

QRS COMPLEX DURATION AND CLINICAL FEATURES OF PATIENTS WITH PERMANENT PACEMAKERS

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125 patients (57 — women, 68 — males) with permanent pacing were examined. Among the indications for pacemaker installation there were atrio-ventricular block (AV-block) — 77 people (62 ± 4 %), sick sinus node syndrome (SSNS) — 32 patients (26 ± 4 %), bradysystolic AF — 8 patients (6 ± 2 %). 8 patients with cardioresynchronization therapy (6 ± 2 %) were also included. Average age was 69 ± 7 years. The patients were divided into two groups: first — patients with QRS complex duration under 120 mc, second — QRS duration complex with more than 120 mc. It was found that QRS complex duration with more than 120 mc is associated with males and patients with postinfarction cardiosclerosis, heavier functional class of heart failure and atrial fibrillation. Given the trend towards more clinically significant cardiovascular disease in patients with a QRS complex duration with more than 120 mc, this group of patients needs optimal therapeutic management. The results show the feasibility of and prospects for further study of this group of patients.

KEY WORDS: permanent pacing, cardioresynchronization therapy, chronic heart failure

ТРИВАЛІСТЬ QRS КОМПЛЕКСУ ТА КЛІНІЧНІ ОСОБЛИВОСТІ ПАЦІЄНТІВ З ПОСТІЙНОЮ ЕЛЕКТРОКАРДІОСТИМУЛЯЦІЄЮ

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Було досліджено 125 пацієнтів (57 — жінок, 68 — чоловіків) з постійною електрокардіостимуляцією. Серед показань до імплантації електрокардіостимулятора було передсердно-шлуночкова блокада (AB — блокада) — 77 осіб (62%), синдром слабкості синусового вузла (СССУ) — 32 пацієнтів (26%), брадісistolіческая форма фібриляції передсердь — 8 пацієнтів (6%). Були також досліджені 8 пацієнтів з кардіоресинхронізуючою терапією (6%). Середній вік пацієнтів склав 69 ± 7 років. Пацієнти були розділені на дві групи: перша — пацієнти з тривалістю QRS комплексу менше 120 мс, друга — більше 120 мс. Було виявлено, що тривалість QRS комплексу більше 120 мс асоціювалася з чоловічою статтю, постінфарктним кардіосклерозом, більш важким функціональним класом хронічної серцевої недостатності та фібриляції передсердь. З урахуванням тенденції до більш клінічно значущих серцево-судинних захворювань у пацієнтів з тривалістю QRS комплексу більше 120 мс, ця група пацієнтів потребує оптимального терапевтичного менеджменту. Результати показують можливість та перспективи для подальшого вивчення цієї групи пацієнтів.

КЛЮЧОВІ СЛОВА: постійна електрокардіостимуляція, кардіоресинхронізуюча терапія, хронічна серцева недостатність

ПРОДОЛЖИТЕЛЬНОСТЬ QRS КОМПЛЕКСА И КЛИНИЧЕСКИЕ ОСОБЕННОСТИ ПАЦИЕНТОВ С ПОСТОЯННОЙ ЭЛЕКТРОКАРДИОСТИМУЛЯЦИЕЙ

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Было исследовано 125 пациентов (57 — женщин, 68 — мужчин) с постоянной электрокардиостимуляцией. Среди показаний к имплантации электрокардиостимулятора было предсердно-желудочко-

вой блокада (АВ-блокада) — 77 человек (62 %), синдром слабости синусового узла (СССУ) — 32 пациентов (26%), брадисистолическая форма фибрилляции предсердий — 8 пациентов (6 %). Были также исследованы 8 пациентов с кардиоресинхронизирующей терапией (6 %). Средний возраст пациентов составил 69 ± 7 лет. Пациенты были разделены на две группы: первая — пациенты с продолжительностью QRS комплекса менее 120 мс, вторая — более 120 мс. Было обнаружено, что продолжительность QRS комплекса более 120 мс ассоциировалась с мужским полом, постинфарктным кардиосклерозом, более тяжелым функциональным классом хронической сердечной недостаточности и фибрилляции предсердий. С учетом тенденции к более клинически значимым сердечно-сосудистым заболеваниям у пациентов с продолжительностью QRS комплекса более 120 мс, эта группа пациентов нуждается в оптимальном терапевтическом менеджменте. Результаты показывают возможности и перспективы для дальнейшего изучения этой группы пациентов.

КЛЮЧЕВЫЕ СЛОВА: постоянная электрокардиостимуляция, кардиоресинхронизирующая терапия, хроническая сердечная недостаточность

Permanent pacing is the primary method of treatment of bradysystolic rhythm disturbances and medical refractory chronic heart failure (CHF) [1].

The effectiveness of pacing is defined by the QRS complex duration. For example, a wide QRS complex is associated with frequent hospitalizations and a higher risk of cardiac death [2–4].

