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THE RISK OF PREMATURE VENTRICULAR CONTRACTIONS DEPENDING ON PARAMETERS OF THE LEFT VENTRICULAR SYSTOLIC FUNCTION AMONG PATIENTS WITH ACUTE MYOCARDIAL INFARCTION

Ризик виникнення шлуночкової екстрасистолії у пацієнтів після гострого інфаркту міокарда в залежності від показників систолічної функції лівого шлуночка

Abstract

Despite the preventive measures taken to reduce the incidence of coronary heart disease, cardiovascular diseases remain the leading cause of death. In patients with acute myocardial infarction ventricular arrhythmias can be an important prognostic factor. Identifying of premature ventricular contractions (PVCs) predictors and stratifying the risk of life-threatening arrhythmias development are a complex clinical task.

Purpose of the study. *To determine the relative risk of premature ventricular contractions depending depending on the parameters of the left ventricular systolic function among patients with acute myocardial infarction.*

Material and methods. *The results of the study are based on the data obtained from a comprehensive examination of 120 patients after STEMI: with premature ventricular contractions (86 patients) and without premature ventricular contractions (34 patients). Screening of patients was carried out at the base of Municipal institution «Regional medical center of cardiovascular diseases» of Zaporizhzhia Regional Council in the period from 2016 to 2017. All examined persons were comparable by age, social status and sex (the ratio of men to women was 4 to 1).*

Results and discussion. *The largest area under the ROC curve (AUC = 0,76, 95% CI 0,668 to 0,829) among the analyzed parameters of systolic heart function had an indicator of the left ventricle ejection fraction (LF EF). At the cut-off point < 54,2% sensitivity was 57,0% and specificity 85,3%. In the group with STEMI and*

Резюме

Незважаючи на профілактичні заходи щодо зниження захворюваності на ішемічну хворобу серця, серцево-судинні захворювання є провідною причиною смерті. У пацієнтів з ішемічною хворобою серця, які перенесли гострий інфаркт міокарда шлуночкової аритмії можуть бути важливим прогностичним фактором. Виявлення предикторів шлуночкової екстрасистолії (ЖЕС) та стратифікація ризику розвитку небезпечних для життя аритмій є складною клінічною задачею.

Мета роботи. *Визначити відносний ризик шлуночкової екстрасистолії в залежності від параметрів систолічної функції лівого шлуночка у хворих з гострим інфарктом міокарда.*

Матеріали та методи. *Під спостереженням перебували 41 хворий. Хворі умовно були розділені на дві групи: перша група – хворі, які мають хронічну серцеву недостатність (n = 28), контрольна група (n = 13) – хворі, яким була виконана ортотопічна трансплантація серця.*

Результати та обговорення. *Найбільшу площу під кривою ROC (AUC = 0,76, 95% ДІ 0,668−0,829) серед аналізованих показників систолічної функції серця мала фракція викиду лівого шлуночка (ФВ ЛШ). В точці відсікання < 54,2% чутливість склала 57,0% та специфічність 85,3%. У групі STEMI з шлуночковими екстрасистолами були 50 пацієнтів з ФВ ЛШ менше 54,2% та 36 вище 54,2%, в групі STEMI без ЖЕС, 6 пацієнтів мали ФВ ЛШ менше 54,2% та 28 з них були ФВ ЛШ вище 54,2% відповідно. Відносний ризик склав 1,59, 95% ДІ 1,26−2,01.*

PVCs were 50 patients with LF EF below 54,2% and 36 ones above 54,2%, in the group STEMI without PVCs, 6 patients had LF EF below 54,2% and 28 ones had LF EF above 54,2% respectively. Relative risk was 1,59, 95% CI 1,26–2,01.

Keywords: *Ischemic heart disease, STEMI, relative risk, premature ventricular contractions, left ventricular systolic function.*

Ключові слова: *ішемічна хвороба серця, STEMI, відносний ризик, шлуночкова екстрасистолія, систолічна функція лівого шлуночка.*

INTRODUCTION

CDespite the preventive measures taken to reduce the incidence of coronary heart disease (CHD), cardiovascular diseases remain the leading cause of death. In patients with acute myocardial infarction ventricular arrhythmias can be an important prognostic factor [1].

The spectrum of ventricular arrhythmias can range from asymptomatic single premature ventricular contractions (PVCs) to fatal arrhythmias. In addition, multiple forms of ventricular arrhythmias can be detected in patients with coronary artery disease [2, 3].

Of particular importance is the detection of PVCs among patients who have STEMI. Prognostic value of PVCs at the present time remains understudied. The role of frequent PVCs as a predictor of unfavorable prognosis was demonstrated in the population of patients with myocardial infarction [4].

Identifying PVCs predictors and stratifying the risk of developing life-threatening arrhythmias is a complex clinical task. It should be noted that currently there are no powerful and effective tools to identify markers of malignant ventricular arrhythmias in the population, and indications for Holter monitoring require some optimization, which makes it relevant to study this issue [5].

