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EFFECTS OF PERMANENT PACEMAKER ON THE PULSE PRESSURE IN PATIENTS IN EARLY POST-IMPLANTATION PERIOD

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The frequency of pulse pressure (PP) and patients migration between PP classes in 220 patients (110 men and 110 women) in average age (70 ± 9) years in the early period after pacemaker implantation (3-5 days) in VVI/VVIR, DDD/DDDR, CRT-P/D pacing modes with atrioventricular block, bundle brunch block, sick sinus node syndrome, permanent bradysystolic form of atrial fibrillation and dilated cardiomyopathy were studied. The results showed that the implantation of the pacemaker helps to normalize PP in 79 % of patients with the prevalence in class III due to reducing of PP in II, IV and V classes in the VVI, DDD, DDDR pacing mode, and there is no significant effect of it on the migration of patients in PP classes in VVIR and CRT mode. Saving in 21 % of patients II, IV and V class of PP after pacemaker implantation shows the necessity in complement drug therapy.

KEY WORDS: permanent pacemaker, arterial hypertension, pulse pressure, acute post-implantation period

ВПЛИВ ПОСТІЙНОЇ ЕЛЕКТРОКАРДІОСТИМУЛЯЦІЇ НА ПУЛЬСОВИЙ АРТЕРІАЛЬНИЙ ТИСК У ПАЦІЄНТІВ В РАННЬОМУ ПІСЛЯІМПЛАНТАЦІЙНОМУ ПЕРІОДІ

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Вивчено частоти зустрічальності пульсового артеріального тиску (ПАТ) і міграцію пацієнтів між класами ПАТ у 220 пацієнтів (110 чоловіків і 110 жінок) віком (70 ± 9) років в ранній період після імплантації електрокардіостимулятора (ЕКС) (3-5 доба) в режимах стимуляції VVI / VVIR, DDD / DDDR, CRT-P / D з атріовентрикулярною блокадою, блокадою ніжок пучка Гіса, синдромом слабкості синусового вузла, постійною брадисистолічною формою фібриляції передсердя і дилатаційною кардіоміопатією. Результати показали, що імплантація ЕКС сприяє нормалізації ПАТ у 79 % пацієнтів з концентрацією в III класі за рахунок зниження в II, IV і V класах ПАТ при VVI, DDD, DDDR режимах стимуляції, а при VVIR і CRT режимах вона не робить достовірного впливу на міграцію пацієнтів в класах ПАТ. Збереження у 21 % пацієнтів II, IV і V класів ПАТ після імплантації ЕКС показує необхідність її доповнення медикаментозною терапією.

КЛЮЧОВІ СЛОВА: постійна електрокардіостимуляція, артеріальна гіпертензія, пульсовий артеріальний тиск, гострий післяімплантаційний період

ВЛИЯНИЕ ПОСТОЯННОЙ ЭЛЕКТРОКАРДИОСТИМУЛЯЦИИ НА ПУЛЬСОВОЕ АРТЕРИАЛЬНОЕ ДАВЛЕНИЕ У ПАЦИЕНТОВ В РАННЕМ ПОСТИМПЛАНТАЦИОННОМ ПЕРИОДЕ

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Изучены частоты встречаемости пульсового артериального давления (ПАД) и миграция пациентов между классами ПАД у 220 пациентов (110 мужчин и 110 женщин) в возрасте (70 ± 9) лет в ранний период после имплантации электрокардиостимулятора (ЭКС) (3-5 сут) в режимах стимуляции VVI/VVIR, DDD/DDDR, CRT-P/D с атриовентрикулярной блокадой, блокадой ножек пучка Гиса,

синдромом слабости синусового узла, постоянной брадисистолической формой фибрилляции предсердия и дилатационной кардиомиопатией. Результаты показали, что имплантация ЭКС способствует нормализации ПАД у 79 % пациентов с концентрацией в III классе за счет снижения во II, IV и V классах ПАД при VVI, DDD, DDDR режимах стимуляции, а при VVIR и CRT режимах она не оказывает достоверного влияния на миграцию пациентов в классах ПАД. Сохранение у 21 % пациентов II, IV и V классов ПАД после имплантации ЭКС показывает необходимость ее дополнения медикаментозной терапией.

КЛЮЧЕВЫЕ СЛОВА: постоянная электрокардиостимуляция, артериальная гипертензия, пульсовое артериальное давление, острый постимплантационный период

INTRODUCTION

Permanent pacemaker is the standard treatment for patients with such disorders as bradyarrhythmia and chronic heart failure (CHF) [1]. One of its positive effects is the improvement of the pumping function of the heart, what increases the blood pressure (BP) [2–4].

Pulse pressure (PP) rises when systolic blood pressure (SBP) increases, what negatively affects the hemodynamics of elastic properties of the major vessels and function of the left ventricle (LV) [5–7]. However, there is only one research, which contains PP changes in patients with a pacemaker [8] studying, but the classes of PP were not studied.

