THE COMPARATIVE VALUE OF EXERCISE STRESS TEST AND HOLTER MONITORING IN THE EVALUATION OF ARRHYTHMIC PATIENTS

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Keywords: arrhythmias, exercise test, ambulatory monitoring

Abstract: Introduction: It is already known that ambulatory monitoring of heart rhythm (Holter) is the gold standard in the diagnosis and evaluation of rhythm disorders and in the evaluation of the efficacy of antiarrhythmic therapy. The important role of sympathetic stimulation in induction of the majority of rhythm disorders, especially of those in ischemic patients, is also known. We considered the evaluation of patients with known rhythm disorders useful from the point of view of their manifestation during exercise stress testing in comparison with 24 hours ambulatory monitoring, this being the purpose of our study. Also we considered the role of these two methods in the evaluation of treatment efficacy of these patients, either medical or interventional therapy. Methods: We enrolled 225 patients with known rhythm disorders, hospitalized in the Cardiology Clinic of the Rehabilitation Hospital Cluj-Napoca, during 2004-2006. These patients were untreated or treated with medication or ablation therapy. The patients were integrated into two groups. The first one was represented by 135 patients with atrial premature beats (APB, 25 patients), supraventricular tachycardia (SVT, 20 patients), Wolf-Parkinson-White syndrome (WPW, 30 patients), atrial fibrillation (AF, 30 patients) and ventricular premature beats (VPB, 30 patients). The second group was represented by 30 patients with supraventricular tachycardia, 30 patients with WPW syndrome and 30 patients with atrial fibrillation, treated medically or interventional (ablation). Results: Atrial premature beats were registered during treadmill test in 40% of subjects and in 72% during Holter monitoring. Eighty percent of patients with APB during treadmill test had the same modification during Holter. Two thirds of the ones without APB at exercise presented them on ambulatory monitoring. Supraventricular tachycardia was reproduced in 4 (16%) of the 25 cases during treadmill test, four times more frequent than during Holter, where only one patient had SVT. Among the patients without SVT during exercise test none had arrhythmic crises during Holter. It results that in the evaluation of SVT patients exercise test is superior to Holter monitoring, being useful mainly in unmasking those cases in which effort and sympathetic stimulation are responsible for the SVT. This situation is noted mostly in ischemic patients and in those with low left ventricular performance. An interesting analysis resulted from the WPW patients. In 20% of these patients exercise test induced paroxysmal atrial fibrillation, while only 2.25% presented AF during Holter monitoring. One patient from the group with no atrial fibrillation during exercise test (20 patients) presented AF during Holter and also just one from those with AF during exercise test had this modification at Holter, too. The WPW patients were also divided into two groups: 15 patients medically treated (beta-blocker, amiodarone or propafenone) and 15 ablated patients. It is known that atrial fibrillation is one of the risk factors in WPW syndrome, so we evaluated if it was present or not during these examinations. During exercise test 5 medically treated patients (1/3) had atrial fibrillation, whereas only one presented it during Holter monitoring. Among ablated patients only one had atrial fibrillation, and this was during treadmill test. Another risk factor for the WPW syndrome is development of SVT. Eight out of 15 medically treated patients had SVT during exercise test and 2 (four time less) during Holter monitoring. For the ablated patients there was only one SVT crises and this was seen during exercise test. Conclusion: Holter monitoring and treadmill test have complementary value in the evaluation of rhythm disorders, but Holter is twice more sensitive in tracing the malignant potential of premature ventricular beats. For the supraventricular tachycardia exercise test is superior in tracing relapses; it is also more sensitive for selecting WPW syndrome patients who are at higher arrhythmic risk. Exercise test is more valuable for evaluate the inadequate cronotropic response in atrial fibrillation patients.

