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Atrial Fibrillation Triggers in Patients with Coronary Artery Disease and Subclinical Thyrotoxicosis

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Abstract

We examined 202 patients with paroxysms of symptomatic and asymptomatic atrial fibrillation (AF), some of whom suffered from coronary artery disease (CAD) and subclinical thyrotoxicosis (ST). Healthy individuals acted as a comparison group. It was revealed that in all studied groups, extrasystoles and paroxysms of reciprocal atrioventricular orthodortic and nodal tachycardia was the role of the triggering factors of AF. In patients with ST without CAD and in healthy persons, the paroxysms of tachycardia are short and unstable. When CAD combined with ST, the number of extrasystoles and AF paroxysms is significantly higher than only in ST and in healthy individuals. It was found that in patients with asymptomatic AF the total number of extrasystoles and paroxysms of tachycardia is greater than in the case of symptomatic. Thus, the identification of concomitant subclinical thyrotoxicosis in a patient with CAD should alert the clinician to the development and progression of atrial fibrillation. It should be given great attention to screening thyroid pathology in patients with CAD.

Keywords: atrial fibrillation, coronary artery disease, subclinical thyrotoxicosis.

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1. Introduction

In recent years, there has been a trend towards growth and rejuvenation of patients with atrial fibrillation (AF) [1]. In this regard, the diagnosis and treatment of this disease have acquired medical and social significance [2].

AF is often associated with thyroid pathology, which affects its course and prognosis [3, 4]. Given the importance of thyroid hormones in the regulation of the cardiovascular system, it can be assumed that functional disorders of the thyroid system can trigger the occurrence of cardiac arrhythmias [5–7]. The presence of concomitant thyroid pathology in the patient with coronary artery disease (CAD) increases the risk of the onset and progression of AF, reduces the quality of life and the prognosis [8]. According

to available data, the symptomatic and asymptomatic course of AF also differs [9, 10]. Despite this, the triggering factors of atrial fibrillation in this group of patients have not been described in detail so far.

The purpose was to evaluate the electrocardiographic and electrophysiological triggering factors of asymptomatic and symptomatic atrial fibrillation in the combination of CAD with subclinical thyrotoxicosis (ST).

2. Materials and Methods

The study, conducted at the Penza State University (Penza, Russia), involved 202 patients, who were divided into 6 groups. The first group included 38 patients with asymptomatic paroxysms of AF on the background of a combination of CAD with ST (AFas + CAD + ST), the second – 35 patients with symptomatic paroxysms of AF on the background of a combination of CAD with ST (Ass + CAD + ST), in the third – 34 patients with asymptomatic paroxysms of AF in the presence of CAD (AFas + CAD), in the fourth – 32 patients with symptomatic paroxysms of AF in the presence of CAD (AFs + CAD), in the fifth – 33 patients with ST without CAD, and in the last, sixth group – 30 healthy individuals without documented earlier AF (HI).

Symptomatic paroxysms of AF included patients with complaints of irregular heartbeat, palpitation, loss of consciousness (specific symptoms); shortness of breath, dizziness, insomnia (nonspecific symptoms). Patients, who had more than 50% of all paroxysms not accompanied by obvious symptoms, were referred to as asymptomatic.

Methods of the study included Holter monitoring of ECG (HM) and transesophageal electrophysiological study (TEEPS). HM was performed on Astrocard apparate, and TEEPS – on the electrophysiological complex Astrocard (CJSC "Meditek", Russia). The ECG was recorded at a belt speed of 25, 50, 100 mm/s and a signal gain of 1 mV - 10, 20 mm.

Statistical processing of research results was performed on a personal computer using the Statistica for Windows software package v. 8.0 (Stat-Soft Inc., Russia) including parametric and nonparametric criteria.

3. Results and Discussion

As a result of the study, it was established that the starting factors of AF in all the examined groups of patients are presented by extrasystoles, a combination of extrasystoles

with paroxysms of reciprocal atrioventricular orthodromic (AVROT) and nodal (AVRNT) tachycardia (Table 1).

Table 1: Trigger factors of arrhythmia in patients with symptomatic and asymptomatic AF, subclinical thyrotoxicosis and healthy individuals.

Species	AF + CAD + ST		AF + CAD		ST	HI
	Asymptomatic AF	Symptomatic AF	Asymptomatic AF	Symptomatic AF		
	Group 1	Group 2	Group 3	Group 4	Group 5	Group 6
Extrasystoles, n (%)	23 (60,5)	20 (57,1)	23 (67,6)	22 (68,8)	20 (60,6)	21 (70,0)
Extrasystoles + AVROT, n (%)	7 (18,4)	8 (22,9)	6 (17,6)	5 (15,6)	6 (18,2)	4 (13,3)
Extrasystoles + AVRNT, n (%)	8 (21,1)	7 (20,0)	5 (14,7)	5 (15,6)	7 (21,2)	5 (16,7)
Total, n (%)	38 (100)	35 (100)	34 (100)	32 (100)	33 (100)	30 (100)

Abbreviation: AF - atrial fibrillation; CAD – coronary artery disease; ST – sublinical thyrotoxicosis; HI – healthy individuals; AVROT – atrioventricular reciprocal orthodromic tachycardia; AVRNT – atrioventricular reciprocal nodal tachycardia; n – number of patients.

