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## CLINICAL PRESENTATIONS OF ARTERIAL HYPERTENSION DEPENDING ON THE QTc INTERVAL DURATION OF ECG

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The relationship between the duration of the complex QTc ECG and clinical signs of arterial hypertension (AH) in 54 patients (16 men and 38 women) 1-3 degree and I-III stage, mean age  $58 \pm 18$  years, was investigated. 3 classes of QT interval duration were allocated: classified shortened ( $< 320$  ms), normal ( $> 320$  ms and  $< 440$  ms), classified prolonged ( $> 440$  ms). The binomial distribution of frequencies of studied parameters in classes of the QTc interval for alternative criteria was determined. The duration of the QTc interval in the sampling was 350 ms – 490 ms. The proportion of the normal range ( $> 320$  ms and  $< 440$  ms) was 0.85, classified prolonged ( $> 440$  ms) – 0.15. The probability of occurrence of QTc prolongation ECG increased in elderly patients, obesity, abusing of alcohol, mild and moderate degree and stage II AH, diabetes mellitus, atherosclerotic cardiosclerosis, stable angina functional class (FC) II, HF FC III and II A stage. Dependencies of the elongated QTc of ECG from the sex of the patients have not been established.

**KEY WORDS:** arterial hypertension, duration of the QTc interval of ECG

## КЛІНІЧНІ ПРОЯВИ АРТЕРІАЛЬНОЇ ГІПЕРТЕНЗІЇ ЗА РІЗНИХ ДІАПАЗОНІВ ТРИВАЛОСТІ ІНТЕРВАЛУ QTc ЕКГ

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Досліджено зв'язок між тривалістю комплексу QTc ЕКГ та клінічними ознаками АГ у 54 пацієнтів з АГ (16 чоловіків та 38 жінок) 1-3 ступені та I-III стадії, середнім віком  $58 \pm 18$  років. Виділено 3 класи тривалості інтервалу QTc: класифікований укорочений ( $< 320$ мс), нормальний ( $> 320$  та  $< 440$ мс), класифікований подовжений ( $> 440$ мс). Визначалась біноміальна розповсюдженість частот поширеності вивчених показників в класах інтервалу QTc для альтернативних критеріїв. Тривалість інтервалу QTc в вибірці складала 350мс – 490мс. Питома вага нормального інтервалу ( $> 320$  та  $< 440$ мс) дорівнювала 0,85, класифікованого подовженого ( $> 440$ мс) – 0,15. Ймовірність поширеності подовженого інтервалу QTc ЕКГ збільшувалася серед пацієнтів похилого віку, з ожирінням, які зловживали алкоголем, мали м'який та помірний ступені, а також II стадію АГ, наявний цукровий діабет, атеросклеротичний кардіосклероз, стабільну стенокардію II ФК, СН III ФК та ПА стадії. Залежності подовженого інтервалу QTc ЕКГ від статі у пацієнтів з АГ не встановлено.

**КЛЮЧОВІ СЛОВА:** артеріальна гіпертензія, тривалість інтервалу QTc ЕКГ

## КЛИНИЧЕСКИЕ ПРОЯВЛЕНИЯ АРТЕРИАЛЬНОЙ ГИПЕРТЕНЗИИ ПРИ РАЗЛИЧНЫХ ДИАПАЗОНАХ ДЛИТЕЛЬНОСТИ ИНТЕРВАЛА QTc ЭКГ

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Исследована связь между продолжительностью комплекса QTc ЭКГ и клиническими признаками АГ у 54 пациентов с АГ (16 мужчин и 38 женщин) 1-3 степени и I-III стадии, средний возраст  $58 \pm 18$  лет. Выделено 3 класса продолжительности интервала QTc: классифицированный укороченный ( $< 320$ мс), нормальный ( $> 320$  и  $< 440$ мс), классифицированный удлинённый ( $> 440$ мс). Определялось биномиальное распространение частот встречаемости изученных показателей в классах интервала QTc для альтернативных критериев. Продолжительность интервала QTc в выборке составила 350мс – 490мс. Удельный вес нормального интервала ( $> 320$  и  $< 440$ мс) составлял 0,85, классифицированного удлинённого ( $> 440$ мс) – 0,15. Вероятность встречаемости удлинённого интервала QTc ЭКГ увеличивалась среди пациентов пожилого возраста, с ожирением, которые злоупотребляли алкоголем, имели мягкую и умеренную степени, а также II стадию АГ, сахарный диабет, атеросклеротический

кардиосклероз, стабильную стенокардию II ФК, СН III ФК и ПА стадии. Зависимости удлинённого интервала QTc ЭКГ от пола у пациентов с АГ не установлены.

