

Acquired prolonged QT interval in patients with Type 2 diabetes: Prevalence a risk factor

Maryame Ben Lafqih *, Hind Asbar, Sana Rafi, Ghizalane El Mghari and Nawal El Ansari

Department of Endocrinology, Diabetes, Metabolic Diseases and Nutrition, Mohammed VI University Hospital, Marrakech, Morocco.

World Journal of Advanced Research and Reviews, 2023, 17(01), 088–092

Publication history: Received on 17 November 2022; revised on 30 December 2022; accepted on 02 January 2023

Article DOI: <https://doi.org/10.30574/wjarr.2023.17.1.1467>

Abstract

The QT interval on the electrocardiogram (ECG) represents the total duration of depolarization and repolarization of the ventricles, its lengthening is associated with rhythm disturbances and increased mortality. QT interval prolongation occurs in approximately 26% of type 2 diabetics. The objective of this study was to assess the prevalence and risk factors of QTc prolongation in patients with type 2 diabetes in a 3-day cross-sectional study conducted at the Department of Endocrinology and Diabetology, Mohammed VI University Hospital, Marrakech, including volunteer type 2 diabetes patients admitted out of emergency. The QT interval was measured manually on ECG tracings. QTc was calculated using Bazett's formula, a QTc interval at the ECG > 440 ms for men and women was considered pathological. Demographic and biological data were also collected. Potential risk factors for prolonged QTc interval were evaluated. Results: We included 126 patients. The mean age of the patients was 57.59 years. The mean duration of diabetes progression was 8.26 years. Mean glycated hemoglobin (HbA1c) was 8.04%, 5.55% were smokers, 2.38% were on diuretics and mean QTc was 432.65 ms. The prevalence of prolonged QTc interval in our patients was 27.77% (21.42% of women and 6.35% of men (p=0.645). Smoking (p=0.025), diuretics (p=0.046) and duration of diabetes (p=0.02) were the significant risk factors in our study.

Keywords: Prolonged QT; Type2 diabetes; QTc; ECG; Smoking; Diuretics

1. Introduction

The QT interval on the electrocardiogram (ECG) represents the total time of depolarization and repolarization of the ventricles. A lengthening of this interval results from a dysfunction of the ion channels and proteins involved in the repolarization of the myocardium. The measurement of the heart rate-corrected QT interval (QTc) has been proposed as a simple and non-invasive method for the evaluation of cardiovascular risk in the clinical setting, its elongation is associated with arrhythmias and increased mortality. in diabetics [1-4]. The lengthening of the QT interval concerns approximately 26% of type 2 diabetics, several risk factors have been incriminated, in particular female gender, glycemic control, arterial hypertension and certain medications. [5-10]. The objective of our study was to assess the prevalence and risk factors of prolonged QTc interval in patients with type 2 diabetes..

2. Material and methods

This was a cross-sectional study conducted over 3 days at the endocrinology and diabetology department, CHU Mohammed VI in Marrakech, including 126 voluntary type 2 diabetic patients admitted outside of an emergency context. The inclusion criteria were type 2 diabetes with no context of metabolic or cardiovascular decompensation,

* Corresponding author: maryame ben lafqih

Department of Endocrinology, Diabetes, Metabolic Diseases and Nutrition, Mohammed VI University Hospital, Marrakech, Morocco.

particularly coronary, and the absence of heart failure within the last 3 months. The exclusion criteria were type 1 diabetes and metabolic or cardiovascular emergencies. The data was collected via a questionnaire including anthropometric parameters, cardiovascular risk factors and medication. A meticulous clinical examination was carried out with measurement of weight, height, blood pressure, DN4 score and systolic pressure index (IPS). All patients underwent a standard biological assessment.

QT interval and RR intervals were measured on resting ECG traces in lead II. They were measured manually from the point of the start of the QRS complex to the end of the T wave, QTc was calculated using Bazett's formula $QTc = QT / (RR)^{1/2}$, an interval QTc on ECG (> 440 ms for males/females) was considered pathological.

Statistical analysis was performed using SPSS.25 software. The qualitative variables were analyzed using the KHI2 test, and the quantitative variables using the Student test.

P values less than 0.05 were considered significant.

3. Results

3.1. The characteristics of the population studied

We included 126 type 2 diabetic patients, the majority of whom were women (74.60%). The average age of the patients was 57.59 years with a minimum of 21 years and a maximum of 85 years. The average duration of diabetes evolution was 8.26 years. The prevalence of smoking in our population was estimated at 5.55%. Arterial hypertension was present in 28.6% of patients and dyslipidemia affected 15% of patients (Figure 1). Regarding drug intake, 2.38% of patients were on diuretics, 3.96% on antidepressants, 15.87% on antibiotics; 55.55% on oral antidiabetics, 42% on insulin, and 2.45% on lifestyle and dietary measures. The DN4 was greater than 4 in 41% and the systolic pressure index was less than 0.9 in 60.31% of patients. Mean HbA1c was 8.04%, and mean QTc was 432.65 ms (Table 1).