As can be seen from the data obtained (Table 1), the unified mechanism of arrhythmia is preserved in all patient groups. The most frequent triggering factor of AF is extrasystole (60.5-70.0% of cases). More rarely, the appearance of AF has a more complex mechanism. Initially, the extrasystoles provokes a short AVRNT (14.7-21.2%) or AVROT (13.3-22.9%), which soon turns into AF.

The number of extrasystoles and paroxysms of tachycardia in the combination of asymptomatic AF with CAD and ST, symptomatic AF with CAD and ST, asymptomatic and symptomatic AF in patients with CAD without ST, ST, and in healthy individuals is presented in Table. 2.

As an analysis result of the total extrasystoles in patients with AF, subclinical thyrotoxicosis and healthy individuals, it was found that in patients with asymptomatic AF (group 3) their number is greater than in symptomatic AF (group 4) by 33.0% ($p<0.001$). The combination of asymptomatic AF and subclinical thyrotoxicosis (group 1) is accompanied by an increase in the number of extrasystoles by 21.2% ($p = 0.007$). In patients with ST (group 5), the number of extrasystoles is greater than in HI (group 6) by 39.0% ($p<0.001$).

It was also found that the paroxysms of tachycardia are more frequent in patients with asymptomatic AF (group 3) 11.0% ($p = 0.166$), and the addition of ST (group 1) to

Table 2: The number of extrasystoles and paroxysms of tachycardia in patients with AF, subclinical thyrotoxicosis, and healthy individuals (M ± m).

Species	AFas + CAD + ST (n = 38)	AFs + CAD + ST (n = 35)	AFas + CAD (n = 34)	AFs + CAD (n = 32)	ST (n = 33)	HI (n = 30)
	Group 1	Group 2	Group 3	Group 4	Group 5	Group 6
Total SVE	1373 ± 74,2	1098,4 ± 62,4 p_{1-2} = 0,009	1241,5 ± 70,5 p_{1-3} = 0,199 p_{2-3} = 0,134	777 ± 45,8 p_{1-4} <0,001 p_{2-4} <0,001 p_{3-4} <0,001	715,4 ± 42,2 p_{1-5} <0,001 p_{2-5} <0,001 p_{3-5} <0,001 p_{4-5} = 0,345	463,7 ± 28,2 p_{1-6} <0,001 p_{2-6} <0,001 p_{3-6} <0,001 p_{4-6} <0,001 p_{5-6} <0,001
Total VE	1020 ± 55,1	786,7 ± 44,6 p_{1-2} = 0,005	926,2 ± 52,6 p_{1-3} = 0,225 p_{2-3} = 0,045	676,4 ± 40,1 p_{1-4} <0,001 p_{2-4} = 0,069 p_{3-4} <0,001	434,1 ± 25,6 p_{1-5} <0,001 p_{2-5} <0,001 p_{3-5} <0,001 p_{4-5} <0,001	237,2 ± 14,5 p_{1-6} <0,001 p_{2-6} <0,001 p_{3-6} <0,001 p_{4-6} <0,001 p_{5-6} <0,001
Total SVE and VE	2393 ± 129,4	1885,1 ± 107 p_{1-2} = 0,007	2167,7 ± 123 p_{1-3} = 0,21 p_{2-3} = 0,086	1453,4 ± 85,7 p_{1-4} = <0,001 p_{2-4} = 0,006 p_{3-4} <0,001	1149,5 ± 67,8 p_{1-5} <0,001 p_{2-5} <0,001 p_{3-5} <0,001 p_{4-5} = 0,01	700,9 ± 42,6 p_{1-6} <0,001 p_{2-6} <0,001 p_{3-6} <0,001 p_{4-6} <0,001 p_{5-6} <0,001
AF amount (per year)	18,1 ± 1,0	14,3 ± 0,8 p_{1-2} = 0,007	15,4 ± 0,9 p_{1-3} = 0,042 p_{2-3} = 0,384	13,7 ± 0,8 p_{1-4} = 0,003 p_{2-4} = 0,575 p_{3-4} = 0,166	7,6 ± 0,4 p_{1-5} <0,001 p_{2-5} <0,001 p_{3-5} <0,001 p_{4-5} <0,001	3,8 ± 0,2 p_{1-6} <0,001 p_{2-6} <0,001 p_{3-6} <0,001 p_{4-6} <0,001 p_{5-6} <0,001
AF duration (min)	24,5 ± 1,3	18,3 ± 1 p_{1-2} = 0,0003	22,2 ± 1,3 p_{1-3} = 0,212 p_{2-3} = 0,017	16,2 ± 1 p_{1-4} <0,001 p_{2-4} = 0,144 p_{3-4} <0,001	2,6 ± 0,2 p_{1-5} <0,001 p_{2-5} <0,001 p_{3-5} <0,001 p_{4-5} <0,001	1,2 ± 0,1 p_{1-6} <0,001 p_{2-6} <0,001 p_{3-6} <0,001 p_{4-6} <0,001 p_{5-6} <0,001
AF HR (bpm)	146,5 ± 7,9	152,6 ± 8,6 p_{1-2} = 0,575	145,3 ± 8,3 p_{1-3} = 0,781 p_{2-3} = 0,531	151,4 ± 8,9 p_{1-4} = 0,63 p_{2-4} = 0,785 p_{3-4} = 0,585	154,5 ± 9,1 p_{1-5} = 0,505 p_{2-5} = 0,758 p_{3-5} = 0,463 p_{4-5} = 0,712	140,4 ± 8,5 p_{1-6} = 0,574 p_{2-6} = 0,336 p_{3-6} = 0,629 p_{4-6} = 0,393 p_{5-6} = 0,275
Specific symptoms (in points)	0,5 ± 0,027	0,72 ± 0,041 p_{1-2} <0,001	0,51 ± 0,03 p_{1-3} = 0,706 p_{2-3} <0,001	0,7 ± 0,04 p_{1-4} <0,001 p_{2-4} = 0,661 p_{3-4} <0,001	0,34 ± 0,02 p_{1-5} <0,001 p_{2-5} <0,001 p_{3-5} <0,001 p_{4-5} <0,001	0,22 ± 0,02 p_{1-6} <0,001 p_{2-6} <0,001 p_{3-6} <0,001 p_{4-6} <0,001 p_{5-6} <0,001
Nonspecific symptoms (in points)	1,5 ± 0,081	1,28 ± 0,073 p_{1-2} = 0,046	1,6 ± 0,09 p_{1-3} = 0,42 p_{2-3} = 0,054	1,3 ± 0,08 p_{1-4} = 0,076 p_{2-4} = 0,739 p_{3-4} = 0,087	1,66 ± 0,098 p_{1-5} = 0,213 p_{2-5} = 0,006 p_{3-5} = 0,231 p_{4-5} = 0,008	1,8 ± 0,11 p_{1-6} = 0,03 p_{2-6} <0,001 p_{3-6} = 0,035 p_{4-6} <0,001 p_{5-6} = 0,362