PURPOSE OF THE STYDY

To determine the relative risk of PVCs depending on parameters of the left ventricular systolic function among patients with acute myocardial infarction.

MATERIALS AND METHODS

The results of the study are based on the data obtained from a comprehensive examination of 120 patients after STEMI: with premature ventricular contractions (86 patients) and without premature ventricular contractions (34 patients). Screening of patients was carried out at the base of Municipal institution «Regional medical center of cardiovascular diseases» of Zaporizhzhia Regional Council in the period from 2016 to 2017. All examined persons were comparable by age, social status and sex (the ratio of men to women was 4 to 1).

The criteria for inclusion in the study are male and female patients age is from 46 to 75 years; postmenopausal women more than 1 year; STEMI – 5 day from the onset; informed consent of patients for further observation.

The criteria for exclusion from the study are atrioventricular block of the III degree; permanent atrial fibrillation; revealed congenital or acquired hemodynamically significant heart disease; chronic heart failure of the III stage; decompensated comorbidities; acute inflammatory diseases or exacerbation of chronic ones; the left ventricle ejection fraction < 45%; coronary artery bypass grafting in the anamnesis; cancer.

The patients were divided into groups after the establishment of the compliance of patients regarding to the criteria for inclusion / exclusion from the study depending on the presence/or absence of PVCs:

– the first group includes 86 patients with STEMI and PVCs (average age is 60,0 (54,0–66,0) years);

– the second group consists of 34 patients with STEMI without PVCs (average age is 59,0 (50,0–65,0) years),

Clinical examination of patients. All patients were thoroughly examined for compliance with the criteria for inclusion / exclusion. All patients underwent clinical, laboratory and instrumental examination according to the order No 455 of the Ministry of health of Ukraine dated 03.07.2014. The Verification of the diagnosis of AMI was performed on the basis of the ESC/ACCF/AHA/WHF Third universal definition of myocardial infarction (2012).

ECG monitoring was carried out with calculation of indicators of heart rate turbulence. Holter ECG monitoring lasted 24 hours, registration was carried out with the three-channel Cardiosens-K (KhAI-Medica, Ukraine), followed by an analysis of the record for the standard protocol [6].

Echocardiography. Echocardiographic study was carried out on the Vivid 3 Expert device (General Electric, USA) in M- and B-modes using a 3S sensor with a frequency of 1,5–3,6 MHz by conventional techniques EACVI (European Association of Cardiovascular Imaging), ASE (the American Society of Echocardiography). Determined parameters of the left ventricular (LV), systolic function: the size of the left atrium (LA), end-systolic and end-diastolic

LV volumes (LVVd, LVVs), stroke volume (SV), calculated the left ventricle ejection fraction (LV EF) using Simpson's method [7].

Treatment of patients. Patients were treated in conformity with the recommendations of ESC (2012), according to the order No 455 of the Ukraine's Ministry of health dated 02.07.2014. In the group of patients with STEMI was the following therapy: systemic thrombolytic therapy was performed among 34 (28,3%) patients, percutaneous coronary intervention was among 59 (49,2%) patients, combination of thrombolytic therapy and percutaneous coronary intervention were among 27 (22,5%) patients. The follow-up treatment was carried out with the anticoagulants, antiaggregants, selective β-blockers, inhibitors of angiotensin converting enzyme, lipid-lowering drugs.

STATISTICAL PROCESSING OF THE OBTAINED RESULTS

The obtained data had a different distribution from the normal, and are presented in the form of median and inter quartile Me range [Q25−Q75]. The results of the study were processed by parametric or nonparametric statistics depending on the sample allocation using specialized computer applications Apache Open Office (version 4.1) and PSPP (version 0.10.2, GNU Project, 1998−2016). While comparing more than two independent variables, they used a variance analysis (One-way ANOVA), followed by a posteriori test. Equality of variances was checked using Leven's test. They used the criterion Scheff while equality of variances in the studied groups, and they used to test T2-Tamhane while the absence of equality of variances was. In the case of distribution of data distinct from normal, they used the analogue of dispersion analysis by the Kruskal-Wallis method followed by post-hoc analysis using the Dunn criterion. The curves of operational characteristics (ROC − Receiver Operating Characteristic curve) were constructed and analyzed, the area under ROC curve (AUC-Area under the ROC curve) and its 95% confidence interval (CI), sensitivity (sensitivity, Se) and specificity (specificity, Sp) were also calculated. The model was considered to be adequate at statistically significant at AUC value more than 0,5. Cut off was determined using Youden index J. Using the Cut off values, was calculated relative risk.

OBTAINED RESULTS

We analyzed left ventricular systolic function parameters among patients with STEMI with and without PVCs. The results are shown in table 1.