OBJECTIVE

Purpose of this study is to investigate effects of permanent pacemaker on the PP in the early post-implantation period, for developing proposals for the control of blood pressure and complement drug therapy.

MATERIALS AND METHODS

220 patients, including 110 men and 110 women were examined in the department of ultrasound and instrumental diagnostics with miniinvasive interventions of SI «V. T. Zaytsev Institute of General and Emergency Surgery NAMS of Ukraine». Mean age of the patients was 70 ± 9 years; all of them were implanted pacemaker in period from 2006 to 2015. Indications for pacemaker implantation were: atrioventricular (AV) block - 125 patients, bundle branch block - 55, sick sinus syndrome (SSS) – 51 patients, permanent bradysystolic form of atrial fibrillation (AF) - 70, dilated cardiomyopathy (DCM) – 16 patients. The patients were treated with different pacing modes: VVI / VVIR (isolated ventricular node without or with frequency adaption) – 69 patients, DDD / DDDR (double chamber pacing without or with frequency adaption) – 132 patients, CRT-P / D – 19 patients.

Exclusion criteria were: age less than 40 years, the presence of concomitant angina IV functional class (FC), chronic heart failure (CHF) IV FC.

SBP and DBP were measured by Korotkov's method according to the recommendations of the Association of Cardiologist of Ukraine for the prevention and treatment of hypertension by tonometer Microlife BP AGI-20 after 15 minutes rest. PP was calculated by the formula: PP=SBP-DBP (mm Hg).

Patients were assigned into five classes according to levels of PP: I - very low PP - less than 20 mm Hg; II – low PP - from 20 to 40 mm Hg; III – normal PP - from 40 to 60 mm Hg; IV – high PP – from 60 to 80 mm Hg; V – very high PP – more than 80 mm Hg.

Frequencies of occurrence of PP and patients migration between PP classes were studied before the operation, and in the early postoperative period (3–5 days) after the pacemaker implantation at various modes of stimulation.

The data were brought into the Microsoft Excel base. For statistical evaluation of the results were used the parametric criteria (relative (p, percentage (%) and the mean percenttage error (sP)) units). Probable results were determined at levels of reliability $p < 0,05$ and $p < 0,01$.

RESULTS AND DISCUSSION

Frequencies of PP classes' occurrence in patients before and in the early period after pacemaker implantation are shown in Fig. Pacemaker implantation in the acute post-implantation period has positive effect on PP, what manifests by increasing frequency of PP class III ($p \leq 0,01$) because of reducing frequency of II, IV and V of PP classes ($p > 0,05$).

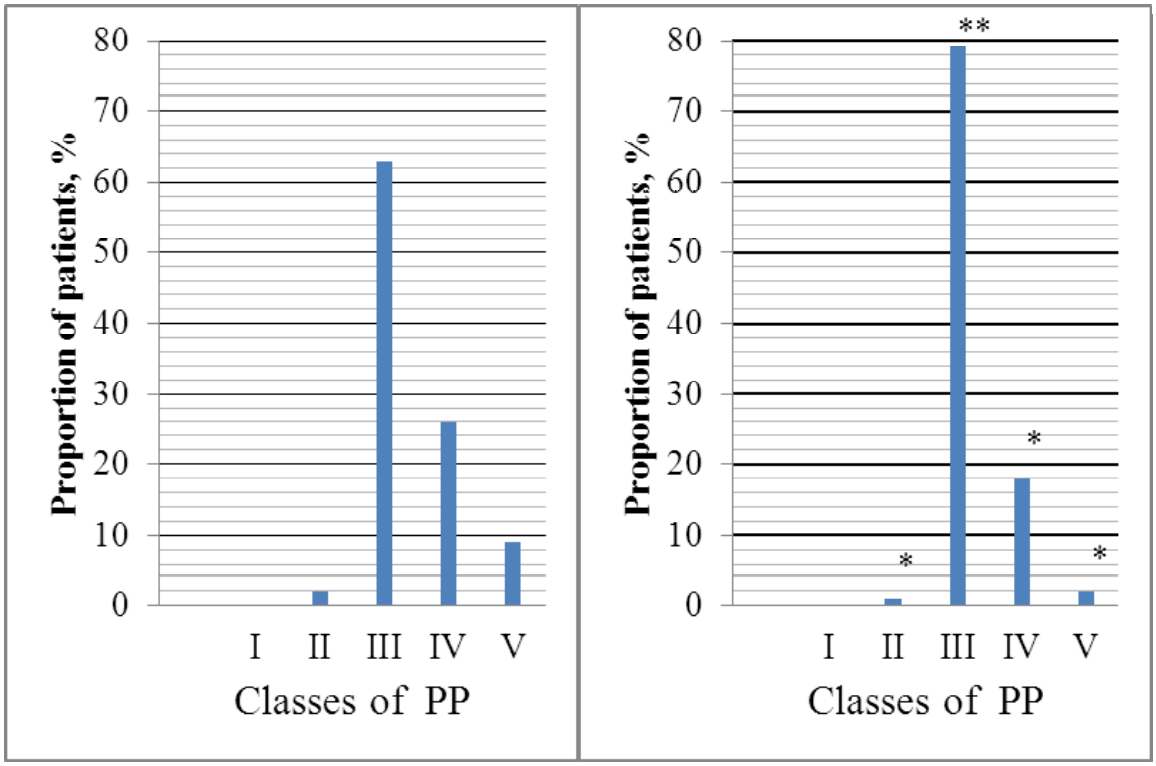

Fig. Frequencies of PP classes' occurrence in patients before (a) and in the early period after (b) pacemaker implantation

