Prolonged QTc interval is associated with high $CHADS_2$/CHA_2DS_2-VASc scores and indicates prior stroke among atrial fibrillation patients

Kyeong-Hyeon Chun

Department of Medicine

The Graduate School, Yonsei University

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Directed by Professor Hui-Nam Pak

The Master's Thesis
submitted to the Department of Medicine,
the Graduate School of Yonsei University
in partial fulfillment of the requirements for the degree
of Master of Medical Science

Kyeong-Hyeon Chun

December 2014

This certifies that the Master's Thesis of Kyeong-Hyeon Chun is approved.

Thesis Supervisor : Hui-Nam Pak

Thesis Committee Member#1 : Boyoung Joung

Thesis Committee Member#2 : Deok-Seon Ahn

The Graduate School
Yonsei University

December 2014

ACKNOWLEDGEMENTS

First of all, I would like to thank professor Hui-Nam Pak, Boyoung Joung, Deok-Seon Ahn. They gave a lot of help to write this paper. During the life of a resident, it was a little difficult to fully concentrate to write a thesis for me. When I was an intern, I decided to be an internal medicine physician because it is academically very attractive. And after one year, I decided to move my first step on a way of cardiologist. Professor Pak is my best advisor, makes me feel an interest in arrhythmia, and has a great passion for research and education for us. Professor Joung is my old friendly seniors and always teaching me with affection. Thank Professor Ahn who taught me the basic medical knowlegde which is my weakness as a clinician, and thank for his encouragement.

I had realized what is low part of me in preparing the paper, and it was a good opportunity to learn what kind of skills or abilities are needed as researchers. I hope to be a good internal medicine physician as well as continue to learn on this way and contribute to the development of medical science through the study of cardiology.

Finally, I would like to appreciate my family, especially my sister. She is my best friend and counselor.

Thank you for all people once again.

2014.10. Kyeong-Hyeon Chun

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ABSTRACT

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Kyeong-Hyeon Chun

Department of Medicine
The Graduate School, Yonsei University

(Directed by Professor Hui-Nam Pak)

Background Prolonged QTc is associated with an increased risk of stroke or early onset atrial fibrillation (AF) in the general population. We hypothesized that a prolonged QTc is independently associated with the risk scores and prevalence of strokes in AF patients.

Methods and results Among 1,154 patients (75.4% male, 57.2 ± 11.1 years old, 68.4% with paroxysmal AF) included in the Yonsei AF ablation Cohort, we analyzed 823 pre-ablation sinus rhythm electrocardiograms. Patients who took amiodarone were excluded. We compared the QTc with the clinical parameters including the $CHADS_2/CHA_2DS_2$-VASc scores and imaging parameters. Among the patients with prolonged QTc (≥460 ms in women, ≥450 ms in men), the $CHADS_2/CHA_2DS_2$-VASc scores (both, $P < 0.001$) were higher, and the proportions of female, heart failure, and persistent AF were significantly higher compared with those in patients with a normal QTc. In a multivariate linear regression analysis, the QTc (regression coefficient 0.003, 95% confidence interval, 0.000–0.006, $P = 0.033$), LA dimension (regression coefficient 0.022, 95% confidence interval, 0.007–0.037), and E/Em (regression coefficient 0.054, 95% confidence interval, 0.034–0.074) were independently associated with the $CHADS_2$ score. The same parameters including the QTc (regression coefficient 0.006, 95% confidence interval, 0.002–0.010, $P = 0.001$) were consistently related to the CHA_2DS_2-VASc score. The QTc was independently associated with a stroke (Odds ratio 1.011, 95% confidence interval, 1.002–1.019, P =

0.019).

Conclusions A prolonged QTc interval is independently associated with the $CHADS_2$/CHA_2DS_2-VASc scores and prior strokes among AF patients.

