and unstable angina were enrolled in the test group, while the control group included 310 patients with unstable angina without left bundle branch block. The following parameters were detected: proteinuria, low GFR, hypercreatinaemia, azotemia, pre-renal azotemia. The proportions of patients with azotemia (0.66) and pre-renal azotemia (0.46) were higher in the test group. In both groups the proportion of patients with decreased level of GFR (less than 90 ml/min/1.73 m^2) was equally high (about 0.5). Half of patients with unstable angina revealed GFR decline as a sign CRS type 1. Unstable angina with left bundle branch block is characterized by a higher prevalence of azotemia, including pre-renal azotemia.

List of Abbreviations: ACS - acute coronary syndrome, MI - myocardial infarction, LBBB - left bundle branch block, UA - unstable angina, GFR - glomerular filtration rate, PRA - pre-renal azotemia, CRS - cardiorenal syndrome

Key words: Unstable Angina · Left Bundle Branch Block · Cardiorenal Syndrome · Hypercreatinemia · Azotemia · Pre-Renal Azotemia

INTRODUCTION

The role of renal dysfunction among other risk factors of death and adverse cardiovascular events in acute coronary syndrome is well known [1]. In patients with unstable angina (UA) renal function is poorly understood issue, although UA is part and continuation of ACS. LBBB in patients with unstable angina occurs in up to 13% of cases [2]. However, LBBB is associated with the highest mortality (22.9%) in comparison with other ECG changes in UA and Q-MI [3]. The purpose of the research is to assess renal function in patients with unstable angina and LBBB.

MATERIALS AND METHODS

Object of the study-patients with unstable angina in combination with LBBB. The site for selection of patients was the Cardiology Department of the City Clinical Hospital No. 9 of the Perm city named after M.A. Tver'e (Head Doctor V.N. Petuhov, Head of Cardiological Department E.F. Varova). The study plan was approved by the Ethics Committee of the State Budgetary Educational Institution of Higher Education "Perm State Medical Academy" of the Ministry of Health of Russian Federation (resolution dated 08.02.2010, protocol number 74). Inclusion criteria were the following: patients with LBBB in any age. Exclusion criteria were the following: WPW syndrome, hyperkalemia, ventricular and nodal heart rhythm, artificial pacemaker, valvular defect, myocardial revascularization surgery (performed by the hospital for the current period).

Among 383 patients with unstable angina who were in the hospital, 56 patients suffering from LBBB (test group) and 310 not suffering from LBBB (control group) were included in the present study. There were 27 (48%) males in the test group and 157 (51%) males in the control group. There were no gender differences ($p = 0.78$).

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Table 1: Comparative analysis of concomitant pathology in patients of the test and control groups

Parameters	Test group (N = 56)	Control group (N = 310)	*P*
Stable angina (in anamnesis)	44 (79%)	216 (72%)	0.323
Heart surgeries in past medical history	9 (16%)	29 (9%)	0.174
Myocardial infarction in past medical history	26 (46%)	116 (37%)	0.168
Atrial fibrillation	12 (21%)	44 (14%)	0.252
Chronic heart failure	44 (79%)	223 (72%)	0.482
Previous stroke	6 (11%)	40 (13%)	0.837
Arterial hypertension	52 (93%)	159 (51%)	0.000
Cerebrovascular disease	9 (16%)	23 (7%)	0.048
Diabetes mellitus	16 (29%)	6 (2%)	0.000

The median age of the people at the test group was 75 (67-81) years, which was considerably higher than that of the control group, being 68 (59-75) years, $p = 0.000$. According to the medical records patients of both groups had a history of cardiovascular disease (Table 1).