So far, we haven't found any publications containing with comparing clinical conditions of patients with pacemakers in different QRS complex duration.

The purpose of this paper is to analyze the clinical features of patients with pacemakers depending on the QRS complex duration.

MATERIALS AND METHODS

125 patients (57 — women, 68 — men) who underwent permanent pacing therapy were examined in the department of ultrasound and instrumental diagnosis with miniinvasive interventions of SI «Zaycev V. T. Institute of General and Urgent Surgery NAMS of Ukraine». The average age was 69 ± 7 years.

Evaluation was made of the age and sex of the patients, the availability of diseases (chronic ischemic heart disease (CIHD) and its forms — postinfarction cardiosclerosis, stable angina (I–IV functional classes (FC)), arterial hypertension (AH) — 1–3 degrees and stages 1–4), and the presence of clinical syndromes (atrial fibrillation (AF) (paroxysmal, persistent and permanent), chronic heart failure (CHF) — stages I–III, I–IV (FC)). Also, left ventricle ejection fraction (LVEF), end-diastolic and end-systolic volumes, interventricular septum (IVS) thickness, left (LA) and right atrium (RA), right ventricular (RV) sizes, systolic (SBP) and diastolic blood pressure (DBP) were estimated.

CIHD and AH were diagnosed in accordance with the recommendations of the Ukrainian Association of Cardiology (2007). CHF stage and FC were assessed in line with the guidelines of the Ukrainian Association of Cardiology (2012) [5]. Evaluation of AF and its forms was made according to the Working Group of Cardiac rhythm disorders [7].

SBP and DBP were measured by Korotkov's method as recommended by the Association of Cardiologists of Ukraine to prevent and treat hypertension through using tonometer Microlife BP AG1 — 20 after 5 minute rest. The measurement accuracy was 2 mm Hg.

Electrocardiogram (ECG) was performed with computer electrocardiograph Cardiolab+2000 in the early postoperative period (the third — fifth day after the pacemaker installation). The stimulated QRS complex duration was measured in leads II, V5, V6 (the average of three consecutive complexes) with choosing of a maximum value. The measurement accuracy was 1mc.

Echocardiography was conducted by the ultrasound machine Toshiba. LF, RF, RV sizes and IVS thickness was measured. EDV and ESV were calculated by Teichholz's formula. $EDV = (7 \cdot EDD^3) / (2,4 + EDD)$, $ESV = (7 \cdot ESD^3) / (2,4 + ESD)$. LVEF was calculated using the formula $LVEF = (EDV - ESV) / EDV * 100 \%$. The measurement accuracy was 0,5 mm.

The patients were divided into two groups: 1 — with the QRS complex duration under 120 mc, 2 — more than 120 mc. The age and sex of the patients, along with the availability of diseases, clinical syndromes and functional values were assessed and compared in the selected groups.

The data were brought into the Microsoft Excel base. For statistical evaluation of the re-

sults, the parametric criteria (the mean — M, sd — the average deviation) and nonparametric ones (absolute (n, the number) and relative (p, %) units) were used. The probability of differences between groups was determined using a non-parametric U — Mann-Whitney test. The expected result is determined by levels of reliability $p < 0,01$ and $p < 0,05$.

RESULTS AND DISCUSSION

Table 1 shows the distribution of patients with installed pacemakers into groups according to the QRS stimulated complex duration. The average age of the patients in the groups was the same ($p > 0,05$). In the first group the predominant patients were women, and in the second — men ($p < 0,05$).

Table 1

Clinical characteristics of patients with pacemakers

Clinical data			Total	QRS complex duration		
				Under 120 mc	More than 120 mc	
Age, years (M ± sd)			125	69 ± 8	69 ± 7	
Sex (n, % ± sP)			F	57	65 ± 9	
			M	68	35 ± 9	
Diseases	CIHD	Postinfarction cardiosclerosis, (n, % ± sP)		14	3 ± 1	14 ± 4*
		Stable angina (n, % ± sP)	Total	41	38 ± 9	31 ± 8
			FC I	10	—	33 ± 9
			FC II	19	63 ± 15	40 ± 9
			FC III	10	37 ± 15	20 ± 7
	FC IV	2	—	7 ± 5		
	Arterial hypertension (n, % ± sP)	Total		102	83 ± 7	81 ± 4
		Degree	0	23	14 ± 6	19 ± 4
			1	39	26 ± 8	33 ± 5
			2	52	50 ± 9	40 ± 5
			3	11	10 ± 6	8 ± 3
		Stage	0	23	14 ± 6	19 ± 4
			1	3	7 ± 5	2 ± 1
			2	60	38 ± 9	51 ± 5*
			3	39	41 ± 9	28 ± 5*
		Diabetes mellitus, (n, % ± sP)	Type	1	—	—
	2			15	14 ± 6	12 ± 3
	Severity		Light	—	—	—
			Medium	10	10 ± 6	8 ± 3
	Heavy	5	4 ± 3	4 ± 2		
Clinical syndromes	CHF (n, % ± sP)	Total		95	70 ± 5	78 ± 4
		Stage	I	7	10 ± 6	4 ± 2
			IIA	60	31 ± 9	51 ± 5*
			IIB	25	24 ± 8	19 ± 4
			III	3	4 ± 4	2 ± 1
		FC	I	5	10 ± 6	3 ± 2
			II	48	66 ± 9	50 ± 7
	III		29	21 ± 8	39 ± 6*	
	AF (n, % ± sP)	Total		40	24 ± 8	34 ± 5
		Paroxysmal and persistent		20	10 ± 6	17 ± 4
Permanent		20	14 ± 6	17 ± 4		