Abbreviation: AF – atrial fibrillation; AFas - asymptomatic atrial fibrillation; AFs - symptomatic atrial fibrillation; CAD – coronary artery disease; ST – sublinical thyrotoxicosis; HI – healthy individuals; SVE – supraventricular extrasystoles; VE – ventricular extrasystoles; HR – heart rate; n – number of patients; M – arithmetic mean; m – standard mean error.

them is accompanied by an increase in the number of arrhythmia by 21.1% (p = 0.007). It should be noted that in patients with ST (group 5), the number of paroxysms of AF is greater than in HI (group 6) by 50.0% (p<0.001).

The duration of spontaneous paroxysms in patients with asymptomatic AF (group 3) is greater than in symptomatic (group 4) by 37.0% (p<0.001). It is important to note that as a result of the combination of CAD with ST, the duration of asymptomatic paroxysms of AF (group 1) increased by 33.8% compared to symptomatic (group 2) (p = 0.003). The duration of spontaneous AF paroxysms in ST (group 5) is more by 53.9% (p <0.001) than in HI (group 6).

As a result of the analysis of AF clinical manifestations by the points scale, it was established that, in symptomatic AF (group 4) the number of specific symptoms is greater by 37,2% (p<0,001), that in asymptomatic AF (group 3); and nonspecific symptoms is less by 23,0% (p = 0.087). A similar pattern persisted in the combination of ST with asymptomatic and symptomatic AF (groups 1 and 2). Specific symptoms are more pronounced in combination of ST with symptomatic AF (group 2) by 44.0% (p<0.001), and non-specific – with asymptomatic (group 1) by 17.1% (p = 0.046).

4. Conclusions

1. Paroxysms of atrial fibrillation in patients with subclinical thyrotoxicosis and in healthy individuals are unstable.

2. In patients with coronary artery disease, subclinical thyrotoxicosis, healthy individuals, the triggering factors of atrial fibrillation are presented by extrasystoles, a combination of extrasystoles with paroxysms of reciprocal atrioventricular orthodontic and nodal tachycardia.

3. Triggering extrasystoles in CAD, subclinical thyrotoxicosis and in healthy individuals have different amounts, but the same structure.

4. The frequency and duration of asymptomatic paroxysms of atrial fibrillation is superior to symptomatic.

5. The combination of subclinical thyrotoxicosis with CAD is accompanied by an increase in the number and duration of asymptomatic and symptomatic paroxysms of atrial fibrillation.

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