Key words : atrial fibrillation; QT interval; $CHADS_2$ score; CHA_2DS_2-VASc score; stroke

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I. INTRODUCTION

The QT interval represents the time duration between ventricular depolarization and repolarization, and a prolonged QT interval is known to be associated with cardiovascular death,[1] sudden death, or all-cause death in the general population. Additionally, the QT interval is related to other risk factors for cardiovascular events such as malignant ventricular arrhythmias[2] or myocardial ischemia because it reflects conduction abnormalities, electrolyte imbalances or drug sensitivity related to ventricular repolarization. Recent studies have shown that a prolonged corrected QT (QTc) interval is associated with an increased risk of atrial fibrillation (AF) or strokes in the general population, respectively.[3] Although there were associations between the QTc interval and AF or between the QTc and strokes in the general population, it is not clear whether the QTc is related to the risk or events of ischemic strokes in the population with AF. AF is known to be a major underlying cause of cardioembolic strokes and 20–25% of cases of ischemic strokes are associated with AF.[4] In patients with non-valvular AF, heart failure, hypertension, old age, diabetes, vascular disease, and a female sex all play some role as risk factors of ischemic stroke, and the $CHADS_2$ or CHA_2DS_2-VASc scores incorporating these factors have been used as risk scores for strokes.[5] Therefore, we hypothesized that the simple electrocardiographic (ECG) parameter, the QTc, has a significant association with the $CHADS_2$/ CHA_2DS_2-VASc scores and ischemic strokes in patients with non-valvular AF. To test this hypothesis we analyzed and compared the QTc indices with the clinical or prognostic factors and detailed intracardiac electrophysiologic parameters in patients who underwent radiofrequency catheter ablation (RFCA) of AF.

II. MATERIALS AND METHODS

1. Study population

The study protocol adhered to the Declaration of Helsinki and was approved by the Institutional Review Board of the Yonsei University Health System. All patients provided written informed consent for inclusion in the Yonsei AF Ablation Cohort Database. This study included 1,154 consecutive patients with AF (75.4% males, mean age 57.2 ± 11.1 years old) who underwent RFCA. After the exclusion of 302 patients who had taken amiodarone and 29 patients who did not have an analyzable sinus rhythm ECG, 823 patients with pre-procedural sinus rhythm ECGs. Among the final patient population, 75.0% had paroxysmal AF (PAF) and 25.0% had persistent AF (PeAF). Three patients had prior history of pre-excitation syndrome and a patient experienced aborted sudden cardiac arrest due to long QT syndrome. All anti-arrhythmic drugs were discontinued for a period corresponding to at least five half-lives. Anticoagulation therapy was maintained before the catheter ablation. Prior stroke event was defined as an ischemic stroke, and its diagnosis was based on brain imaging study in each patient.

2. Electrocardiographic measurement of the corrected QT (QTc) interval

We analyzed the standard 12-lead ECG in all patients (GE Healthcare, Marquette, MAC5500, Waukesha, WI). The paper speed was 25 mm/sec and the calibration was 10 mm/mV. The heart rate, PR interval, QRS, QTc, and P-axis were automatically measured by the ECG system. We used the pre-procedural sinus rhythm ECG without the effects of anti-arrhythmic drugs for the analysis. The Bazett formula was used for the analyses of the QTc interval. Prolongation of the corrected QT interval was defined as ≥460 ms in women and ≥450 ms in men.[6,7]

3. Echocardiographic evaluation of the heart

All patients underwent trans-thoracic echocardiography (TTE; Sonos 5500, Philips Medical System, Andover, MA, USA or Vivid 7, GE Vingmed Ultrasound, Horten, Norway) prior to the RFCA. The chamber size, transmitral Doppler flow velocity, and ratio of the early diastolic mitral peak mitral inflow velocity and early diastolic mitral annular velocity (E/Em) were acquired according to the American Society of Echocardiography guidelines.[8] Trans-esophageal echocardiography (TEE) was performed to exclude any intra-cardiac thrombi. The emptying velocity of the left atrial (LA) appendage was measured in all patients.