Comment:

* $p < 0,05$; ** $p < 0,01$ — the level of significance of differences;

sP — percent average error,

M — mean value,

sd — standard deviation

In the structure of CIHD, the proportion of patients with postinfarction cardiosclerosis was

lower in group 1 than in group 2 ($p < 0,05$). The distribution of patients with stable angina

in both groups was even. In the first group the patients with II and III stable angina FC were predominant. The patients with hypertension were also divided into groups evenly. The differences between the groups in degrees of AH have not been detected ($p > 0,05$). There were less patients with stage 2 hypertension in the first group and more with stage 3 ($p < 0,05$). The number of patients with stage 2 hypertension was prevailing in group 2 ($p < 0,05$). The

proportion of the patients with CHF and AF was lower in group 1, but the differences were not significant ($p > 0,05$). The patients with type 1 diabetes have not been identified. The distribution of patients with type 2 diabetes in both groups was uniform ($p > 0,05$).

The significance levels of heart rate, systolic and diastolic blood pressure, as well as echocardiographic parameters in patients with pacemakers are presented in Table 2.

Table 2

Functional performance in patients with pacemakers

Functional value	QRS complex duration		
	Under 120 mc	More than 120 mc	
BP, (M \pm sd, mm. Hg)	SBP	149 \pm 20	145 \pm 17
	DBP	88 \pm 10	84 \pm 9
HR, (M \pm sd, beats/min)	Spontaneous	54 \pm 13	50 \pm 11
	Stimulated	69 \pm 6	69 \pm 9
	EF (M \pm sd, %)	53 \pm 13	50 \pm 10
	ESV (M \pm sd, ml)	82 \pm 56	85 \pm 47
	EDV (M \pm sd, ml)	152 \pm 64	151 \pm 46
	IVS, (M \pm sd, cm)	1.15 \pm 0.2	1.2 \pm 0.1
	LA (M \pm sd, cm)	4.5 \pm 0.7	4.3 \pm 0.6
	RA (M \pm sd, cm)	4.3 \pm 0.7	4.4 \pm 0.6
	RV (M \pm sd, cm)	2.9 \pm 0.6	3.2 \pm 0.6

Comment:

* $P < 0,05$ — the level of significance of differences

Functional characteristics of patients in groups did not vary significantly ($p > 0,05$).

QRS complex duration is estimated as a useful indicator of ventricular function, in patients with own rhythm [3] and those with pacemakers [4, 7].

QRS complex widening in patients with pacemakers, as well as with their own rhythm, is associated with the higher prevalence of comorbid conditions. CHF severity and consequent increase in the frequency of hospitalizations were showed by Shukla [2]. In our study, CHF also proved to be more serious in patients in QRS complex duration with more than 120 mc. The high rate of occurrence of permanent atrial fibrillation in patients with widened QRS complex [9, 10] is reflected in our work.

The relationship between QRS complex duration and the changes in the functional parameters in patients with pacemakers has been studied to a much lesser extent. The decrease in SBP in QRS complex widening patients with pacemakers was showed by Young J. H. et al. Sumiyoshi et al. associated the lower LVEF and LV EDV in patients with pacemakers with QRS complex widening, which is

confirmed by other studies. Our research has found no significant differences in terms of echocardiography in patients with pacemakers in different rates of QRS complex duration.

The fact that there is no statistically significant differences in most clinical parameters in patients with pacemakers in different rates of QRS complex duration is positive. The higher prevalence of postinfarction cardiosclerosis, CHF FC, AF in patients with QRS duration with more than 120 mc and their sex differences should be taken into account in the course of therapeutic management after the pacemaker installation.

CONCLUSIONS

1. QRS complex duration is associated with clinical features of patients with permanent pacemakers. Among the patients with QRS complex duration with more than 120 mc vs that under 120 mc, predominant are males and patients with postinfarction cardiosclerosis, heavier functional class of chronic heart failure and atrial fibrillation.

2. Patients with QRS duration more than 120 mc require thorough therapeutic management.

It seems appropriate to undertake a further clinical insight into features of patients with permanent pacemakers, taking into account QRS complex duration.

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