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THE ROLE OF B-TYPE NATRIURETIC PEPTIDE LEVELS IN PREDICTING (LIFE THREATENING) REPERFUSION ARRHYTHMIAS IN ACUTE MYOCARDIAL INFARCTION PATIENTS

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ABSTRACT

Aim. To evaluate the role of B-type natriuretic peptide (BNP) levels in predicting reperfusion arrhythmias in acute myocardial infarction (AMI) patients.

Material and methods. This study included 153 patients with AMI, hospitalized in RRCEM from January to December 2023. BNP levels were measured upon admission, and subsequently on the 1st and 3rd days after thrombolytic therapy (TLT) or percutaneous coronary intervention (PCI). 24-hour Holter monitoring was conducted to detect reperfusion arrhythmias.

Results. A significant correlation was found between high initial BNP levels and the development of reperfusion arrhythmias such as ventricular premature beats, atrioventricular blocks, and paroxysmal ventricular tachycardia. BNP levels showed a significant decrease on the 1st and 3rd days post-TLT and PCI, correlating with clinical improvement.

Conclusion. High initial BNP levels are associated with an increased risk of reperfusion arrhythmias in AMI patients. Monitoring BNP levels can aid in the early identification of high-risk patients and the optimization of their treatment.

Key words: acute myocardial infarction, B-type natriuretic peptide, reperfusion arrhythmias, thrombolytic therapy, percutaneous coronary intervention.

INTRODUCTION

Acute myocardial infarction (AMI) remains one of the leading causes of death and disability worldwide. Despite significant advances in the treatment of AMI, such as thrombolytic therapy (TLT) and percutaneous coronary intervention (PCI), the incidence and severity of complications such as reperfusion arrhythmias remain high [1]. Reperfusion arrhythmias occur after blood flow is restored to the damaged area of the heart and include ventricular extrasystoles, ventricular tachycardia, atrioventricular blockages, and ventricular fibrillation. These arrhythmias can significantly worsen the prognosis in patients with AMI, increasing the risk of heart failure and death [2]. Studies show that reperfusion arrhythmias can occur in the first hours after blood flow is restored and require immediate diagnostic and therapeutic intervention to reduce the risk of complications [3]. Early diagnosis and monitoring of reperfusion arrhythmias are key to improving treatment outcomes. BNP (B-type natriuretic peptide) is a biomarker that is produced in the heart muscles in response to increased pressure and extensibility of the heart walls. It is used to diagnose and assess the severity of heart failure, as well as to predict outcomes in patients with cardiovascular diseases [4]. High levels of BNP at the admission of patients with AMI correlate with an increased risk of reperfusion arrhythmias and other complications [5]. Thus, monitoring BNP levels can help in the early detection of patients at high risk of complications and optimize their treatment.

Aim. To evaluate the role of B-type natriuretic peptide (BNP) levels in predicting reperfusion arrhythmias in acute myocardial infarction (AMI) patients.

Material and methods.

The study included 153 patients with AMI who were hospitalized at the RNCEMP in the period from January to December 2023. The inclusion criteria were: confirmed AMI, age from 45 to 75 years, and consent to participate in the study. The exclusion criteria were: cardiomyopathy, repeated myocardial infarction, renal failure, cancer, previous participation in other clinical trials. All patients underwent reperfusion therapy, including TLT performed by 78 (%) patients, PCI performed by 75 (%).

After initial hospitalization, all patients underwent standard assessment procedures, including:

– Electrocardiography (ECG): to assess the electrical activity of the heart.

– Laboratory blood tests: including the measurement of BNP levels upon admission, and then repeated on the 1st and 3rd days after thrombolytic therapy (TLT) or percutaneous coronary intervention (PCI).