4. Electroanatomical mapping and LA computed tomographic measurement

Three-dimensional (3D) spiral computerized tomography (CT) scans (64 Channel, Light Speed Volume CT, Philips, Brilliance 63, Amsterdam, Netherlands) were performed to visually define the pulmonary vein (PV) anatomy. The 3D spiral CT images of the LA were analyzed on an imaging processing workstation (Aquarius, Terarecon Inc., Foster city, CA, USA). Each LA image was divided according to the embryologic origin into the venous LA, anterior LA, and LA appendage.[9] A 3D electroanatomical map (NavX, St. Jude Medical Inc., Minnetonka, MN, USA) was generated using a circular PV mapping catheter (Lasso; Biosense-Webster Inc., Diamond Bar, CA, USA). A NavX system-generated 3D geometry of the LA and the PV was merged with the corresponding 3D spiral CT images. We generated LA voltage maps by obtaining contact bipolar electrograms from 350–500 points on the LA endocardium during atrial pacing at 500 ms and calculated the mean LA voltage as previously described.[10,11] A blinded technician analyzed color-coded

CT-merged NavX voltage maps with customized software (Image Pro) as previously described.[12]

5. Statistical analysis

The normally distributed continuous variables are described as means ± standard deviation (SD). Intergroup comparisons for continuous variables were performed with the non-parametric Mann-Whitney U test or paired t-test as appropriate. The Chi-square test was used to assess the statistical significance of the comparison of the categorical variables. Univariate and multivariate linear regression analyses were performed to identify the independent predictive value of the QTc interval for a high $CHADS_2$ score and CHA_2DS_2-VASc score. After that, univariate and multivariate logistic regression analyses were performed to evaluate the association between the QTc interval and strokes. Variables that were associated with the QTc in the univariate analyses were included in multivariate regression models. Missing values were excluded from the analyses, and a P value < 0.05 was considered statistically significant. All analyses were performed using IBM® SPSS® Statistics 21 software (IBM® -Armonk, NY, USA).

III. RESULTS

1. Clinical characteristics of AF patients with a prolonged QTc

Table 1 summarizes the baseline clinical characteristics of the study individuals and compares the patients with a normal QTc to those with a prolonged QTc. Among the patients with a prolonged QTc interval, the age (P < 0.001), proportion of females (P = 0.022), heart failure (P = 0.002), hypertension (P < 0.001), associated stroke (P = 0.010), coronary artery disease (P = 0.039), $CHADS_2$ score (P < 0.001) and CHA_2DS_2-VASc score (P < 0.001) were higher compared to those in the patients with a normal QTc. The left atrial (LA) dimension (P = 0.001), LA volume index (P = 0.001), and plasma level of the hsCRP (P = 0.004) were higher, but the proportion of paroxysmal AF (P = 0.001), body surface area (BSA) (P = 0.002), eGFR (P = 0.018) and LA voltage

(P = 0.003) were lower in the patients with a prolonged QTc than in those with a normal QTc. In the ECG analyses, the patients with a prolonged QTc had a higher ventricular rate (P < 0.001), prolonged PR interval (P = 0.001) and QRS duration (P < 0.001) than those with a normal QTc (Table 1). Figure 1 shows representative examples of more advanced electroanatomical remodeling of the LA (greater LA volume index (LAVI) and lower LA endocardial voltage) in patients with a prolonged QTc. The QTc interval was significantly longer in the patients with heart failure (453.7 ± 28.7 ms vs. 430.7 ± 28.3 ms, P < 0.001), hypertension (435.2 ± 28.9 ms vs. 427.9 ± 27.7 ms, P < 0.001), an age ≥65 (439.0 ± 27.2 ms vs. 428.4 ± 28.4 ms, P < 0.001), prior stroke (442.5 ± 32.6 ms vs. 429.9 ± 27.7 ms, P < 0.001), or a female sex (443.1 ± 28.1 ms vs. 427.0 ± 27.4 ms, P < 0.001) than in those without (Figure 2).

Table 1. Baseline characteristics with a comparison between the patients with a normal QTc and prolonged QTc

