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Detection rate of irregular heart rhythm in the patients with combination of chronic obstructive pulmonary disease and stable ischemic heart disease by daily ECG monitoring data

Key words: *chronic obstructive pulmonary disease, heart rhythm disorders, daily ECG monitoring, comorbidity.*

Chronic obstructive pulmonary disease (COPD) and stable ischemic heart disease (IHD) are widespread medical conditions of inner organs which have common risk factors, pathogenetic aspects and some clinical manifestations, leading to difficulties in diagnostics and treatment. Some studies present different data as to COPD prevalence among the patients with IHD – from 6.4 % to 33.6 %, but most of them confirm mutual burdening effect of these pathologies [7, 9]. The development of heart rhythm disorders is a well-recognized prognostic unfavourable complication of IHD, and now great attention is focused on the study of arrhythmias in COPD patients [4, 6]. The relationship between supraventricular and ventricular rhythm disturbances and increased mortality among COPD patients, as well as an increased number of rhythm disturbances in exacerbation of COPD have been corroborated [2, 5, 8].

According to retrospective analysis data of Ukrainian researchers, COPD patients with associated IHD were shown to have atrial arrhythmia in 5.1 % of cases, ventricular extrasystole – in 19 % and paroxysmal atrial fibrillation – in 18 % [3].

Thus, the problem of determination and evaluation of abnormal heart rhythm in the patients with combination of COPD and IHD is rather urgent, being helpful for therapy improvement.

The aim of the study was to determine specific features of heart rhythm disorders in the patients with combination of COPD and stable IHD by the results of ECG and 24-hour Holter monitoring.

Materials and methods

98 patients, mean age 65.8 ± 0.83 years (group I), with COPD combined with stable IHD were studied. Comparison groups included: 96 patients with stable IHD without associated COPD, average age 58.9 ± 0.9 years (group II), and 78 patients with COPD but no IHD, average age 57.9 ± 0.85 years (group III). Stable IHD was diagnosed according to the Order of Ministry of Health of Ukraine № 152 of 02.03.2016 [1], COPD was diagnosed according to the Order of Ministry of Health of Ukraine № 555 of 27.06.2013 [2]. The patients' characteristics are given in Table 1.

The inclusion criteria were: age over 40, sinus rhythm, IHD verified by coronary angiography or revascularization, or history of Q-wave myocardial infarction, COPD confirmed by spirography. The criteria for exclusion from the study were the following: previous acute myocardial infarction (< 6 months), previous acute cerebrovascular disturbance (< 6 months), previous coronary artery bypass graft surgery or percutaneous coronary intervention (< 6 months), previous operative interventions (< 6 months), chronic disease in decompensation stage, acute infectious diseases, infectious endocarditis, myocarditis, pericarditis, heart defects requiring surgical treatment or prosthetic

				Table 1
Characteristics of patients				
Indexes	Group I Patients with COPD and IHD (n = 98)	Group II Patients with COPD (n = 96)	Group III Patients with COPD (n = 78)	P
Average age, years	65,8 ± 0,83	58,9 ± 0,9	57,9 ± 0,85	$p_{1-2} < 0,001$ $p_{1-3} < 0,001$ $p_{2-3} = 0,51$
Men, abs., %	78 (79,6 %)	70 (72,9 %)	46 (59 %)	$p_{1-2} = 0,33$ $p_{1-3} = 0,002$ $p_{2-3} = 0,031$
Women, abs., %	20 (20,4 %)	26 (27,1 %)	32 (41 %)	$p_{1-2} = 0,332$ $p_{1-3} = 0,002$ $p_{2-3} = 0,031$
Body mass index, kg/m²	30,5 ± 0,56 (26,7; 33)	29,3 ± 0,48 (26; 32,6)	29,2 ± 0,77 (24; 33,9)	$p_{1-2} = 0,196$ $p_{1-3} = 0,129$ $p_{2-3} = 0,556$
Smoking, abs., %	70 (71,4 %)	51 (53,1 %)	44 (56,4 %)	$p_{1-2} = 0,012$ $p_{1-3} = 0,039$ $p_{2-3} = 0,734$
Postinfarction cardiosclerosis, abs., %	69 (70,4 %)	75 (78,1 %)	–	0,173
Coronarography in past medical history, abs., %	55 (56,1 %)	70 (72,9 %)	–	0,01
Myocardial revasculization, abs., %	39 (39,8 %)	56 (58,3 %)	–	0,03