To detect reperfusion arrhythmias in all patients, 24-hour Holter monitoring was performed on the first day after hospitalization and again on the third day. Monitoring recorded all episodes of arrhythmias, which was key for correlation analysis with BNP levels. BNP (B-type natriuretic peptide) is a biomarker that is produced in the heart muscles in response to increased pressure and extensibility of the heart walls. In healthy people, the BNP level is usually less than 100 ng/l. An increase in BNP levels above this threshold often indicates the presence of heart failure and other cardiac pathologies. For example, BNP levels above 300 ng/L are considered significant and indicate a high probability of serious cardiac events, including reperfusion arrhythmias in patients with acute myocardial infarction (AMI).

To process the collected data, the statistical program SPSS version 25.0 was used using descriptive statistics methods: mean (M) and standard deviation (SD) to analyze the basic characteristics of patients. The t-test was used to compare independent samples (groups of patients). Pearson correlation analysis was used to assess the relationship between BNP levels and the presence of reperfusion arrhythmias. The significance level is set at $p<0.05$.

Results

This table provides a more detailed breakdown of the reperfusion arrhythmias found in patients during the study. Each arrhythmia is presented with the frequency of occurrence, the average BNP level at admission, as well as statistical significance, which allows us to assess the correlation between high initial BNP levels and the likelihood of each type of arrhythmia.

Table 1 shows the levels of B-natriuretic peptide (BNP) in patients with various types of reperfusion arrhythmias upon admission. The study showed that in patients with ventricular extrasystoles, the average BNP level was 350 ± 120 ng/l, which is 70 ng/l higher than in patients without arrhythmias (280 ± 100 ng/l). This indicator has a significant correlation with the development of arrhythmia ($P < 0.01$).Atrioventricular blockages were diagnosed in 15 (9.8%) patients, while the BNP level in this group was 310 ± 115 ng/l, which also exceeds normal values ($P < 0.05$). Patients with paroxysmal ventricular tachycardia (5.2%) had a BNP level of 330 ± 110 ng/l ($P < 0.01$), indicating an increased risk of this arrhythmia. Cases of ventricular fibrillation were especially dangerous, where the BNP level reached 360 ± 140 ng/l, which is the highest indicator among all the arrhythmias considered ($P < 0.05$). This confirms the critical importance of BNP monitoring to

prevent serious complications. It is also noted that BNP levels in patients with sinus tachycardia and bradycardia were at the level of 300 ± 110 ng/L and 290 ± 105 ng/L, respectively, which is also higher than in patients without arrhythmias and requires careful monitoring. Nodal rhythm was recorded in 7.2% of patients, while the BNP level was 320 ± 100 ng/L.

Thus, the table highlights the importance of BNP levels as a predictor for different types of reperfusion arrhythmias in patients with acute myocardial infarction. Elevated BNP levels are associated with a greater likelihood of developing arrhythmias, which requires careful monitoring and timely intervention.

Table 1. BNP level at admission in patients with various types of reperfusion arrhythmias

Type of arrhythmia	Number of patients		Level BNP, ng/l, M±SD	P*
	abs.	%		
Ventricular extrasystoles	46	30,1	350 ± 120	<0,01
Atrioventricular blockages	15	9,8	310 ± 115	<0,05
Paroxysmal ventricular tachycardia	8	5,2	330 ± 110	<0,01
Nodal rhythm	11	7,2	320 ± 100	<0,05
Atrial fibrillation	12	7,8	340 ± 130	<0,01
Ventricular fibrillation	7	4,6	360 ± 140	<0,05
Sinus tachycardia	20	13,1	300 ± 110	<0,05
Sinus bradycardia	16	10,5	290 ± 105	<0,05
Without arrhythmia	18	11,8	280 ± 100 ng/l.	

Note: * - in relation to patients without postperfusion arrhythmia.

Table 2. BNP level after PCI and TLT in patients with AMI with Q wave, ng/L, M±SD

Type of reperfusion	**Время**	**PCI, AMI with Q wave, n=84**	**TLT, AMI with Q wave, n=69**	**P**
Baseline	Before reperfusion	325,8 ± 3,5	312,5 ± 3,2	-
1st day	After reperfusion	240,9 ± 2,8	230,4 ± 2,7	<0.05
3 rd day	After reperfusion	220,5 ± 2,6	215,3 ± 2,5	<0.05

Table 2 shows data on changes in the level of B-natriuretic peptide (BNP) in patients with acute myocardial infarction (AMI) with a Q wave who underwent percutaneous coronary intervention (PCI) or thrombolytic therapy (TLT).