	All (n = 823)	**Normal QTc (n = 650)**	**Prolonged QTc (n = 173)**	***P***
Age (years)	56.5 ± 11.5	55.5 ± 11.2	60.3 ± 11.9	**<0.001**
Male (n, %)	608 (73.8%)	492 (80.9%)	116 (67.1%)	**0.022**
PAF (n, %)	617 (75.0%)	504 (77.5%)	113 (65.3%)	**0.001**
Weight (kg)	69.8 ± 11.0	70.3 ± 11.1	67.7 ± 10.7	**0.003**
Height (cm)	167.5 ± 8.4	168.1 ± 8.2	165.5 ± 8.7	**0.001**
BSA (m^2)	1.81 ± 0.18	1.82 ± 0.18	1.77 ± 0.18	**0.002**
BMI (kg/m^2)	24.8 ± 2.8	24.8 ± 2.8	24.6 ± 2.8	0.697
$CHADS_2$ score	0.84 ± 1.02	0.75 ± 0.96	1.17 ± 1.15	**<0.001**
CHA_2DS_2-VASc score	1.38 ± 1.40	1.23 ± 1.30	1.94 ± 1.59	**<0.001**
Heart failure (n, %)	19 (2.3%)	9 (1.4%)	10 (5.8%)	**0.002**
Hypertension (n, %)	368 (44.7%)	267 (41.1%)	101 (58.4%)	**<0.001**
Age ≥75 years (n, %)	31 (3.8%)	15 (2.3%)	16 (9.2%)	**<0.001**
Diabetes (n, %)	92 (11.2%)	69 (10.6%)	23 (13.3%)	0.324
Prior stroke (n, %)	81 (9.8%)	55 (8.5%)	26 (15.0%)	**0.010**
Vascular disease (n, %)	16 (1.9%)	8 (1.2%)	8 (4.6%)	**0.009**
Coronary artery disease (n, %)	66 (8.0%)	45 (6.9%)	21 (12.1%)	**0.039**

eGFR (mL/min/1.73m^2)	83.5 ± 17.8	84.5 ± 16.3	79.6 ± 21.9	**0.018**
hsCRP (mg/L)	2.67 ± 11.50	2.47 ± 12.22	3.39 ± 8.28	**0.004**
Echocardiographic parameters				
LA dimension (mm)	40.7 ± 5.8	40.4 ± 5.7	41.9 ± 5.8	**0.001**
LV EF (%)	64.1 ± 7.2	64.2 ± 7.3	63.5 ± 6.9	0.153
E/Em	10.1 ± 4.3	9.7 ± 3.9	11.7 ± 5.2	**<0.001**
LVMI (g/m^2)	91.7 ± 20.6	91.0 ± 20.0	94.6 ± 22.7	0.118
3D-CT				
LA volume (mL)	132.8 ± 40.5	130.4 ± 39.5	141.8 ± 43.0	**0.012**
LAVI (mL/m^2)	73.8 ± 22.7	72.1 ± 21.7	80.5 ± 25.0	**0.001**
LA voltage (mV) (n=592)	1.25 ± 0.64	1.29 ± 0.64 (n=461)	1.12 ± 0.64 (n=131)	**0.003**
ECG parameters				
Ventricular rate (bpm)	60.4 ± 9.9	59.7 ± 9.6	63.0 ± 10.5	**<0.001**
PR interval (ms)	183.5 ± 30.7	181.8 ± 29.9	190.2 ± 32.7	**0.001**
QRS duration (ms)	100.2 ± 15.4	98.4 ± 12.9	107.1 ± 21.1	**<0.001**
QTc interval (ms)	431.2 ± 28.5	420.7 ± 20.2	470.7 ± 18.5	**<0.001**

PAF, paroxysmal atrial fibrillation; BSA, body surface area; BMI, body mass index; eGFR, estimated glomerular filtration rate; hsCRP, high-sensitivity C-reactive protein; LV EF, LV ejection fraction; E/Em, ratio of early diastolic trans-mitral flow velocity and mitral annular velocity; LVMI, LV mass index; LAVI, LA volume index.

