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Peculiarities of 24 hours ECG monitoring and frequency of vascular dementia in patients with different approaches to treatment of atrial fibrillation

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Abstract

Atrial fibrillation is one of the major risk factors of stroke. Identifying predictors of arrhythmia can be a key to its early diagnosis and reducing the frequency of cognitive impairment. The purpose of our study was to investigate the prerequisites of paroxysmal AF, as well as their relationship to the occurrence of dementia. The work is based on a study of 204 patients with paroxysmal and / or persistent forms of AF and 42 healthy individuals. Methods we used, were; 24-hours ECG monitoring, clinical and anamnestic data, Hachinski Ischemic Score. It was revealed that the incidence of pathological electrogramms' manifestations depends on patient management.

In summary, the study found that the incidence of pathological disorders during 24-hours ECG monitoring depends on patient management. The highest electrogramms' disorders, as well as incidence of vascular dementia are typical for patients with sole drug tactics. Less often displayed data were ascertained in patients after ablation. Application of cardioversion does not reduce the incidence of pathological phenomena during 24-hours ECG monitoring, but reduces the risk of vascular dementia.

Keywords: Atrial fibrillation, 24-hours ECG monitoring, predictors, vascular dementia, Hachinski ischemic score.

1. Introduction

Atrial fibrillation (AF) is one of the most common arrhythmias in the population, which incidence is steadily increasing [3, 12, 17]. Patients with AF have a five times higher risk of cerebrovascular events and two times higher risk of sudden death [4, 5, 7]. Also recently the completed study «ARIC» has affirmed that the presence of AF is linked with cognitive deficits in patients. Early treatment requires early diagnosis, but optimal methods of arrhythmias detection are still being sought. One of such methods could be 24-hours ECG monitoring, which makes possible not only to detect paroxysms of arrhythmia, but also to identify its possible predictors. According to Perez *et al.* the P index, a measurement of disorganized atrial depolarization, is one of the strongest predictors that can identify patients at risk of AF [15]. Disturbances of intra- and interatrial conduction play important role also [9]. Recently, as a predictor of AF recurrence other markers were proposed: the size of the left atrium, left ventricle myocardial mass and the average P wave on the ECG [10]. But relationships between these and other pathological phenomena and clinical manifestations of disease, in particular – the incidence of dementia are still to identify. The purpose of our study was to investigate the predictors of atrial fibrillation initiation, as well as their relationships to the occurrence of dementia.

2. Methods

We surveyed the data of 204 patients with paroxysmal and persistent forms of AF and 42 healthy individuals (control group). There were three research groups with different treating approaches: medicaments only (the first – 132 persons), after cardioversion (the second – 50 persons) and after ablation (the third – 22 persons).

Selection of patients in the study took place in accordance to the inclusion criteria: patient's consent and compliance, availability of clinical and instrumental criteria of AF according to the protocol of medical care in the specialty "Cardiology". The exclusion criteria included: patients with chronic forms of AF, acute coronary syndromes, inflammatory diseases of the heart valves and layers, apparent disorders of the endocrine system, severe somatic pathology, and cancer. As research and control groups were relevant for age and sex. The main portion of patients was distributed through the age groups of "40-55" and "60 and more" years. Research methods included analysis of anamnesis and clinic, and 24-hours ECG monitoring.

Research methods included analysis of anamnesis and clinic, and 24-hours ECG monitoring. The ECG monitoring was performed by the standard method [11, 14] using the Holter-system "Cardiosens K". We analyzed automaticity and conduction abnormalities, the presence of organized paroxysmal arrhythmias and ectopic activities. Also the "stability of sinus rhythm", which was calculated as the percentage of time with sinus rhythm to the overall time monitoring was analyzed.

Also in all subjects the «Hachinski Ischaemic Score» [13] was assessed. The scale consists of 13 statements, describing the features of the formation and progression of dementia. Each of judgments is estimated from 1 to 2 points. The scale is useful to distinguish dementia of vascular origin and Alzheimer's disease. For values less than or equal 4 points Alzheimer's disease is stated; for 7 points and more – dementia of vascular genesis.