Note: * p > 0,05; **p ≤ 0,01 - in the class between the baseline values.

Frequencies of PP classes' occurrence in patients before and in the early period after pacemaker implantation at various pacing modes are presented in Table 1. Pacemaker implantation in the acute period is presented by increasing frequency of PP class III in VVI, DDD, DDDR pacing modes (p ≤ 0,01) because of reducing frequency of II, IV and V of PP classes, and frequencies of PP classes' occurrence in VVIR and CRT pacing modes were not significantly changed.

Table 1

Frequencies of PP classes' occurrence in patients before and in the early period after pacemaker implantation at various pacing modes

		PP classes (% ± sP)							
		II		III		IV		V	
Pacing modes	All of patients in class (n, % ± sP)	Before pacing	After pacing	Before pacing	After pacing	Before pacing	After pacing	Before pacing	After pacing
VVI	55 (25 ± 3)	2 ± 1	2 ± 2	63 ± 3	78 ± 6**	26 ± 3	16 ± 5#	9 ± 2	4 ± 2#
VVIR	14 (6 ± 2)	2 ± 1	0	63 ± 3	79 ± 10*	26 ± 3	21 ± 10*	9 ± 2	0
DDD	61 (28 ± 3)	2 ± 1	2 ± 2	63 ± 3	79 ± 5**	26 ± 3	16 ± 5*	9 ± 2	3 ± 2*
DDDR	71 (32 ± 3)	2 ± 1	1 ± 1	63 ± 3	80 ± 5**	26 ± 3	17 ± 4#	9 ± 2	1 ± 1
CRT	19 (8 ± 2)	2 ± 1	0	63 ± 3	74 ± 10*	26 ± 3	26 ± 10*	9 ± 2	0

Note: *p > 0,05, **p ≤ 0,01, #p < 0,05 - in the class between the baseline values.

Results of patients' migration between PP classes in the early period after pacemaker implantation are shown in Table 2. Most of patients (16 %) after pacemaker implantation migrated from II, IV and V classes to III class of PP (79 % of patients). Only 6 % of patients with classes III and V migrated to class IV and only 0.5 % - from III to the II class of PP. Preservation of II, IV and V classes of PP was registered in 21 % of patients.

Table 2

Results of patients' migration between PP classes in the early period after pacemaker implantation

Patients (% ± sP)	PP classes			
	II	III	IV	V
Were in class	2 ± 1	63 ± 3	26 ± 3	9 ± 2
Remaining in class	1 ± 1	62 ± 3	11 ± 2	2 ± 1
Moved into class I	0	0	0	0
Moved into class II	-	0,5 ± 0,5	0	0
Moved into class III	1 ± 1	-	15 ± 2	0,5 ± 0,5
Moved into class IV	0	0,5 ± 0,5	-	6 ± 2
Moved into class V	0	0	0	-
Became in class	1 ± 1	79 ± 3	18 ± 3	2 ± 1

The received data about the improving of PP in patients in the early period after pacemaker implantation, what manifested by its concentration in class III because of reducing in II, IV and V classes of PP, broadly in line with [8] in which, however, classes of PP were not studied.

We could not find studies which have examined the migration of patients between PP classes, which occurs by theirs transfer from class III to II, IV and V classes of PP, according to the data obtained.

Concentration of patients in class III of PP, what is established in the early period after the pacemaker implantation, corresponding to its physiological values, indicates its positive influence on the course of hypertension. However, preservation of PP in non-physiological classes in some patients or their transition only to the II, IV classes from class V shows the need for additional supportive drug therapy.

CONCLUSIONS

1. Pacemaker implantation promotes the normalization of PP in 79 % of patients with concentration in class III by reducing in II, IV and V classes of PP.
2. After early period of pacemaker implantation the concentration of patients in the III class of PP occurs in VVI, DDD, DDDR pacing modes, and in VVIR and CRT pacing mode it has no significant effect on the migration of patients in PP classes.
3. Preservation of II, IV and V classes of PP in 21 % of patients after pacemaker implantation shows necessity of its complement drug therapy.

PROSPECTS FOR FUTURE STUDIES

Further investigation of effect of drug therapy on the optimization of PP in patients with implanted pacemaker in the long pacing period seems to be a perspective direction of researches.

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