Notes:
1. Quantity indexes are described as (M ± m) – mean ± standard error of mean and (per25; per75) – interquartile range
2. Percent comparison were assessed by χ² test;
3. Comparison of quantity indexes were assessed by Mann — Whitney U-test;
4. P<0.05 were considered to indicate statistical significance

valves, artificial pacemaker, exertional angina of functional class IV, unstable angina, II-III stage heart failure of functional class IV by NYHA, COPD exacerbation.

All the patients underwent general clinical assessment including history taking and study of previous clinical documentation, objective study, ECG readings, spirometry using computed spirograph «MasterScopeCT» and 24-hour Holter ECG monitoring using the apparatus DiaCard 03500 (Solveig, Kyiv). The following indices were determined: average daily heart rate, in active and passive period; maximal daily heart rate, in active and passive period; minimal average daily heart rate, in active and passive period; the patients of each group with ventricular and supraventricular rhythmdisturbances; frequency of ventricular premature beats (VPB) and supraventricular premature beats (SVPB); the patients with the episodes of supraventricular tachycardia (SVT), ventricular tachycardia (VT) and atrial fibrillation (AF); duration of SVT, VT, AF; the patients with the episodes of myocardial ischemia; duration of ST elevation and depression episodes. The daily continuous monitoring was done during 24 hours, the active study period being from 7 a.m to 23 p.m., the passive study period — from 11 p.m. to 7 a.m.

Statistical analysis of the data obtained was performed using application package STATISTICA 10.0 and MicrosoftExcel. Discriptive values of the variables are expressed as «mean ± standard error of the mean» (M ± m), median and interquartile range — between 25 and 75 percentiles. Statistically significant differences between the values were assessed by χ² test, Kruskal-Wallis test, nonparametric Mann-Whitney U-test and Student's t-test in normal distribution of values. All P values of less than 0.05 were considered to indicate statistical significance.

Results

Associated pathology was revealedin the majority of studied individuals, the most common being hypertensive disease (HD) — in 91 patients (92.8 %) of group I, 84 patients (87.5 %) of group II and 66 patients (84.6 %) of group III.No significant difference was found. There were much more patients ill with diabetes mellitus (DM) among those having IHD and COPD 24 (24.9 %), as compared to group II — 14 patients(14.6 %), in group III — 8 patients (10.2 %) (p1-2 = 0.075, p1-3 = 0.01, p2-3 = 0.34).Studied patients of group II were found to have the history of gastrointestinal (GI) diseases more often when compared to those of group I and group III — 27 (28.1 %) versus15 (15.3 %) and 8 (10.2 %), respectively (p1-2= 0,043, p1-3= 0,98, p2-3= 0,062). As to other associated pathology — diseases of genitourinary system (GUS), musculoskeletal system (MSS) — no significant difference between the groups was found (Fig.1)

Thus, there was a high proportion of patients in group I with combined pathology and high comorbidity index.

Groups I and III were representative by the course of COPD (clinical groups and indices of external respiration function).

