КАРДІОХІРУРГІЯ

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ELECTROPHYSIOLOGICAL CHARACTERISTICS OF CANDIDATE PATIENTS FOR THE IMPLANTATION OF A THREE-CHAMBER PACEMAKER

The electrophysiological characteristics of candidate patients for the implantation of a three-chamber pacemaker assessed. There was shown that narrow QRS interval (< 120 ms) occurs in 77 (57.5 %) patients, and an elongated (> 120 ms) in 57 (42.5 %), including in 32 (23.9 %) – due to LBBB. Patients with an extended QRS interval, on average (141±7) ms, have the changes in the amplitude of the Q, and R in the leads V1, V2, V3R, and VRR in the form of rSR', rsR', RsR', RSR', and rR'. Combination of the prolonged atrioventricular conduction and conducting on the right branch of the bundle with an elongated ejection time in the pulmonary artery and aorta could be considered as indications for three-chamber pacing in patients with chronic heart failure.

Keywords: *chronic heart failure, ventricular dyssynchrony, electrocardiography.*

Introduction

Chronic heart failure (CHF), according to national and international epidemiological studies, occurs in 1.0–5.7 % of people over 18 years of age, and the prevalence of this pathology increases with age, exceeding 10 % in patients older than 65 years [1, 2]. The epidemiology of CHF in Tunisia has not been adequately studied. According to O. Saidi, 30 % of Tunisians suffer from cardiovascular diseases, while the death rate from this class of diseases in the last 20 years has increased by 10.8 % among men, and by 23.8 % among women [3]. In Ukraine CHF occurs in 2 % of the adult population, and occurs in 12–15 % of cases in patients over 50 years of age. According to the data of Ukrainian authors, at the age of 55, the risk of heart failure is 33 % for women, and 28 % for men [4]. Among patients with CHF, the annual mortality varies from 7 % for stable / ambulatory patients and up to 17 % for inpatients, and hospital admissions up to 12 months after the previous hospitalization are 44 and 32 % respectively [5].

The dissynchrony of the contractile function of the ventricles is an essential pathogenetic moment of development and progression of CHF with a reduced systolic function and can not be corrected by modern drug therapy [6–8]. ECG – a sign of mechanical dissynchrony is the expansion of the QRS complex ≥ 120 ms, which indicates a violation of intraventricular conduction. Echocardiographic markers of dissynchrony are presystolic regurgitation of the mitral valve, interventricular mechanical delay ≥ 40 ms, delay in activation of the posterolateral wall of the LV, delay in movement from the aorta ≥ 140 ms. Prevalence of DS with age grows, which can serve as an explanation for the severe course of CHF in old age. Modern adequate drug therapy in accordance with the protocols of medical care for patients with CHF does not eliminate the dissynchrony [6, 9].

Patients with LV systolic dysfunction often have an elongated QRS, in some cases a left bundle branch block develops, aggravating electrophysiological disorders [6, 7]. The use of biven-

tricular pacing can significantly improve the prognosis and quality of life of patients with CHF, reduce the number of hospitalizations. At the same time, ECG criteria for mechanical disinhronia are indirect, up to 30 % of patients with prolonged QRS interval do not respond to cardiomyostimulation [10]. Direct criteria of ventricular desynchrony include echocardiography, CT and MRI of the heart, PET [6]. It is also proposed to use spatial criteria based on a 3D scan of the vectorradiography [11]. However, ECG criteria still remain one of the most important when selecting candidate patients for the implantation of an artificial pacemaker.

The study was aimed to assess the electrophysiological characteristics of candidate patients for the implantation of a three-chamber pacemaker.

Material and methods

The study was performed on the basis of the Regional Clinical Hospital (Odessa). 134 patients with CHF were examined, including 71 (53.0 %) men, and 63 (47.0 %) women. The age of patients ranged from 47 to 77 years, an average of (57.4±1.3) years.

The patients were examined according to the requirements of the current clinical protocol, regulated by the order of the Ministry of Health of Ukraine dated 03.07.06, № 436 «On approval of the protocols for the provision of medical care in the specialty "Cardiology"» [12].

All patients underwent an assessment of the degree of circulatory failure in NYHA, assessed exercise tolerance with a 6-minute walk test, and assessed the ECG. ECG analysis was performed at MAC 5500 (GE Healthcare, USA) [13]. Statistical processing was carried out with the help of Statistica 10.0 software (StatSoft Inc., USA) [14].

Research results

At the time of the beginning of the study, all patients had manifestations of heart failure. Patients complained of shortness of breath during physical exertion, swelling of the legs, general weakness, lack of energy, a constant sense of fatigue, sleep disturbances, decreased appetite, nocturia and pollakiuria memory impairment. Functional class II of CHF was established in 35 (26.1 %) patients, class III of CHF – in 72 (53.7 %), and class IV – in 47 (35.1 %).

Further analysis showed that a narrow QRS interval (< 120 ms) occurs in 77 (57.5 %) patients, and an elongated (> 120 ms) in 57 (42.5 %), including 32 (23.9 %) – due to LBBB. For patients with an extended QRS interval – on average (141±7) ms, the changes in the amplitude of Q and R waves in the leads V1, V2, V3R, and AVR in the form of rSR', rsR', RsR', RSR', and rR'. Paroxysms of reciprocal AV tachycardia were registered in 4 (3.0 %) patients. On average, heart rate was in patients with an elongated QRS interval of (92.3±1.1) bpm.