Cuvinte cheie: aritmii, test de efort, monitorizare Holter

Rezumat: Introducere: Este cunoscut faptul că monitorizarea ambulatorie a electrocardiogramei (tehnica Holter) reprezintă standardul de urmă în diagnosticul practic şi evaluarea tulburărilor de ritm ca şi a rezultatelor terapiei antiaritmice. Pe de altă parte este recunoscut rolul important pe care îl deţine stimularea simpatică în declanşarea majorităţii tulburărilor de ritm rapid. Am considerat utilă studierea bolnavilor cu entităti aritmice cunoscute, din punct de vedere al comportării acestora pe parcursul testării de efort în comparaţie cu monitorizarea ambulatorie a electrocardiogramei pe 24 de ore, acesta reprezentând scopul lucrării de faţă. De asemenea s-a luat în considerare rolul pe care cele două metode îl

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INTRODUCTION

It is already known that ambulatory monitoring of heart rhythm (Holter) is the gold standard in the diagnosis and evaluation of rhythm disorders and in the evaluation of the efficacy of antiarrhythmic therapy. (1,2,3)

The important role of sympathetic stimulation as part of the mechanism of the majority of rhythm disorders, especially in ischemic patients, is also known. (4,5) This is why exercise testing often represents a more powerful stimulus for the development of arrhythmias, especially ventricular (6) than the daily physical activity, which is monitored with 24-72 hours Holter ECG.

The comparative value of exercise stress testing and Holter monitoring in the diagnosis and evaluation of arrhythmic patients has already been studied (3,7) but substantial changes appeared in the last decade in the profile of rhythm disorders, their diagnosis and therapeutic methods. In this setting is important to re-evaluate the comparative value of the two considered complementary methods, but with a clear superiority of Holter monitoring. Re-evaluation is also important because during the last decades appeared a number of new causes for arrhythmias, especially heart failure during which arrhythmias are responsible for 50% of the deaths (8, 9); on the other hand ischemic heart disease is still the main cause of arrhythmias. In the same period the number of rheumatic valvulopathies decreased considerably, including our country.

In this setting we considered the evaluation of patients with known rhythm disorders useful from the point of view of their behaviour during exercise stress testing in comparison with 24 hours ambulatory monitoring, this being the purpose of our study. Also we considered the role of the two methods in the evaluation of treatment efficacy of these patients, either medical or interventional therapy.

METHODS

There were enrolled 225 patients with known rhythm disorders, admitted in the Cardiology Clinic of the Rehabilitation Hospital Cluj-Napoca, during 2004-2006. These patients were untreated or treated with medication or ablation therapy. The patients were divided into two groups.

The first one was represented by 135 patients with atrial premature beats (APB, 25 patients), supraventricular tachycardia (SVT, 20 patients), Wolf-Parkinson-White syndrome (WPW, 30 patients), atrial fibrillation (AF, 30 patients) and ventricular premature beats (VPB, 30 patients).

The second group was represented by 30 patients with supraventricular tachycardia, 30 patients with WPW syndrome and 30 patients with atrial fibrillation, treated medically or interventional (ablation).

All patients were addressed to a symptom limited maximal exercise treadmill test and a 24 hours ambulatory Holter monitoring. We used the classical methodology of steps of 25 Watts for three minutes for the cycloergometer test.

The diagnosis of arrhythmias was made previous to this evaluation, by a resting ECG. During the evaluation the patients were not under medication. For the 90 patients treated medically or by ablation, the medication was not with draught.
For the first group we considered the percentage of patients in whom the arrhythmias was reproduced during cycloergometer test or Holter. Also we evaluated the percentage of patients in whom the arrhythmias, present or not during the exercise test, were reproduced during ambulatory monitoring.

In the second group we evaluated the relapses of arrhythmias, treated medically or by ablation, during exercise test and Holter. As for the patients with WPW syndrome we considered important only atrial fibrillation or SVT, without considering atrial or ventricular premature beats.

### STATISTICAL ANALYSIS

The data were analyzed using SPSS 8.0 for Windows. We calculated mean and standard deviation for normal distributed quantitative variables. Differences between quantitative variables were examined using Student test (independent-sample T test), and for qualitative variables we used χ² test. A p value less than 0.05 was considered significant from statistical point of view.