ECG readings of all studied patients were analyzed (Table 2). The signs of left ventricular hypertrophy (LVH) were found in all the groups with no significant difference — 59 (60.2 %) in group I, 54 (56.2 %)
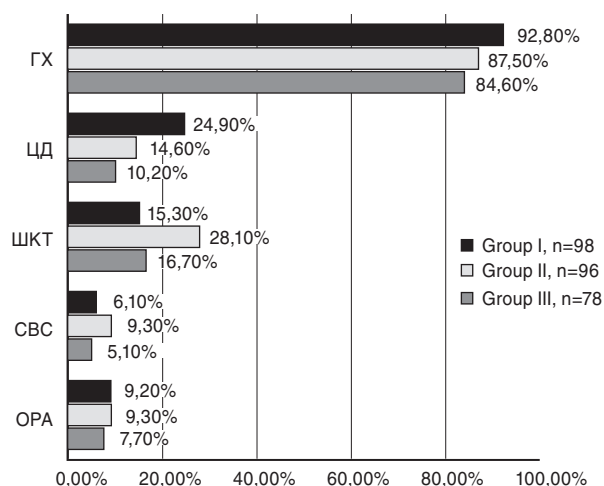
Figure 1. Concomitant pathology of patients.

Notes:
1. HD – hypertensive disease, DM – diabetes mellitus, GI – gastrointestinal diseases, GUS – diseases of genitourinary system, MSS – musculoskeletal diseases/
2. Percent comparison were assessed by χ^2 test;
3. P<0.05 were considered to indicate statistical significance;
4. * – statistically significant difference between groups I and II; ** – statistically significant difference between groups I and III, *** – statistically significant difference between groups II and III.

block (RBBB) occurred significantly more often in the patients with COPD – in 10 (10.2 %) patients of group I, in 13 (16.7 %) patients of group III, while among the patients with isolated IHD – only in 3 (3.1 %). Left His bundle branch blocks (LBBB) were rarely found in the individuals with isolated COPD and significantly more often in those having IHD (groups I and II).

Heart rhythm disorders detected by standard ECG were indicative of the absence of significant difference between the groups in VPB detection rate. In the patients with IHD and COPD, SVPB and the episodes of atrial fibrillation (AF) were found significantly more frequently.

24-hour Holter ECG monitoring showed the results quite different from those obtained by routine ECG. Significantly larger total number of daily SVPB and paired SVPB were recorded in the patients with IHD and COPD. Besides, a higher proportion of patients in this group had paired SVPB and SVPB series (57.1 % and 36.7 %, respectively) (Table 3).

The number of ventricular rhythm disturbances was significantly higher in the patients with combined pathology than incompared groups: VPB number was 341 (90; 1209) in group I, 120 (33; 576) in group II, 34 (10; 254) in group III. The differences in VPB detection frequency were observed between the groups as well: the proportion of patients with all VPB types predominated in group I as compared to the patients with isolated pathologies. Among those with IHD and COPD there was a significantly higher proportion of patients with high gradation ventricular rhythm disorders: frequent VPB (40.8 %), early VPB (69.4 %), paired VPB (53.1 %), ventricular bigeminy (52 %) and trigeminy (33.6 %), as well as salvos (16.3 %) (Table 4). An average daily number of early and paired VPB was significantly larger in the patients with combined pathology – 13 (0; 57) and 8 (0; 52), respectively. Thus,

in group II and 37 (47.4 %) in group III, while hypertrophy signs of the right ventricle (RVH) and the right atrium (RA) were diagnosed more often in COPD patients with no concomitant IHD – in 6 (7.7 %) and 9 (11.5 %) persons, respectively. It is noteworthy, that hypertrophy of the right heart chambers was rarely detected by standard ECG. Cicatrical myocardial changes were diagnosed with equal frequency both in the patients with combination of IHD and COPD and in those with IHD but no COPD. The signs of impaired intraventricular conductivity were registered in 19 (19.4 %) patients with IHD and COPD. Right His bundle branch