Patients suffering from UA with LBBB are almost 2 times more likely to have hypertension, 2.5 times more likely to have cerebrovascular disease and 14 times more likely to have diabetes mellitus. UA was diagnosed according to the recommendations of ACCF/AHA [4]. The diagnosis of unstable angina was established in 12 hours after beginning of pain, with no signs of myocardial infarction. LBBB criteria were based on recommendations of the American Heart Association Electrocardiography and Arrhythmias Committee [5]. Laboratory blood and urine tests were performed at the time of admission to the hospital. Proteinuria was assessed by the qualitative methods using diagnostic test strips. Creatinine and urea plasma concentration was determined using the analyzer Architect i2000SR (produced by Abbott, USA). Normal concentration of creatinine was considered at 50-115 μmol/L, urea – 4.2-8.3 mmol/L [6]. Exceeding the normal values of creatinine and urea in blood and plasma was regarded as hypercreatininemia and azotemia, respectively. Glomerular filtration rate (GFR) was calculated by CKD-EPI formula for adults and elderly patients, taking into account the data on plasma creatinine level, age and sex of the patient [7]. The criterion of kidney failure was set as the decline of GFR below 90 ml/min/1.73 m^2 [8]. Also urea: creatinine (mmol/L: mmol/L) ratio was calculated. Normal urea:creatinine ratio in a healthy population was considered as 20 mmol/L: mmol/L, while urea:creatinine ratio equal to 21 mmol/L: mmol/L was evaluated as a sign of prerenal azotemia (PRA) [9]. Statistical analysis was performed using the software STATISTICA 6.1. Nonparametric statistical methods were used as the studied parameters hadn't proper distribution (H. Lilliefors criterion, at $p < 0.05$) [10]. The difference between two groups was assessed by Mann Whitney U-test, the rate difference was assessed by Z criterion. Considerable differences were reported at $p<0.05$.

RESULTS

In the test group, concentration of urea and urea:creatinine ratio were higher than that in the control group (Table 2; minimal and maximal values are presented since it is important to indicate variability).

Accordingly, the proportion of patients with pre-renal azotemia and azotemia were higher in the test group (Table3). The proportion of patients with reduced GFR values were equally high (about 0.5) in both groups.

Table 2: Comparison of renal function between test and control groups of patients

	Test Group N = 56	Control group n = 310	
Parameter	---------- M (25% -75%) ----------		*p*
Creatinine, μmol/l.	92.2 (73.0-111.0)	90.5 (74.0-103.0)	0.642
GFR, ml/min per 1.73 m^2	58.8 (53.7-74.3)	61.9 (54.6-75.5)	0.105
Urea, mmol/l.	8.9 (6.8-20.9)	6.5 (6.0-16.0)	0.000
Urea:creatinine ratio, mmol/L: mmol/l.	93.6 (71.2-110.7)	41 (30-46)	0.019

Table 3: Comparison of signs of renal function disturbance in the patients of test and control groups

Sign	Absolute number/proportion of patients of the test group N = 56	Absolute number /proportion of patients of the control group N = 310	*p*
Proteinuria	11 (19%)	39 (13%)	0,32
Reduced GFR	29 (52%)	143 (46%)	0.49
Hypercreatininemia	13 (23%)	42 (14%)	0,129
Azotemia	37 (66%)	121 (39%)	0.00
Pre-renal azotemia	26 (46%)	76 (25%)	0,02

DISCUSSION

The problem of CRS has been actively discussed during recent years as it represents the common pathology of cardiovascular system and kidneys [11, 12]. Earlier renal dysfunction was associated with chronic cardiovascular diseases, especially with CHF, but nowadays it's also associated with acute diseases [13- 15]. Current CRS classification adopted on ADQI Consensus Conference in 2010 includes five subtypes of primary renal dysfunction. This is CRS type 1 (acute cardio-renal syndrome) and type 3 (acute reno-cardiac syndrome) that may be of interest to emergency cardiology [16]. If CRS type 1 is characterized by an acute deterioration of cardiac function, resulting in acute kidney injury (AKI), AKI in CRS type 3 leads to an acute heart damage and/or cardiac dysfunction. Most often these CRS types occur in acute cardiac ischemia, congestive heart failure, arrhythmias in patients who are treated in cardiac departments or intensive care units of the hospital [17].

Prerenal syndrome is one of CRS mechanisms that includes spasm of renal arteries, decrease in blood volume, decrease in myocardial contractility, hypotension, increased venous pressure in organs of the abdominal cavity [18]. PRA develops as a result of the reduction in renal blood flow and subsequent renal hypoperfusion (increase in passive reabsorption of urea as a byproduct of the reabsorption of water and sodium in the absence of creatinine reabsorption).

The same results (decrease in GFR in patients with UA as a sign of CRS) were obtained by Mueller *et al*. [19]. Among 1,400 patients with the diagnosis of UA and MI without ST elevation there were 746 patients with decreased GFR value (less than 90 ml/min per 1.73 m^2).

CONCLUSION

- Decreased GFR value as a sign of CRS type 1 was observed in half of patients with UA and LBBB.
- Patients with unstable angina accompanied by LBBB have some clinical features: older age, associated with an increased frequency of hypertension, diabetes mellitus and cerebrovascular disease.
- UA with LBBB is characterized by a higher incidence of azotemia (occurs in 2/3 of the patients) and pre-renal azotemia (occurs in half of the patients).

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