The appearance of the cardiogram of the patient with HF, and the prolongation of the QRS interval is shown in the figure.

Results of ECG analysis of a patient with heart failure at the stage of selection of candidates for the implantation of a three-chamber pacemaker

The observations showed, that in patients with nonspecific elongation of the QRS integral, a change in the QT / RR ratio occurs (in average 450±12). In addition, there was a change in echocardiographic characteristics, including a delayed achievement of the maximum systolic velocity of the myocardium in comparison with the opposite wall of the left ventricle by 80 ms and more (by placing the sensor in the apical four-chamber position or from the apical access along the long axis) or by using the method of estimating the lateral deformation due to deformation delay in the direction from the anteroposterior to the posterior wall – 120 ms or more when obtaining an image of middle segments of the left ventricle along a short axis.

Currently, DDD is a method of choice that contributes to the survival of patients with heart failure. In this regard, we are considering the possibility of using endocardial biventricular pacing as a more physiological method for treating ventricular asynchrony.

Complex QRS ECG is the key time interval in the work of the heart. Its shortening is evidence of accelerated depolarization and transmural activation and can contribute to electrical instability of the myocardium and the development of fatal ventricular arrhythmias. The prolongation of the QRS complex is associated with impaired depolarization and early repolarization of the ventricular myocardium, which leads to intra- and interventricular dyssynchrony, pathological myocardial remodeling, intracardiac hemodynamic disturbances, decreased cardiac output, and may predispose to the occurrence of fatal ventricular arrhythmias.

In our opinion, in patients with CHF when combined with prolonged atrioventricular conduction and conducting on the right branch of the bundle with an elongated ejection time in the pulmonary artery and aorta there are indicated to provide the implantation of a three-chamber pacing.

Conclusions

1. Narrow QRS interval (< 120 ms) occurs in 77 (57.5 %) patients, and an elongated (> 120 ms) in 57 (42.5 %), including 32 (23.9 %) – due to the LBBB.

2. Patients with an extended QRS interval, on average (141±7) ms, have the changes in the amplitude of the Q and R in the leads V1, V2, V3R, and VRR in the form of rSR', rsR', RsR', RSR', and rR'.

3. Combination of the prolonged atrioventricular conduction and conducting on the right branch of the bundle with an elongated ejection time in the pulmonary artery and aorta could be considered as indications for three-chamber pacing in patients with CHF.

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ЕЛЕКТРОФІЗІОЛОГІЧНІ ХАРАКТЕРИСТИКИ ПАЦІЄНТІВ – КАНДИДАТІВ НА ІМПЛАНТАЦІЮ ТРИКАМЕРНОГО КАРДІОСТИМУЛЯТОРА

Оцінювали електрофізіологічні характеристики пацієнтів – кандидатів на імплантацію трикамерного кардіостимулятора. Показано, що вузький QRS-інтервал (< 120 мс) спостерігається у 77 (57,5 %) пацієнтів, а подовжений (> 120 мс) – у 57 (42,5 %), у тому числі у 32 (23,9 %) – через блокаду лівої ніжки пучка Гіса. Пацієнти з розширеним інтервалом QRS, у середньому (141±7) мс, мають зміни амплітуди зубців Q і R у відведеннях V1, V2, V3R та VRR у вигляді rSR', rsR', RsR', RSR' та rR'. Комбінація тривалої атріовентрикулярної провідності та вповільненої провідності у правих відділах серця з подовженим часом викиду в легеневій артерії й аорті може розглядатись як показання до імплантації трикамерного кардіостимулятора у пацієнтів з хронічною серцевою недостатністю.

Ключові слова: *хронічна серцева недостатність, диссинхронізація шлуночків, електрокардіографія.*

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ЭЛЕКТРОФИЗИОЛОГИЧЕСКИЕ ХАРАКТЕРИСТИКИ ПАЦИЕНТОВ – КАНДИДАТОВ НА ИМПЛАНТАЦИЮ ТРЕХКАМЕРНОГО КАРДИОСТИМУЛЯТОРА

Оценивали электрофизиологические характеристики пациентов – кандидатов на имплантацию трехкамерного кардиостимулятора. Показано, что узкий QRS-интервал (< 120 мс) наблюдается у 77 (57,5 %) пациентов, а удлиненный (> 120 мс) – у 57 (42,5 %), в том числе у 32 (23,9 %) – из-за блокады левой ножки пучка Гиса. Пациенты с расширенным интервалом QRS, в среднем (141±7) мс, имеют изменения амплитуды зубцов Q и R в отведениях V1, V2, V3R и VRR в виде rSR' rsR', RsR', RSR' и rR'. Комбинация длительной атриовентрикулярной проводимости и замедленной проводимости в правых отделах сердца с удлиненным временем выброса в легочной артерии и аорте может рассматриваться как показание к имплантации трехкамерного кардиостимулятора у пациентов с хронической сердечной недостаточностью.

Ключевые слова: *хроническая сердечная недостаточность, диссинхронизация желудочков, электрокардиография.*

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