						Table 2
ECG changes of examined patients						
Indexes	**Group I (n = 98)**	**Group II (n = 96)**	**Group III (n = 78)**	**P₁₋₂**	**P₁₋₃**	**P₂₋₃**
Heart rate per 1 min	74,8 ± 1,4 75 (65;85)	73,4 ± 1,2 75 (65;80)	76 ± 1,5 75 (67;85)	0,42	0,58	0,16
LV hypertrophy, abs., %	59 (60,2 %)	54 (56,2 %)	37 (47,4 %)	0,64	0,09	0,14
RV hypertrophy, abs., %	1(1 %)	0 (0)	6 (7,7 %)	0,32	0,028	0,006
RA hypertrophy , abs., %	3 (3,1 %)	1 (1 %)	9 (11,5 %)	0,33	0,027	0,003
Cicatrical anterior myocardial changes, abs., %	26 (26,5 %)	36 (37,5 %)	0 (0)	0,13	<0,001	<0,001
Cicatrical posterior myocardial changes, abs., %	34 (34,7 %)	28 (29,2 %)	0 (0)	0,41	<0,001	<0,001
SVPB, abs., %	9 (9,2 %)	1 (1 %)	0 (0)	0,01	0,006	0,37
VPB, abs., %	8 (8,1 %)	3 (3,1 %)	2 (2,6 %)	0,13	0,11	0,82
AF, abs., %	5 (5,1 %)	2 (2,1 %)	0 (0)	0,39	0,04	0,19
LBBB, abs., %	9 (9,2 %)	9 (9,3 %)	1 (1,3 %)	0,96	0,024	0,022
RBBB, abs., %	10 (10,2 %)	3 (3,1 %)	13 (16,7 %)	0,048	0,19	0,002

Notes:
1. Quantity indexes are described as (M ± m) – mean value±standard error of mean and Med (per25; per75) – median and interquartile range
2. Percent comparison were assessed by χ^2 test;
3. Comparison of quantity indexes were assessed by Mann — Whitney U-test;
4. P<0.05 were considered to indicate statistical significance

						Table 3
Supraventricular rhythm disturbances according to daily ECG monitoring						
Indexes	Group I (n = 98)	Group II (n = 96)	Group III (n = 78)	p_{1-2}	p_{1-3}	p_{2-3}
SVPB, daily number	1061,7 ± 333 311 (65; 662)	213,4 ± 26,4 120 (61; 268)	759,9 ± 374 114(35; 280)	**0,007**	**0,009**	0,612
Paired SVPB, daily number	26,3 ± 16,3 2 (0; 10)	3,2 ± 0,85 0 (0; 4)	8,98 ± 3,7 0 (0; 4)	**0,012**	**0,027**	0,998
Paired SVPB, abs., %	56 (57,1 %)	40 (41,6 %)	29 (37,2 %)	**0,032**	**0,019**	0,54
Supraventricular bigeminy, abs., %	4 (4,1 %)	4 (4,2 %)	6 (7,7 %)	0,90	0,465	0,382
Supraventricular trigeminy, abs., %	6 (6,1 %)	3 (3,1 %)	2 (2,6 %)	0,337	0,403	0,919
SVPB series, abs., %	36 (36,7 %)	17 (17,7 %)	25 (32,1 %)	**0,011**	0,546	**0,028**

Notes:
1. Quantity indexes are described as (M ± m) – mean ± standard error of mean and Med (per25; per75) – median and interquartile range
2. Percent comparison were assessed by χ^2 test;
3. Comparison of quantity indexes were assessed by Kruskal-Wallis and Mann — Whitney U-test;
4. P<0.05 were considered to indicate statistical significance

the proportion of patients with ventricular rhythm disorders and the daily number of those disturbances were significantly increased in the group of patients with combined pathology.

As to the number of paroxysmal rhythm disturbances (AF, VT), they occurred more frequently in the patients with combined pathology as well — 29 (29.6 %), than in those with IHD — 19 (19.8 %) and with COPD— 9 (11.5 %), the difference between group I and group III being statistically significant (p = 0.018) (Fig. 2).

The patients with combined pathology were found to have more prolonged paroxysmal disturbances: AF paroxysms to 10 seconds in duration — in 16(59.3 %) (p1-2 = 0,023) individuals, those lasting from 10 secondsto 1 hour — in 2 (8.7 %) and for

more than 1hour — in 9 (39.1 %) (p1-2 = 0,049), while the patients with IHD had the following distribution:15 (83.3 %), 0 (0 %) and 3 (16.7 %), respectively. In the patients with COPDonly AF paroxysms to 10 seconds in duration (100 %) were diagnosed. There was no significant difference in duration of VT paroxysms between the groups (up to 10 seconds in all individuals).