**КЛЮЧЕВЫЕ СЛОВА:** артериальная гипертензия, длительность интервала QTc ЭКГ

## INTRODUCTION

Arterial hypertension (AH) is one of the most common chronic diseases, which significantly increases the risk of cardiovascular complications and premature death. Prevalence of AH in different countries varies between 15-30 %. According to official statistics in Ukraine in 2009 was registered more than 12 million of patients with AH, it is about 1/3 of the adult population. With time, including due to the aging of population in developed countries, the prevalence of hypertension will increase [1-2].

Prolongation or reduction of the QT interval duration outside the defined range is regarded as a risk factor of critical arrhythmias [3-5]. Electrophysiological phenomenon of prolonged interval QT is the independent predictor of fatal arrhythmias that lead to sudden cardiac death [6-8].

At present there is no information in the literature about the relationship between the duration of QTc and clinical signs of AH.

The research was conducted as part of research work «Development and research of system of automatic control of heart rate variability», state registration 0109U000622.

## OBJECTIVE

The purpose of the work was to study the relationship between QTc duration on ECG and clinical signs of AH for the development of improvement proposals to its diagnosis and treatment.

## MATERIALS AND METHODS

In the Kharkiv outpatient clinic № 24 54 patients (16 men and 38 women) aged from 45 to 87 years with duration of AH  $58 \pm 18$  years were examined. From 54 patients in 25 was mild degree, 20 - moderate and 9 - severe. Stage I AH occurred in 15, stage II - in 33, stage III - in 6 patients. Ischemic heart disease (IHD) was diagnosed in 43 patients, specifically: stable exertional angina with functional class (FC) I occurred in 6, II FC - in 3, postinfarction cardiosclerosis (PC) - in 2, atherosclerotic cardiosclerosis (AC) - in 32. In

40 patients was presented symptoms of heart failure (HF), specifically: FC I - in 14, FC II - in 23, FC III - in 3. HF stage I occurred in 34 persons, stage IIA - in 6 persons. The study did not include patients with stable exertional angina FC III, acute cardiovascular diseases, HF II B - III stage and FC IV.

For measurement of the QTc interval duration was performed ECG on the computer electrocardiographs «Cardiolab +». QTc interval duration was measured in leads II, V1, V5, V6 (three consecutive complexes) with maximum choice for intervals and leads. SBP and DBP were measured by tonometer Korotkov's «Microlife BP AG1-20».

3 classes of QT interval duration were allocated: classified shortened ( $< 320$  ms), normal ( $> 320$  ms and  $< 440$  ms), classified prolonged ( $> 440$  ms). Probabilities of occurrence of sex, age, weight of patients, duration of AH, the presence of bad habits, degree and stage of AH, FC of stable angina, FC and stage of HF in selected classes of QTc interval duration were calculated [9-11].

With Microsoft Excel 2010 was determined the binomial distribution of frequencies of studied parameters (P - probability and standard deviation  $\sigma$ , as an absolute measure of its variations, %) in classes of QTc interval for alternative criteria. Reliability of differences in parameters between groups of patients was determined using t - Student's test. Statistically reliable data was taken with significance level  $p < 0.05$ .

## RESULTS AND DISCUSSION

The duration of the QTc interval in the sampling was 350 ms - 490 ms. The proportion of the normal range ( $> 320$  ms and  $< 440$  ms) was 0.85, classified prolonged ( $> 440$  ms) - 0.15. Classified shortened QT interval of ECG ( $< 320$  ms) were not detected, due to its low prevalence [3-5].

The frequency of occurrence of different QTc interval duration classes in patients with AH depending on clinical signs presented in the table.