Table 1 Characteristics of the population studied

Settings	Results
age (years)	57.59
Sex Gender (M/F)	32/94
Weight (kg)	74.6
BMI	29.30
Duration of diabetes (years)	8.26
Oral antidiabetics	55.55%
Insulin	42%
RHD	2.45%
Diuretics	2.38%
antidépresseants	3.96%
antibiotics	15.87%
DN4 \geq 4	41%
Systolic pressure index <0.9	60.31%
Average QTC	432.65ms
HBA1C	8.04

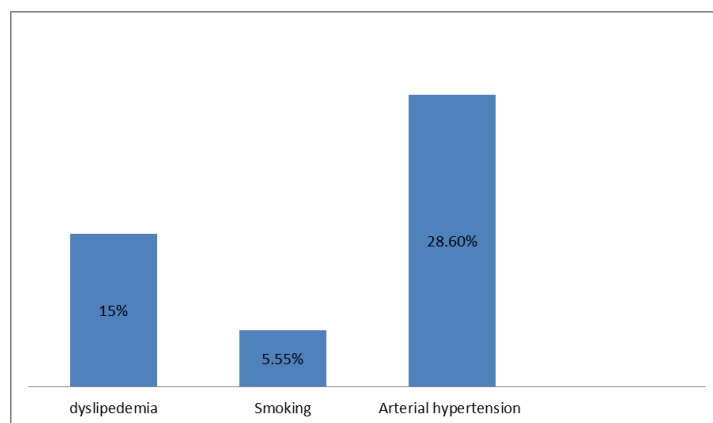


Figure 1 Cardiovascular risk factor

3.2. The prevalence of QT interval prolongation and clinical and biological characteristics according to the QTc interval

The prevalence of prolonged QTc interval in our patients was 27.77% (n=35 patients). The difference between the two sexes was evident with a higher prevalence in women (21.42% of women and 6.35% of men).

Patients with prolonged QTc interval had a longer duration of diabetes than patients with prolonged QT interval. Smoking, dyslipidemia, taking diuretics were also more frequent in patients with prolonged QT interval. Mean HBA1C was higher in patients with prolonged QT interval

3.3. Risk factors for QT interval prolongation

The statistical analysis made it possible to retain certain risk factors for prolongation of the QT interval in our population (Table 2), in particular tobacco (p=0.025), diuretics (p=0.046) and the duration of diabetes (p=0.02).

Table 2 Significant risk factors for QT prolongation

Factors	QTC>440 N=35	P value
Smoking	2.84%	0.025
Durration of diabetes>10 years	45.71%	0.02
Diuretics	8.57%	0.046

4. Discussion

The prevalence of prolonged corrected QT interval is higher in diabetic patients compared to non-diabetic patients, with an increased risk of atrial fibrillation and sudden death [7;10;11;12]. Several risk factors for QTc interval prolongation in diabetic patients have been reported in the literature, including age, gender, duration of diabetes, type of diabetes, arterial hypertension; hyperglycemia, diabetic microvascular complications such as retinopathy and neuropathy and medications [13-17]. In our study the prevalence of the prolonged QT interval was 27.77%. Xiang Li et al in 2012 found 30% QT prolongation in a population of 3156 Chinese type 2 diabetic patients [13]. In another study, the prevalence of the prolonged QT interval was 15.6% [9]. The difference in these percentages is explained by the difference in the characteristics of the populations studied.

The distribution by gender shows a clear female predominance in our population (21.42% VS 6.35%, which is consistent with the results of the majority of authors [1; 5; 9]. In our study, the d age >50 years was the most affected by QTc prolongation, which is similar to data in the literature [9;16].This relationship between age and QT interval may be explained by cardiovascular changes observed in elderly subjects including cardiac hypertrophy (apart from systemic arterial hypertension), myocardial fibrosis and neuro-hormonal activation. The role of tobacco is firmly established by epidemiological studies. In fact, tobacco is associated with hemodynamic and biological effects on endothelial function

[18;19]. In our study, smoking was significantly correlated with QT interval prolongation ($p=0.025$), the same finding was reported by Strauss et al [1].

Drugs are an important risk factor for acquired QT interval prolongation, the main drugs involved are: antiarrhythmics, antibiotics, antihistamines, antidepressants, diuretics and antifungals [8;20]. In our study, diuretics were the main therapeutic class incriminated in the prolongation of the QT interval ($p=0.046$). Several studies [21;22] have proven a correlation between the length of diabetes and the lengthening of the QT interval, this correlation is also proven in our study ($p=0.02$).

Many authors [1; 21] mentioned a correlation between the level of glycated hemoglobin and the prolongation of the QT interval in diabetics, however in our population there was no significant correlation. ACIMI has proven that a positive DN4 score ($DN4>4$) is associated with prolongation of the QT interval [9]. In our series, 43.07% of patients had a positive DN4 score (>4) associated with prolongation of the QT interval, but this correlation was not significant.