The comparison of detection rate of supraventricular and ventricularrhythm disturbances using routine ECG and 24-hour Holter ECG monitoring demonstrated that routine ECG diagnosed a rather small number of heart rhythm disorders, including prognostically unfavourable and dangerous ones in the patients of all groups and gave no information about significant differences in individuals with combination of IHD and COPD (Fig.3).

						Table 4
Ventricular rhythm disturbances according to daily ECG monitoring						
Indexes	Group I (n = 98)	Group II (n = 96)	Group II (n = 78)	p_{1-2}	p_{1-3}	p_{2-3}
VPB, daily number	1066,9 ± 212 341 (90; 1209)	478,8 ± 103 120 (33; 576)	700,7 ± 42 34 (10; 254)	0,004	< 0,001	0,002
Frequent VPB, abs., %	40 (40,8%)	29 (30,2 %)	14 (17,9 %)	0,179	0,003	0,086
Early VPB, daily number	73,9 ± 26,5 13 (0; 57)	23,2 ±5 0 (0; 16)	24,02 ± 7 0(0; 6)	**0,008**	< 0,001	0,138
Early VPB, abs., %	68 (69,4 %)	47 (48,9 %)	27 (34,6 %)	0,014	< 0,001	0,102
Paired VPB daily number	68,5 ± 26,1 8 (0; 52)	38,2 ± 10 0 (0; 34)	13,9 ± 5 0 (0)	0,151	< 0,001	0,004
Paired VPB, abs.,%	52 (53,1 %)	36 (37,5 %)	13 (16,7 %)	**0,042**	< **0,001**	0,002
Ventricular bigeminy, daily number	110,4 ± 52,8 2 (0; 20)	27,4 ± 23 0 (0; 2)	4,57 ± 2 (0)	**0,005**	< 0,001	0,177
Ventricular bigeminy, abs., %	51 (52 %)	30 (31,2 %)	16 (20,5 %)	**0,003**	< 0,001	0,17
Ventricular trigeminy, abs., %	33 (33,6 %)	18 (18,7 %)	13 (16,7 %)	**0,018**	**0,017**	0,72
VPB series, abs., %	16 (16,3 %)	4 (4,2 %)	5 (6,4 %)	**0,01**	**0,043**	0,51

Notes:
1. Quantity indexes are described as (M ± m) – mean standard error of mean and Med (per25; per75) – median and interquartile range
2. Percent comparison were assessed by χ^2 test;
3. Comparison of quantity indexes were assessed by Kruskal-Wallis and Mann — Whitney U-test;
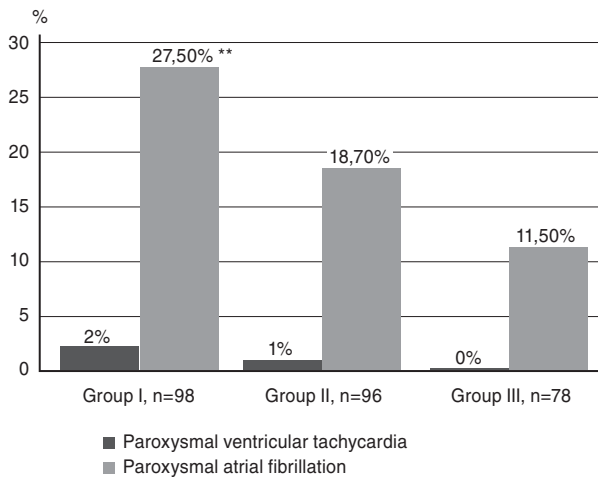4. P<0.05 were considered to indicate statistical significance

Figure 2. Frequency of diagnostics of paroxysmal rhythm disturbances according to daily ECG monitoring