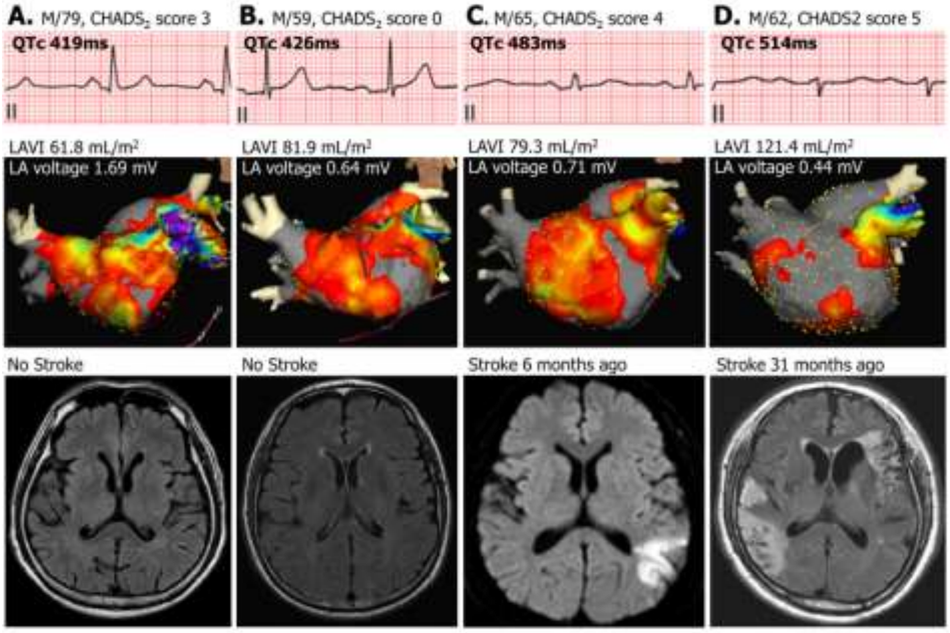

Figure 1. Patients with a prolonged QTc interval had a tendency towards advanced electroanatomical remodeling of the left atrium and prior stroke.

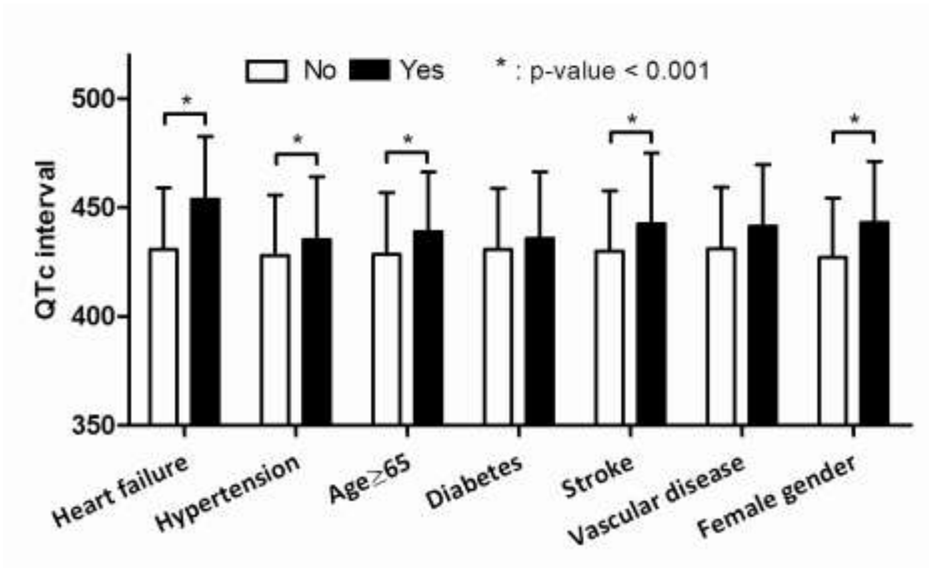

Figure 2. Comparison of the QTc intervals with respect to the clinical risk factors of the CHA_2DS_2-VASc score. Vascular disease includes prior myocardial infarction, peripheral artery disease and aortic plaque.

2. The QTc is independently associated with the $CHADS_2$ score, CHA_2DS_2-VASc score and prior stroke

Table 2 compares QTc intervals and proportions of prolonged QTc in terms of $CHADS_2$ score and CHA_2DS_2-VASc score. The QTc interval was significantly longer in the group with a high risk group (each scores ≥2) than in the low and intermediate-risk group (each scores 0 and 1). In the Chi-square test, the proportion of patients with a prolonged QTc was significantly higher in the group with a $CHADS_2$ score ≥2 than in those with $CHADS_2$ score 0 and 1 (28% vs. 19%, p=0.016), and higher in the group with CHA_2DS_2-VASc score of ≥2 than those with CHA_2DS_2-VASc score 0 and 1 (29% vs. 16%, p<0.001), respectively. In the multivariate linear regression analysis, the QTc was independently associated with the $CHADS_2$ score (regression coefficient [B]=0.003, 95% confidence interval [CI], 0.000–0.006, p=0.033, Table 3) and CHA_2DS_2-VASc score (B=0.006, 95% CI, 0.002–0.010, p=0.001, Table 4). In the multivariate logistic regression analysis, the QTc interval (Odds ratio [OR]=1.011, 95% CI, 1.002–1.019, p=0.019) and diabetes (OR=2.123, 95% CI, 1.135–3.971, p=0.018) were independently associated with a prior stroke (Table 5).