Table

The frequency of occurrence of different QTc interval duration classes in patients with AH depending on clinical signs

Parameters		Total sampling		Classes of QTc interval duration, ms			
		P	σ	≥ 320 < 440 (P)	≥ 440 (P)	σ	
Total patients	54	100	0,00	0,85	0,15	0,36*	
Age (years)	Mature	0,67	0,47*	0,86	0,14	0,35*	
	Elderly	0,30	0,46*	0,81	0,19	0,39*	
	Senile	0,03	0,17*	1	0	0,00	
Sex	Males	0,30	0,46*	0,88	0,12	0,33*	
	Females	0,70	0,46*	0,84	0,16	0,37*	
Weight (BMI, kg/m <sup>2</sup> )	Normal	0,09	0,29*	1	0	0,00	
	Overweight	0,37	0,48*	0,90	0,10	0,30*	
	Obesity	0,54	0,5*	0,79	0,21	0,41*	
Bad habits	Smoking	0,20	0,4*	0,82	0,18	0,39*	
	Alcohol	0,06	0,24*	0,67	0,33	0,47*	
Duration of AH (years)	0-5	0,54	0,5*	0,79	0,21	0,41*	
	5-10	0,22	0,41*	0,92	0,08	0,27*	
	>10	0,24	0,43*	0,92	0,08	0,27*	
AH	Degree	Mild	0,46	0,5*	0,84	0,16	0,37*
		Moderate	0,37	0,48*	0,85	0,15	0,37*
		Severe	0,17	0,38*	0,89	0,11	0,31*
	Stage	I	0,28	0,45*	1,00	0,00	0,00
		II	0,61	0,49*	0,79	0,21	0,41*
		III	0,11	0,31*	0,83	0,17	0,38*
ICH	Total	0,80	0,4*	0,86	0,14	0,35*	
	Stable angina, FC	I	0,11	0,31*	1,00	0,00	0,00
		II	0,06	0,24*	0,67	0,33	0,47*
	Cardiosclerosis	PC	0,04	0,20*	1,00	0,00	0,00
		AC	0,59	0,49*	0,84	0,16	0,37*
HF	FC	I	0,26	0,44*	0,93	0,07	0,25*
		II	0,43	0,50*	0,83	0,17	0,38*
		III	0,06	0,24*	0,67	0,33	0,47*
	Stage	I	0,63	0,48*	0,85	0,15	0,37*
		IIA	0,11	0,31*	0,83	0,17	0,38*

\* -  $p < 0,05$

Obtained data was statistically significant and was within the significance of  $p < 0.05$ .

In the studied patient population mature age formed the largest portion, less than half - the elderly and the least - senile age. The occurrence of normal QTc interval was greatest among patients of mature age, and prolonged - among elderly.

Female patients in the sampling were substantially prevailed. The occurrence of normal QTc interval among males was slightly higher in compare with the females and prolonged - conversely.

Greater proportion of patients with AH was formed by persons with obesity and overweight. The occurrence of normal QTc interval was

greatest among patients with overweight and prolonged - among patients with obesity [12].

As for the bad habits, greater proportion of long QTc ECG was registered among persons who abused alcohol.

Greater proportion of patients was with duration of AH from 0 to 5 years and equally less - from 5 to 10 years and from 10 years. The occurrence of normal QTc interval was greatest with disease duration from 5 to 10 years and from 10 years, and prolonged QTc - with disease duration from 0 to 5 years. Most likely this is due to the predominance of the given category of patients in study and progression of AH.

Most of the study sampling consisted of patients with mild to moderate AH. The occurrence of normal QTc interval was greater among individuals with mild and moderate and stage II AH. Most likely this is due to the irregular, before inclusion to the study, taking of medications.

The largest share of patients with ischemic heart disease was persons with atherosclerotic cardiosclerosis and stable angina FC I. The occurrence of normal QTc interval was greater among individuals with atherosclerotic cardiosclerosis.

Greater proportions of patients with heart failure were persons with I-II FC and stage I HF. The occurrence of normal QTc interval was largest among individuals with HF FC II-III and IIA stage [13-14].

## CONCLUSIONS

1. In the study population of patients with AH QTc interval duration of ECG was

ranged from 350 ms to 490 ms. The proportion of the normal range (> 320 ms and <440 ms) was 0.85, classified prolonged (> 440 ms) - 0.15. Classified shortened QT interval of ECG (< 320 ms) were not detected.

2. The probability of occurrence of QTc prolongation of ECG in patients with AH increased amount elderly patients, with obesity, abusing of alcohol, mild and moderate degree and stage II AH, diabetes mellitus, atherosclerotic cardiosclerosis, stable angina functional class (FC) II, HF FC III and II A stage.

3. Dependencies of the elongated QTc of ECG from the sex of the patients have not been established.

## PROSPECTS FOR FUTURE STUDIES

It is appropriate to find relationships between the duration of the QTc interval of ECG, clinical course and consequences in patients with AH for improving of its diagnosis and treatment.

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