3. Results

Analyzing the duration of AF paroxysms we found it to be different in different groups. For example, in the first experimental group an average paroxysm lasted 54.9±7.1 days; in the second group it was 47.6±5.4 days. In the third the time was 11.6±2.4 days, respectively. The difference was statistically significant between the first and third research groups $p<0.001$. Among other groups, the difference was not statistically significant, although a tendency to prolongation of AF episodes in patients after electrical cardioversion was stated. For stroke risk stratification the scale CHA₂DS₂-VASc was used [1, 2, 6, 8, 16] (Fig. 1).

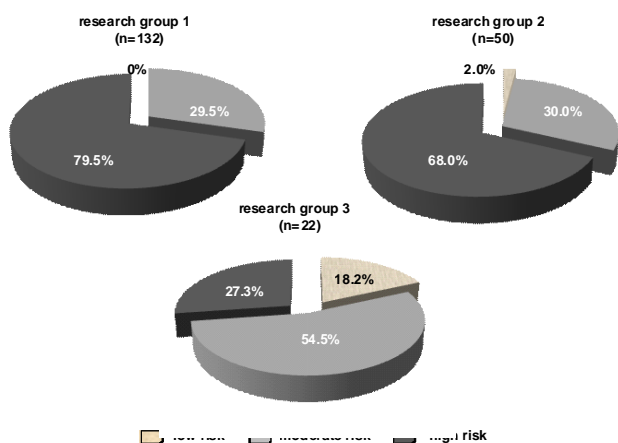


Fig 1: Patients' distribution in respect to CHA₂DS₂-VASc scores.

It was established the absence of low-risk patients in the first research group and virtually only some cases in the second. Instead, the percentage of such patients in the third group was 18.2%. The same group had the lowest percentage of people at high risk (27.3%). The largest portion of patients with a high risk of cerebrovascular events was in the first and the second groups, 79.5% and 68.0% respectively. The proportion of patients who had established the moderate risk was also the lowest in these two groups. We can conclude that patients of the first and the second research groups had the greatest risk of cerebral events. Instead patients after the ablation procedure had definitely lower risk.

The analysis of complications rate (by anamnesis), which showed that cerebral blood flow disorders were often (19.7%) encountered in the first group (medicaments approach only),

was also a proof of stated pattern. Only 4.0% of patients of the second group had such complications and no complications were stated among the patients of the third group. The bleeding occurred more often (20.5%) in the first group also. Unfortunately, there was no information as to whether they were clinically significant or not and, obviously, they were associated with the use of anticoagulants. No patients with bleeding were recorded in the third group. One of the severest complications – pulmonary thromboembolism – occurred in 13.6% of the first group persons, and in 2.0% and 4.6% persons of the second and third groups respectively.

The stated data echoed in many ways with patterns of 24-hour ECG monitoring, which was carried out twice: during the arrhythmia and sinus rhythm (table 1). Analysis of records of AF showed that the average heart rate was significantly higher in the first group (medicaments only approach) compared to the third group (after ablation procedure). It was 107.4±6.8 beats/min. in the first group, 79.4±5.3 beats / min. – in the third, $p<0.05$. It was also shown that patients of the first group had the largest number of both episodes of bradycardia and tachycardia. Thus, if the number of bradycardia episodes in the first group averaged 85.3±8.6/day, in the third it was three times less, 27.1±6.8/ day respectively $p<0.05$.

The same pattern was characteristic for the number of tachycardia episodes. Accordingly, persons of the first group had the longest total period as for bradycardia and tachycardia. Thus, if the total duration of the tachycardia in the first group was 795.5±64 min./day, in the second and the third group they were significantly shorter, 635.8±45 and 229.2±26 min./day, respectively ($p<0.05$). Interestingly, despite this, the total duration of AF was almost the same in all research groups and ranged from 69 to 88% per day.

Table1: Results of 24-hours ECG monitoring (M±m).