Table 2. Association between the QTc interval and $CHADS_2$/ CHA_2DS_2-VASc score

	$CHADS_2$ 0 and 1 (n = 662)	**$CHADS_2$ ≥2** (n = 161)	***P***
QTc interval (ms)	429.4 ± 27.5	438.6 ± 30.9	**0.001***
Normal QTc (n=650)–n (%)	534 (80.7%)	116 (72.0%)	**0.016†**
Prolonged QTc (n=173)–n (%)	128 (19.3%)	45 (28.0%)	
	CHA_2DS_2-VASc 0 and 1 (n = 516)	**CHA_2DS_2-VASc ≥2** (n = 307)	***P***
QTc interval (ms)	426.5 ± 26.8	439.1 ± 29.5	**<0.001***
Normal QTc (n=650)–n (%)	433 (83.9%)	217 (70.7%)	**<0.001†**
Prolonged QTc (n=173)–n (%)	83 (16.1%)	90 (29.3%)	

*Mann-Whitney U test
†Chi-square test

Table 3. Univariate and multivariate linear regression analyses for the non-invasive parameters predicting a high $CHADS_2$ score

	Univariate			Multivariate		
	B	**95% CI**	***P***	**B**	**95% CI**	***P***
QTc interval	0.007	0.004–0.009	**<0.001**	0.003	0.000–0.006	**0.033**
LA dimension	0.033	0.021–0.044	**<0.001**	0.022	0.007–0.037	**0.004**
E/Em	0.075	0.058–0.091	**<0.001**	0.054	0.034–0.074	**<0.001**
LV EF	-0.007	-0.017–0.002	0.139			
LV MI	0.010	0.006–0.014	**<0.001**	0.004	0.000–0.008	**0.044**
eGFR	-0.014	-0.018–0.010	**<0.001**	-0.009	-0.013–-0.004	**<0.001**
BSA	-0.557	-0.944–-0.171	**0.005**	-0.230	-0.701–0.241	0.338

B, regression coefficient; E/Em, ratio of early diastolic trans-mitral flow velocity and mitral annular velocity; LV EF, LV ejection fraction; LV MI, LV mass index; eGFR, estimated glomerular filtration rate; BSA, body surface area.

Table 4. Univariate and multivariate linear regression analyses for non-invasive parameters predicting high CHA_2DS_2-VASc scores

	Univariate			Multivariate		
	B	**95% CI**	***P***	**B**	**95% CI**	***P***
QTc interval	0.013	0.010–0.017	**<0.001**	0.006	0.002–0.010	**0.001**
LA dimension	0.030	0.014–0.046	**<0.001**	0.028	0.009–0.047	**0.004**
E/Em	0.134	0.113–0.156	**<0.001**	0.086	0.061–0.112	**<0.001**
LV EF	0.004	-0.009–0.017	0.568			
LV MI	0.011	0.005–0.016	**<0.001**	0.002	-0.003–0.007	0.340
eGFR	-0.022	-0.027–-0.017	**<0.001**	-0.014	-0.019–-0.008	**<0.001**
BSA	-2.594	-3.098–-2.091	**<0.001**	-2.117	-2.715–-1.520	**<0.001**

B, regression coefficient; E/Em, ratio of early diastolic trans-mitral flow velocity and mitral annular velocity; LV EF, LV ejection fraction; LV MI, LV mass index; eGFR, estimated glomerular filtration rate; BSA, body surface area.

Table 5. Multivariate logistic regression analyses for the non-invasive parameters associated with a stroke.