### RESULTS

Atrial premature beats were registered during exercise test in 40% of subjects and in 72% during Holter monitoring. Eighty percent of patients with APB during cycloergometer test have had the same modification during Holter. Two thirds of the ones without APB at exercise presented them on ambulatory monitoring. The conclusion is that Holter monitoring is indispensable in the evaluation of atrial premature beats, but in a small percent of cases, ABP can be absent at Holter and unmasked only by exercise, cycloergometertest respectively.

Supraventricular tachycardia was reproduced in 4 (16%) of the 25 cases during exercise test, four times more frequent than during Holter, where only one patients developed SVT.

Among the patients without SVT during exercise test none have had arrhythmic crises during Holter. It results that in the evaluation of SVT patients exercise test is superior to Holter monitoring, being useful mainly in unmasking those cases in which effort and sympathetic stimulation are responsible for the SVT. This situation is noted mostly in ischemic patients and in those with low left ventricular performance.

Interesting data resulted from the analysis of the WPW patients. In 20% of these patients exercise test induced paroxysmal atrial fibrillation, while only 2.25% presented AF during Holter monitoring.

One patient from the group without atrial fibrillation during exercise test (20 patients) presented AF during Holter and also just one from those with AF during exercise test developed it at Holter, too. The results suggest that exercise testing is a more important stimulus in developing AF than Holter monitoring. This is true because we know that daily activity and the degree of sympathetic stimulation are lower that the ones achieved during exercise test.

For the patients with atrial fibrillation we took into consideration the heart rate (appropriate or inappropriate) during exercise test and the maximal heart rate achieved during Holter monitoring. It is known that excessive high heart rate during daily activity or during effort represents a trigger for symptoms in heart failure patients. We defined an inappropriate response during exercise test the increase in heart rate with more than 20 beats/step. Such limit does not exist during Holter monitoring.

Forty five percent (9 patients out of 21) of AF patients have had an inappropriate response, the mean maximal heart rate being 150 beats/minute, with the development of symptoms and interruption of test. The maximal heart rate during ambulatory monitoring was 110 beats/minute, a value insignificantly increased in comparison to that of the patients who presented an adequate response (<20 beats/step) during exercise test. Their maximal heart rate at Holter monitoring was 102 beats/minute.

The results from this data are in concordance with the ones already published.(10,11,12) Exercise test is the main non-invasive test for establishing the appropriate cronotrop response for the patients with atrial fibrillation. On the other hand Holter monitoring is useful in studying the heart rate during daily activity and for establishing if the professional activity can be done without major hemodynamic risks, in patients with atrial fibrillation.

As for the ventricular premature beats, these were invariable present both during exercise treadmill test and Holter monitoring. This is why we considered important their “aggravation”, meaning: increased number of VPB/minute or increased Lown grade. The aggravation of ventricular premature beats was seen in just 20% of patients at exercise test and in 40% during ambulatory monitoring.

The second part of this paper is related to the evaluation of the treatment of the arrhythmias, either medical or interventional (ablation).

There were evaluated 30 patients with supraventricular tachycardia, 15 being treated with medication (amiodarone, propafenone or beta-blocker) and 15 ablated patients (from whom 5 were also under arrhythmic treatment). When we compared the results of exercise testing with Holter monitoring we observed that the patients treated medically had 4 relapses of SVT during treadmill test (14%) and only one relapse during ambulatory monitoring (4%). As respect to the ablated patients we registered only one case of relapse and this was during exercise testing.

The 30 WPW patients were also divided into two groups: 15 patients medically treated (beta-blocker, amiodarone or propafenone) and 15 ablated patients. It is known that atrial fibrillation is one of the most important risk factors in WPW syndrome, so we evaluated if it developed or not during these examinations. During exercise test 5 medically treated patients (1/3) had atrial fibrillation, whereas only one presented it during Holter monitoring. Among ablated patients only one had atrial fibrillation, and this was during cycloergometer test. Another risk factor for the WPW syndrome is represented by the development of SVT. Eight out of 15 medically treated patients had SVT during exercise test and 2 (four time less) during Holter monitoring. For the ablated patients there was only one SVT crises and this was seen during exercise test.