ECG phenomena	Control group (n=42)	Research groups (n=204)		
		I (n=132)	II (n=50)	III (n=22)
<i>Atrial fibrillation</i>				
average HR, b/min.	-	107.4±6.8	102.2±4.5	79.4±5.3¶
episodes of bradycardia episodes per day	-	85.3±8.6	48.8±17.1	27.1±6.8¶
episodes of tachycardia episodes per day	-	213.5±29.6	178.3±31.2	74.5±9.8¶
bradycardia, min./day	-	312.6±26	175.1±34¶	116.8±22¶
tachycardia, min./day	-	795.5±64	635.8±45¶	229.2±26¶
AF burden, %	-	88%	83%	69%
SR, %	-	12%	17%	31%
<i>Sinus rhythm</i>				
heart beats per day	89 231±2365	157 529±5196*	147 149±5956*	119 358±2519*¶
stability of SR	2.9±0.2	23.4±5.2*	17.4±3.7*	10.3±1.2*¶
SVE, number per day (%)	1765±268 (1.9%)	24945±1246* (15.8%)	17231±2127*¶ (11.7%)	8637±584*¶ (7.2%)
blocked SVE (% of SVE)	29.5±7.9 (1.7%)	2375±86* (9.5%)	652±45*¶ (3.8%)	238.1±23*¶ (2.8%)
VE, number per day (%)	759.3±42.8 (0.9%)	9523.3±123* (6.1%)	7712.2±395*¶ (5.3%)	3391.4±152*¶ (2.9%)
aberrant complexes (%)	1295±27.2 (1.5%)	15928±1893* (10.1%)	12523±1923* (8.5%)	4368±128*¶ (3.7%)

Remarks: 1. average group data shown;
2. * - SD between control and research groups, $p<0.05$;
3. ¶ - SD between the first and other research groups, $p<0.05$.

Restoring sinus rhythm at different stages of treatment allowed by the next ECG-monitoring to reveal a number of other interesting phenomena. First, the surrogate marker – "stability of sinus rhythm" – was introduced. It is calculated as the ratio

of the sum of all non-sinus complexes to the total beats per day. The largest portion of these complexes was typical for patients of the first group, 23.4 ± 5.2 , and it was significantly higher than in persons of control group, $p < 0.05$. By the way, the values of the marker in patients of the third group were the closest to the "normal" ones (10.3 ± 1.2), which was significantly lower than in the first group, $p < 0.05$. In the second group the values of the "stability of sinus rhythm" were also higher (regarding the ablation group), although this difference was not statistically significant. Secondly, the number of blocked supraventricular extrasystoles was also significantly higher in patients of the first research group ("medicaments only" approach). We also made the comparative analysis of actual electrograms with the past ones of 5-10 years ago, and stated some interesting ECG patterns (Fig. 2-3). The frequency of ectopic beats occurred more often in patients of the first and the second research groups. For example, if pacemaker migration occurred in 17.4% of patients of the first group and in 22.0% of the second group, in the third group it was significantly rarer (9.1%). Frequency of blocked supraventricular extrasystoles was also the lowest among the persons of the third group. It is worth noting that pacemaker migration occurred only in 2.4% of cases of control group. The same was marked for the frequency of the rhythm from the lower atrium zone. Conduction disturbances occurred in different groups without a clear pattern. Thus, for example, the highest percentage of persons with sinoatrial blockade (SA block) was typical for the third research group (9.1%) and atrioventricular conduction disorders (A-V) were stated the most often for the first group. A-V grade I block was recorded in 18.2% of the first research group. For comparison, the same block was characteristic for 8.0% of the second and for 4.6% of the third research groups. Right bundle branch block (RBBB) occurred equally frequently in patients of all research groups except the third. In this group, the frequency of the RBBB was twice less.

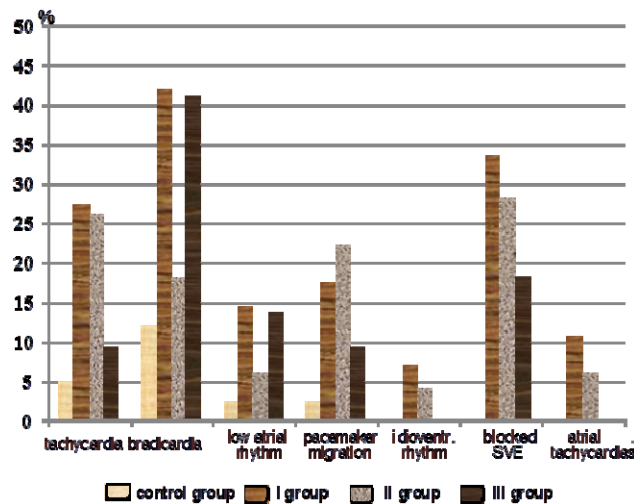


Fig 2: Distribution of persons of control and research groups in respect to past ECG patterns (5-10 years ago) (rhythm disturbances).