	Univariate			Multivariate		
	OR	**95% CI**	***P***	**OR**	**95% CI**	***P***
QTc interval	1.015	1.007–1.023	**<0.001**	1.011	1.002–1.019	**0.019**
Heart failure	2.518	0.815–7.776	0.109			
Hypertension	1.452	0.917–2.300	0.112			
Age ≥ 75	4.836	2.191–10.671	**<0.001**	2.402	0.971–5.943	0.058
Diabetes	2.804	1.589–4.948	**<0.001**	2.123	1.135–3.971	**0.018**
Vascular disease	3.160	0.995–10.037	0.051			
Female sex	1.667	1.028–2.704	**0.038**	1.113	0.622–1.991	0.718
LA dimension	1.049	1.009–1.090	**0.017**	1.024	0.978–1.072	0.315
E/Em	1.087	1.039–1.137	**<0.001**	1.038	0.982–1.098	0.185

OR, odds ratio; E/Em, ratio of the early diastolic trans-mitral flow velocity and mitral annular velocity.

IV. DISCUSSION

In this study, we systematically reviewed the clinical characteristics of the AF patients with a prolonged QTc and examined the relationships between the QTc interval and risk by the $CHADS_2$ score, CHA_2DS_2-VASc score and prior stroke events. Although there have been reports on the association between the QTc interval and early onset of AF, and between a prolonged QTc and a stroke in the general population, to the best of our knowledge this is the first report on the clinical usefulness of the simple ECG parameter**,** the QTc interval, as a risk factor for a stroke in the population with AF.

1. Prolonged QTc as a risk factor for stroke in the AF population

It has been established that a QTc prolongation is a predictor of a stroke in patients with diabetes or in the general population.[13] The REGARDS study[6] demonstrated the association between the QTc prolongation and an increased incidence of strokes in the general population, independent of the traditional risk factors for strokes, and the authors speculated that occult AF was the cause of the increased stroke incidence. Mandyam et al.[3] and Nielsen et al.[14] recently reported that a prolonged QTc interval is associated with the risk of the incident AF in the general population. Previous studies have suggested that prolonged QTc may be a surrogate marker of subclinical atherosclerosis, that can be used to predict atherosclerotic vascular events such as stroke[6]. We presumed that AF patients with prolonged QTc were at higher risk of stroke, and thus analyzed the prevalence of prior stroke and each thromboembolic risk score in this group. In the results, we showed that AF patients with a high risk of a stroke ($CHADS_2$/ CHA_2DS_2-VASc score $\geq$2) had a significantly prolonged QTc, and that the QTc interval was associated with the $CHADS_2$ score and CHA_2DS_2-VASc score, and a prior stroke independently in the AF population. Among the risk factors included in the CHA_2DS_2-VASc score, the prevalence of heart failure, hypertension, old age, vascular disease, a female sex, and a prior stroke were significantly higher in AF patients with a prolonged QTc than in those with a normal QTc.

2. Mechanistic linkage between a prolonged QTc and higher AF burden

The QTc interval represents ventricular repolarization and is known to be affected by cardiovascular conditions such as aging, high blood pressure, metabolic disorders, ischemic heart disease, or cerebrovascular disease.[15] There are several potential explanations for the relationship between a prolonged QTc and AF burden. First, prolongation of the QT interval is known to be present in heart failure, where it may be associated with ventricular hypertrophy.[16] In our study the frequency of heart failure or vascular disease was higher in the group with a prolonged QTc than in those with a normal QTc. Under the condition of heart failure, chronic volume or pressure overload increases the LA pressure, which predisposes to AF.[17] Second, a higher AF burden may lead to deterioration in the ventricular function and eventually promote AF-related cardiomyopathy and QTc prolongation.[18] In addition to mechanical stress such as a pressure overload, neuro-hormonal effects in heart failure also can affect the QT interval.[19] Third, the QTc prolongation itself can mediate susceptibility to AF as a purely electrical problem, as suggested by "atrial torsades de pointes", for the mechanism of AF genesis.[14] Genome-wide linkage studies of one family have identified a genetic locus associated with neonatal AF with variable cardiomyopathy and sudden death.[20] These findings indicate that a prolonged QTc is related to heart failure and AF, both of which are major risk factors for cardioembolic and non-cardioembolic strokes.