We evaluated 30 patients with paroxysmal atrial fibrillation, who were all under treatment with either Amiodarone, Propafenone or Sotalol. During Holter monitoring none of these patients presented relapse of atrial fibrillation, while during exercise testing 40% of them (12 patients) did. The rate of relapse was: 4/7 in patients taking Propafenone, 2/4 for Sotalol and 6/13 for Amiodarone. It results again that exercise test is superior to Holter monitoring in detecting relapses of atrial fibrillation in patients under treatment.

### Picture no. 1. Valoarea procentuală a recidivelor la testul de efort comparativ cu Holter-ul
CLINICAL ASPECTS

DISCUSSION

The results of this paper confirm the data already published in the literature. It results that Holter monitoring for at least 24 hour is useful and needed in evaluation of all patients with known rhythm disorders.

Holter monitoring is useful in Wolf-Parkinson-White syndrome patients for detecting the cases with intermittent pre-excitation, with lower arrhythmogenic risk. It is also useful and indispensable for patients with atrial fibrillation, mainly for those professionally active, for the evaluation of daily activity heart rate under medical treatment and their adaptation to the daily activities.

On the other hand our data demonstrates that the value of exercise test is not obsolescent. In patients with premature beats, either atrial or ventricular, Holter is superior in detecting these arrhythmias and their aggravation, but even here there are cases when atrial premature beats appear only at exercise testing and even more important ventricular premature beats aggravate only during cycloergometer test, thus with exercise. This latter observation has an important prognostic value, knowing for example that in ischemic patients there is a high prevalence of exercise-induced premature beats.

In patients with supraventricular tachycardia, although Holter monitoring must be applied for all patients for detecting asymptomatic relapses, especially during night time, exercise test is superior for these patients and when we have to choose between these methods, the best is without doubt exercise test.

Exercise testing is also superior in patients with atrial fibrillation for detection of inadequate response to exercise and prognosis during excessive stress. Of course for evaluation of hemodynamic effect of daily activity Holter monitoring can be enough.

The results from the second part of this paper reveal that the risk of relapse for different rhythm disorders is higher during exercise test than during Holter monitoring, true also for ablated patients. Of course ambulatory monitoring is important to evaluate the risk of relapse during daily activity in these patients and efficacy of their treatment in prevention of relapses, but the “absolute risk” is better estimated with cycloergometer test. Both Holter monitoring and exercise test sustain again the superiority of ablation over medication in patients with rhythm disorders suitable for this technique.

Both sections of the present paper suggest that exercise testing and Holter monitoring are not opposite and exclusive methods in the evaluation of arrhythmic patients and in the evaluation of the efficacy of treatment. Contrary, they are complementary and although ambulatory monitoring must be done for all these patients, exercise test must also be taken whenever possible, as it brings supplementary data, especially when it concern the risk or relapse of arrhythmias at peak effort or after an apparently successful treatment, medical or interventional.

CONCLUSION

Holter monitoring and treadmill test have complementary value in the evaluation of rhythm disorders, but Holter is twice more sensitive in detecting the malign potential of premature ventricular beats.

For the supraventricular tachycardia exercise test is superior in tracing relapses; it is also more sensitive for selecting WPW syndrome patients who are at higher arrhythmic risk.

Exercise test is more valuable for evaluate the inadequate cronotropic response in atrial fibrillation patients. Both methods are useful and indicated in evaluation of treatment (inclusive ablation) for rhythm disorders, but exercise test is better for detecting relapses.

REFERENCES

9. Arrhythmias in ischemic heart disease, Ital Heart J 2004, 5, Md Biasse, Department of Cardiology, Foggia, Italy
16. Heart rate control in patients with atrial fibrillation

AMT, vol II, nr. 1, 2010, pag. 178
referred for exercise testing, Hilliard AA, Miller TD, Department of Internal Medicine and Cardiovascular Diseases, Mayo Foundation, Rochester, Minnesota, USA. Am J Cardiol. 2008 Sep 15;102(6).