For comparison, among the patients of the second group conducting disturbances of left bundle branch (LBBB) was stated in 6.0% of the first and in 4.6% of the third research groups, respectively.

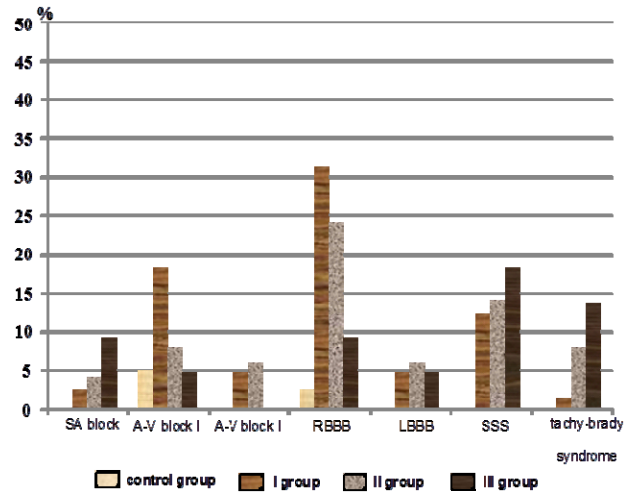


Fig 3: Distribution of persons of control and research groups in respect to past ECG patterns (5-10 years ago) (conduction disturbances).

It is interesting in this respect to draw parallels with the values of the Hachinski Ischemic Score (Fig 4). Among patients of the first research group the number of persons who scored averagely 7 or more points prevailed (71.2%). That corresponded to vascular origin of dementia. For comparison, in the second and third groups the percentage of the mentioned patients was 24.0% and 18.2% respectively. Notably, among the persons of the third group the portion of those with vascular dementia was the lowest, 18.2% of cases. The value of average scores found is also worth noting. If in the first group the average sum of points was the highest 9.4 ± 1.1 points, than in the second and the third groups it stated 7.3 ± 0.7 and 5.8 ± 0.3 points respectively. The difference between the mean values of the third and the first group was statistically significant, $p < 0.05$.

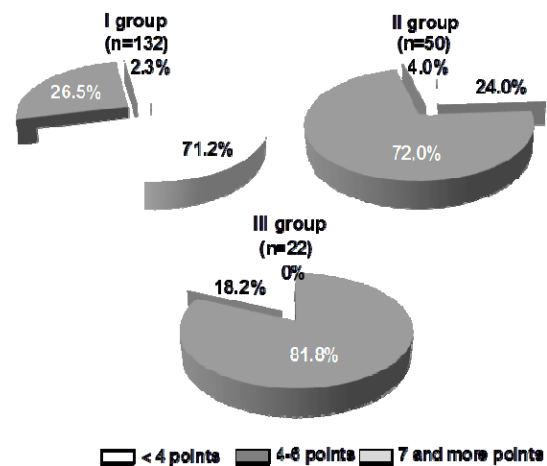


Fig 4: Distribution of persons of control and research groups in respect to Hachinski Ischemic Score, %.

4. Conclusions

One can conclude that in patients with paroxysmal and/or persistent forms of AF conduction disturbances and the high incidence of aberrant complexes (based on 24-hours ECG monitoring during sinus rhythm period) are prevailing ECG patterns. For patients of the first (medicaments only approach) and the second (after cardioversion) groups parasympathetic

and sympathetic influences are typical. Arrhythmias predictors include the tendency to vagotonia, high frequency of ectopic beats and blocked SVE, as well as RBBB and A-V I block. Also the patients with «medicaments only» approach have a higher risk of vascular dementia and worse clinical outcomes compared to persons after ablation. The latter also are characterized by the prevailing parasympathetic influences and better sinus rhythm stability. However, patients whom ablation procedure was performed have signs of sinus node sick syndrome (SSS) and «tachy-brady» syndrome more often. Performing of cardioversion does not reduce the incidence of pathological 24-hour ECG monitoring phenomena, but reduces the risk of dementia of vascular origin. This analysis demonstrates the priority of early ablation performance in patients with paroxysmal and/or persistent forms of AF and adding to the basic treating schemes drugs with cerebral protection, efficiency of which, however, still requires further research in this clinical context.

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