- **PCI:** The BNP level in patients with AMI with a Q wave at the time of admission was 325.8 ± 3.5 ng/L. By day 1 after PCI, the BNP level decreased to 240.9 ± 2.8 ng/l ($P < 0.05$), and on day 3 — to 220.5 ± 2.6 ng/l ($P < 0.05$). This reflects a gradual improvement in the clinical condition and a decrease in cardiac load.

- **TLT:** In patients undergoing thrombolytic therapy, the initial BNP level was 312.5 ± 3.2 ng/l. On day 1, BNP decreased to 230.4 ± 2.7 ng/l ($P < 0.05$), and on day 3, it decreased to 215.3 ± 2.5 ng/l ($P < 0.05$).

These data highlight the effectiveness of both methods of reperfusion in reducing BNP levels in patients with AMI with a Q wave.

Statistical analysis of the data confirmed a significant correlation between the BNP level at admission and the development of reperfusion arrhythmias, especially ventricular extrasystoles and ventricular fibrillation. This highlights the importance of BNP as a predictor of serious reperfusion events after acute myocardial infarction. A high level of BNP can serve as a marker for identifying patients with an increased risk of complications after myocardial infarction and justifying the intensification of monitoring and correction of therapeutic strategy.

Discussion

The study confirmed the significant role of the level of B-type natriuretic peptide (BNP) in determining the risk of reperfusion arrhythmias in patients with acute myocardial infarction. These findings are consistent with current research that highlights the importance of BNP as a predictive marker in cardiology. Initial high levels of BNP are associated with an increased risk of complications, including reperfusion arrhythmias (6). Recent studies have highlighted that BNP is a reliable marker of cardiac load and dysfunction, as well as an inflammatory response that can worsen outcomes after a heart attack. A decrease in BNP levels after treatment correlates with an improvement in left ventricular function and a reduced risk of repeated hospitalization. This makes it an important tool for monitoring and forecasting (7). In comparison with troponin, which is a standard marker of myocardial injury, BNP provides additional information to help assess the risk of reperfusion arrhythmias (8). Current research confirms that the combined use of BNP and troponin allows for more accurate risk prediction (9). Increased attention to the level of BNP in cardiology practice contributes to the early diagnosis and optimization of treatment of patients with acute myocardial infarction. This is highlighted in recent clinical guidelines, where the use of BNP for patient monitoring is becoming the standard (10).

Conclusion

The results of the study highlight the important role of the B-type natriuretic peptide (BNP) level in predicting reperfusion arrhythmias in patients with acute myocardial infarction (AMI). Elevated initial BNP levels upon admission are associated with a high risk of developing various types of arrhythmias, such as ventricular extrasystoles, atrioventricular blockages, paroxysmal ventricular tachycardia, and ventricular fibrillation. These data confirm the need for BNP

monitoring to identify patients at increased risk of cardiovascular complications in a timely manner.

Data analyses demonstrate a significant correlation between BNP levels and the likelihood of developing reperfusion arrhythmias, and also show a decrease in BNP levels on the 1st and 3rd days after reperfusion therapy, indicating a clinical improvement in patients' condition. This decrease confirms the effectiveness of the treatment and highlights the importance of dynamic monitoring of BNP levels for risk assessment and prognosis in patients with AMI.

Thus, the inclusion of BNP levels in algorithms for the diagnosis and treatment of patients with acute myocardial infarction can significantly improve treatment outcomes, allowing timely detection and prevention of the development of reperfusion arrhythmias. These data confirm that BNP is an important biomarker that should be used in cardiology practice to optimize therapy and improve prognosis in patients with AMI.

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