3. Clinical usefulness of the ECG in AF management

Although many clinical and imaging-related factors are associated with the prognosis of patients with AF, the ECG has a simple, economical, and highly reproducible diagnostic and prognostic value for these patients. It has been reported that the P-wave dispersion, duration, and amplitude have some prognostic value in patients with AF. We recently found that the PR interval also has prognostic value for AF recurrence after catheter ablation, although the PR interval includes electrophysiological characteristics from the peri-sinus nodal tissue to the Purkinje-ventricular muscle junction. In contrast, the QTc is purely dependent on ventricular depolarization and repolarization. Nonetheless, we found that the QTc was associated with risk factors and prior stroke events in patients with AF. Therefore, the ECG provides clinically valuable information for patients with AF. However, it is necessary to consider other cardiovascular factors and to exclude any effects of drugs, such as long-lasting amiodarone, before interpreting the QTc prolongation as a predictive marker for strokes among patients with AF.

4. Study limitations

First, this study was an observational study from a Cohort registry that included a highly selective group of patients who were referred for AF catheter ablation. Therefore, the results of this study cannot be generalized to the overall AF population. Although we provided compelling evidence for the association of the QTc interval with the $CHADS_2$ score and CHA_2DS_2-VASc score and prior stroke events, the QTc prolongation cannot be interpreted as a predictor of a stroke based on the results of this cross-sectional study alone. Second, we used only traditional Bazett formula to correct QT interval for heart rate rather than the Framingham or Fridericia formula. But in clinical setting, the Bazett formula which we used is the most available and suitable method to analyze.

V. CONCLUSION

A prolonged QTc interval is independently associated with the $CHADS_2$/ CHA_2DS_2-VASc scores and prior stroke events among patients with non-valvular AF who underwent catheter ablation. This simple ECG parameter provides clinically valuable information in AF populations, suggesting that prolonged QTc is associated with prior stroke history, and, consequently, higher thromboembolic risk score. However, the confirmation of this relationship requires further prospective randomized investigation.

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ABSTRACT(IN KOREAN)

심방 세동 환자에서 QTc 간격 연장의 $CHADS_2$/ CHA_2DS_2-VASc 점수 및 뇌졸중 병력 예측력 분석

<지도교수 박희남>

연세대학교 대학원 의학과

전경현

서론 : 일반인에게서 심전도상 QTc 간격이 연장되어 있으면 뇌졸중이나 조기 심방 세동의 발생 위험도가 증가하는 것으로 알려져 있다. 이 연구에서는 심방 세동 환자 군에서 QTc 간격 연장이 높은 색전증 위험도 점수 및 뇌졸중 유병율과 독립적으로 연관관계가 있음을 가정하였다.

방법 : 연세 심방 세동 코호트 중 1,154명의 환자 (75.4% 남성, 57.2 ± 11.1세, 68.4% 발작성 심방 세동) 중, 정상 동율동의 심전도를 분석 가능한 823명의 환자를 대상으로 하였다. 아미오다론 항부정맥제를 복용한 환자는 제외하였다. QTc 간격과 $CHADS_2$/ CHA_2DS_2-VASc 점수 및 영상검사 수치를 포함한 임상 정보를 비교 분석하였다. QTc 간격이 연장된 환자들은 정상 QTc 간격 환자에 비해 $CHADS_2$/ CHA_2DS_2-VASc 점수가 높았고 ($P < 0.001$), 여성, 심부전, 지속성 심방 세동의 비율이 유의하게 높았다. 다변량 선형 회귀 분석에서, $CHADS_2$ 점수는 각각 QTc 간격 (regression coefficient [B] 0.003, 95% confidence interval [CI], 0.000–0.006, *P* = 0.033), 좌심방 크기 (B 0.022, 95% CI, 0.007–0.037), E/Em 수치 (B 0.022, 95% CI, 0.007–0.037)와 유의한 연관성을 보였다. QTc 간격을 포함한 위 변수들은 CHA_2DS_2-VASc 점수와도 유의한 상관 관계를 보였다. 또한 QTc 간격은 뇌졸중 유병 여부와 유의한 상관 관계를 보였다 (Odds ratio 1.011, 95% CI, 1.002–1.019, *P* = 0.019).

결론 : QTc 간격이 연장된 심방 세동 환자에서, $CHADS_2$/ CHA_2DS_2-VASc 점수가 높았으며, 이전의 뇌졸중 유병 여부와

독립적인 상관 관계가 있음을 알 수 있었다.

핵심되는 말 : 심방 세동, QT 간격, $CHADS_2$ 점수, CHA_2DS_2-VASc 점수, 뇌졸중