Notes:
1. Percent comparison were assessed by χ² test;
2. P<0.05 were considered to indicate statistical significance;
3. * – statistically significant difference between groups I and II; ** – statistically significant difference between groups I and III, *** – statistically significant difference between groups II and III.
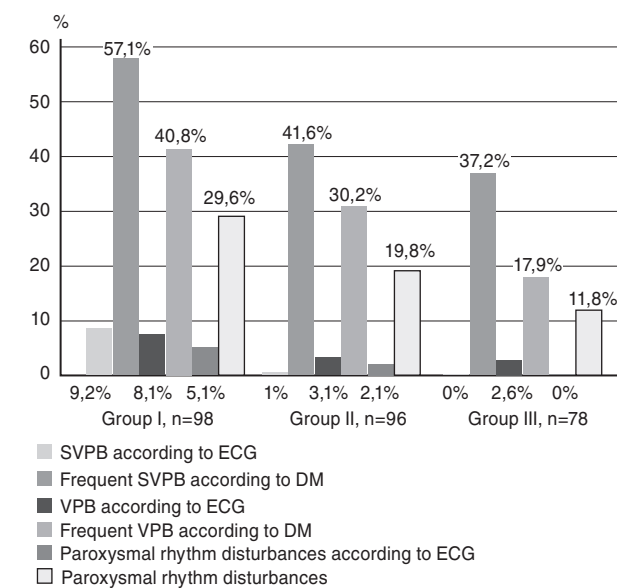

Figure 3. Frequency of diagnostics of rhythm disturbances according to routine ECG and daily ECG monitoring

Note: DM – daily monitoring of ECG.
Thus, it is reasonable to use 24-hour Holter ECG monitoring in the patients with combined pathology.

Conclusions

1. ECG taken in the patients with COPD and stable IHD revealed supraventricular premature beats in 9.2 % of cases, ventricular premature beats — in 8.1 %, atrial fibrillation paroxysms — in 5.1 %.

2. Daily ECG monitoring recorded abnormal and irregular heart rhythm significantly more frequently in the patients with combination of COPD and IHD than in IHD patients without concomitant COPD as well as in COPD patients with no IHD, in particular paired supraventricular premature beats — in 57.1 %, salvos — in 36.7 %, frequent ventricular premature beats — in 40.8 %, early VPB — in 69.4 %, group VPB— in 16.3 %.

3. The patients with combined pathology had significantly larger number and duration of paroxysmal rhythm disturbances — atrial fibrillation (27.5 %) andventricular tachycardia (2 %).

Thus, it is reasonable to use 24-hour Holter ECG monitoring in the patients with COPD to prevent arrythmogenic manifestations and choose proper therapeutic regimen.

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ЧАСТОТА ВИЯВЛЕННЯ ПОРУШЕНЬ РИТМУ У ПАЦІЄНТІВ ІЗ ПОЄДНАННЯМ ХРОНІЧНОГО ОБСТРУКТИВНОГО ЗАХВОРЮВАННЯ ЛЕГЕНЬ ТА СТАБІЛЬНОЇ ІШЕМІЧНОЇ ХВОРОБИ СЕРЦЯ ЗА ДАНИМИ ДОБОВОГО МОНІТОРУВАННЯ ЕЛЕКТРОКАРДІОГРАМИ

Д.В. Діденко

Резюме

Хронічне обструктивне захворювання легень (ХОЗЛ) є розповсюдженим захворюванням серед осіб старше 40 років, в той же час у пацієнтів старших вікових груп зростає вірогідність коморбідної патології. Внаслідок дії спільних факторів ризику та патогенетичних аспектів поширеним є поєднання ХОЗЛ та ішемічної хвороби серця (ІХС), що модифікує перебіг обох патологій.

Метою роботи було визначення особливостей порушень ритму у пацієнтів із поєднанням ХОЗЛ та стабільної ІХС за результатами стандартної ЕКГ та добового моніторування ЕКГ.