Table 1

The levels of parameter the LV systolic function among patients with STEMI Me (Q25−Q75), n = 120

Variable	Patients with PVCs (n = 86)	Patients without PVCs (n = 34)	p-level
LA, cm	3,7 (3,4−4,0)	3,7 (3,4−4,1)	0,73
LVVd, cm³	110,5 (89,7−134,8)	103,2 (86,8−136,6)	0,77
LVVs, cm³	49,8 (37,9−60,0)	42,1 (38,0−50,4)	0,02
LVEF, %	53,1 (48,5−59,6)	60,6 (54,8−66,1)	0,001

There was no significant difference in left atrium size between the groups of patients with STEMI and PVCs 3,7 (3,4−4,0) cm vs 3,7 (3,4−4,1) cm in the STEMI without PVCs group, (p > 0,05). Also, there was no significant difference in such indicator of LV systolic function as end-diastolic LV volumes (LVVd) among the examined persons.

The LVVs among patients with STEMI and PVCs was 49,8 (37,9−60,0) cm³ and was significantly higher than against 42,1 (38,0−50,4) cm³ in the STEMI without PVCs group (p < 0,05). The left ventricular ejection fraction in the group of patients with STEMI and PVCs was significantly lower and amounted to 53,1% (48,5−59,6) versus 60,6% (54,8−66,1) in the group of patients with STEMI without PVCs (p < 0,05).

Further, using two data sets: the first group of patients with STEMI and PVCs (n = 86) and the second – STEMI without PVCs (n = 34) performed ROC-analysis. The results are presented in table 2.

The largest area under the ROC curve (AUC = 0,76, 95% CI 0,668 to 0,829) among the analyzed parameters of systolic heart function had an indicator of the LV EF. At the cutoff point < 54,2% sensitivity was 57,0% and specificity 85,3 %. The average quality of the model (AUC = 0,63; 95% CI AUC 0,534 to 0,714) had LVVs. The value of this index relative to PVCs at the cutoff point > 46,9 cm³ in patients with STEMI sensitivity was 58,14% and specificity − 70,59%.

Systolic function indices such as LA and LVVd, although had significant prognostic value according to ROC-analysis (AUC > 0,5) for PVCs detection, however, their models were unsatisfactory (AUC 0,5−0,6).

Using the Cut off values, relative risk was calculated for analyzed indicators the LV systolic function. Obtained result shown in table 3.

Table 2

The cutoff of parameter the LV systolic function for PVCs

Variable	Cutoff	AUC	95% CI AUC	Se, %	Sp, %
LA, cm	< 4,04	0,52	0,431 to 0,616	87,21%	26,47%
LVVd, cm³	< 144,7	0,52	0,425 to 0,610	89,53%	23,53%
LVVs, cm³	> 46,9	0,63	0,534 to 0,714	58,14%	70,59%
LVEF, %	< 54,2	0,76	0,668 to 0,829	57,0%	85,3%

Table 3

The relative risk of occurrence for PVCs among patients with STEMI

Variable	Cut off	RR	95% CI RR
LA, cm	< 4,04	0,733	0,486–1,108
LVVd, cm³	< 144,7	1,412	0,890–2,241
LVVs, cm³	> 46,9	1,389	1,097–1,758
LVEF, %	< 54,2	1,587	1,256–2,006

For variables LA and LVVd the value of RR was unreliable because 95% CI crossed a RR of 1. In the group with STEMI and PVCs were 36 patients with LVVs below 46,9 cm³ and 50 ones above 46,9 cm³, in the group STEMI without PVCs, 24 patients had LVVs below 46,9 cm³ and 10 ones had LVVs above 46,9 cm³ respectively. Relative risk was 1,39; 95% CI 1,10–1,76. In the group with STEMI and PVCs were 50 patients with the LV EF below 54,2% and 36 ones above 54,2%, in the group STEMI without PVCs, 6 patients had the LV EF below 54,2% and 28 ones had the LV EF above 54,2% respectively. Relative risk was 1,59; 95% CI 1,26–2,01.

RESULTS AND DISCUSSION

Significant reduction of left ventricular ejection fraction in the group of patients with STEMI with PVCs 53,1% (48,5–59,6) against 60,6 (54,8–66,1), (p < 0,05) in the group of patients with STEMI without PVCs indicates deterioration of LV function in PVCs. The obtained results are consistent with the results of previous studies, which showed that the dysfunction of LV was associated with an increase in the frequency of episodes of ventricular arrhythmias [8, 9].

We believe that in patients after STEMI, even with a slight decrease in LV EF and moderate LV dilation, 24-hour Holter monitoring and more detailed examination of patients to predict arrhythmic complications are extremely relevant.

CONCLUSION

1. STEMI with PVCs patients have lower ejection fraction than patients without PVCs.

2. The relative risk of premature ventricular contracts increases in 1,6 times among patients with acute myocardial infarction with decreased ejection fraction below 54,2%.

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