Матеріали та методи дослідження. Проведено обстеження 98 пацієнтів із ХОЗЛ в поєднанні зі стабільною ІХС, середнього віку (65,8 ± 0,83) років (група I). Групи порівняння склали 96 пацієнтів з стабільною ІХС без супутнього ХОЗЛ, середній вік (58,9 ± 0,9) років (група II) та 78 пацієнтів з ХОЗЛ без ІХС, середній вік (57,9 ± 0,85) років (група III). Всім пацієнтам виконано загально клінічне дослідження та добове моніторування ЕКГ.

Результати. Встановлено, що у пацієнтів із поєднанням ХОЗЛ та стабільної ІХС при записі ЕКГ надшлуночкова екстрасистолія реєструється в 9,2 % випадків, шлуночкова екстрасистолія – у 8,1 %, пароксизми фібриляції передсердь – у 5,1 %. За даними добового моніторування ЕКГ у пацієнтів із поєднанням ХОЗЛ та ІХС порушення ритму визначаються достовірно частіше, ніж у пацієнтів із ІХС без супутнього ХОЗЛ та у осіб з ХОЗЛ без ІХС, зокрема парні надшлуночкові екстрасистоли – у 57,1 %, групові надшлуночкові екстрасистоли – у 36,7 %, часті шлуночкові екстрасистоли – у 40,8 %, ранні – у 69,4 %, групові – у 16,3 %.

Ключові слова: хронічне обструктивне захворювання легень, порушення серцевого ритму, добове моніторування електрокардіограми, коморбідність.

ЧАСТОТА ВЫЯВЛЕНИЯ НАРУШЕНИЙ РИТМА У ПАЦИЕНТОВ С СОЧЕТАНИЕМ ХРОНИЧЕСКОГО ОБСТРУКТИВНОГО ЗАБОЛЕВАНИЯ ЛЕГКИХ И СТАБИЛЬНОЙ ИШЕМИЧЕСКОЙ БОЛЕЗНИ СЕРДЦА ПО ДАННЫМ СУТОЧНОГО МОНИТОРИНГА ЭЛЕКТРОКАРДИОГРАММЫ

Д.В. Диденко

Резюме

Хроническое обструктивное заболевание легких (ХОЗЛ) распространено среди пациентов старше 40 лет, в то же время в старших возрастных группах возрастает вероятность коморбидной патологии. Как следствие действия общих факторов риска и патогенетических аспектов, частым является сочетание ХОЗЛ и ишемической болезни сердца (ИБС).

Целью работы было определение особенностей нарушений ритма у пациентов с сочетанием ХОЗЛ и стабильной ИБС по результатам стандартной ЭКГ и суточного мониторинга ЭКГ.

Материалы и методы. Проведено обследование 98 пациентов с ХОЗЛ в сочетании со стабильной ИБС, средний возраст (65,8 ± 0,83) года (группа I). Группы сравнения составили 96 пациентов со стабильной ИБС без сопутствующего ХОЗЛ, средний возраст (58,9 ± 0,9) года (группа II), и 78 пациентов с ХОЗЛ без ИБС, средний возраст (57,9 ± 0,85) года (группа III). Всем пациентам проведено общеклиническое исследование и суточный мониторинг ЭКГ.

Результаты. Установлено, что у пациентов с сочетанием ХОЗЛ и ИБС при записи ЭКГ наджелудочковая экстрасистолия регистрируется в 9,2 % случаев, желудочковая экстрасистолия — в 8,1 %, пароксизмы фибрилляции предсердий — в 5,1 %. По данным суточного мониторинга ЭКГ у пациентов с сочетанной патологией нарушения ритма определяются достоверно чаще, чем у лиц с ИБС без ХОЗЛ и у пациентов с ХОЗЛ без ИБС, а именно парные наджелудочковые экстрасистолы — у 57,1 %, групповые наджелудочковые экстрасистолы — у 36,7 %, частые желудочковые экстрасистолы — у 40,8 %, ранние — у 69,4 %, групповые — у 16,3 %.

Ключевые слова: хроническое обструктивное заболевание легких, нарушения сердечного ритма, суточный мониторинг электрокардиограммы, коморбидность.

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