5. Conclusion

The prevalence of prolonged QTc interval in type 2 diabetic patients is higher compared to the general population. In our study, the prevalence found was 27.77%. Several factors are associated with the lengthening of this interval, in our population the risk factors found were: the duration of diabetes, smoking and treatment with diuretics. The prolonged QTc interval is associated with an increased risk of arrhythmia and is a predictive factor for cardiovascular mortality, hence the importance of identifying patients at risk and monitoring them.

Compliance with ethical standards

Acknowledgments

I thank my teachers for their help in developing this work

Disclosure of conflict of interest

I declare no conflict of interest.

Statement of ethical approval

Informed consent was obtained from all individual participants included in the study.

References

- [1] Hooft CS, Hofman A, Heeringa J, Deckers JW, Kingma JH, Sturkenboom MC et al. Prolonged QTc interval and risk of sudden cardiac death in a population of older adults. *J Am Coll Cardiol*. 2006 Jan 17, 47(2):362-7.
- [2] Veglio M, Sivieri R, Chinaglia A, Scaglione L, Cavallo-Perin P. QT interval prolongation and mortality in type 1 diabetic patients: a 5-year cohort prospective study. *Neuropathy Study Group of the Italian Society of the Study of Diabetes, Piemonte Affiliate. Diabetes Care*. 2000 Sep, 23(9):1381-3.
- [3] Okin PM, Devereux RB, Lee ET, Galloway JM, Howard BV. Electrocardiographic repolarization complexity and abnormality predict all-cause and cardiovascular mortality in diabetes: the strong heart study. *Diabetes*. 2004 Feb, 53(2):434-40.
- [4] Rana BS, Lim PO, Naas AA, Ogston SA, Newton RW, Jung RT, Morris AD, Struthers AD. QT interval abnormalities are often present at diagnosis in diabetes and are better predictors of cardiac death than ankle brachial pressure index and autonomic function tests. *Heart*. 2005 Jan, 91(1):44-50.
- [5] Benoit SR, Mendelsohn AB, Nourjah P, Staffa JA, Graham DJ. Risk factors for prolonged QTc among US adults: Third National Health and Nutrition Examination Survey. *Eur J Cardiovasc Prev Rehabil*. 2005 Aug, 12(4):363-8.
- [6] Suys B, Heuten S, De Wolf D, Verherstraeten M, de Beeck LO, Matthys D, et al .R.Glycemia and corrected QT interval prolongation in young type 1 diabetic patients: what is the relation?. *Diabetes Care*. 2006 29(2):427–9
- [7] Veglio M, Borra M, Stevens LK, Fuller JH, Perin PC. The relation between QTc interval prolongation and diabetic complications. *The EURODIAB IDDM Complication Study Group. Diabetologia*. 1999 Jan, 42(1):68-75.

- [8] Combined liste of drugs that prolong QT and /or cause torsade de pointes. www.crediblemeds.org . 5 octobre 2014
- [9] Allongement de l'Intervalle QT acquis chez les Diabétiques au Service de Médecine Interne du CHU Tlemcen . 2015 . ACIMI Amira
- [10] Veglio M, Bruno G, Borra M and al. Prevalence of increased QT interval duration and dispersion in type 2 diabetic patients and its relationship with coronary heart disease: a population based cohort. *Journal of Internal Medicine*. 2002, 251(4):317–24
- [11] Ninkovic VM, Ninkovic SM, Miloradovic V, Stanojevic D, Babic M, Giga et al. .Pevalence and risk factors for prolonged QT interval and QT dispersion in patients with type 2 diabetes. *Acta Diabetol*. 2016 Oct, 53(5):737-44
- [12] Fiorentini A, Perciaccante A, Valente R, Paris A, Serra P, Tubani L. The correlation among QTc interval, hyperglycaemia and the impaired autonomic activity. *Auton Neurosci*. 2010 Apr 19, 154(1-2):94-8
- [13] Xiang L, Hui R, Zhang-rong X, Yan-jun L, Xiao Y, Jian-qin L. Prevalence and Risk Factors of Prolonged QTc Interval among Chinese Patients with Type 2 Diabetes. *Hindawi*. 2012, 2012:234084
- [14] Roden DM. Drug-induced prolongation of the QT interval. *N Engl J Med*. 2004 Mar 4, 350(10):1013
- [15] S. Ouali, H. Ben Salem H, Kacem S, Hammas S, Fradi E, Neffeti F et al .The QT interval: standardization, limits and interpretation .*annals of cardiology and angiology*.2012, 61(1):42-48
- [16] Mangoni AA, Kinirons MT, Swift CG, Jackson SH. Impact of age on QT interval and QT dispersion in healthy subjects: a regression analysis. *Age Ageing*. 2003 May, 32(3):326-31.
- [17] Subbalakshmi NK, Adhikari PM, Sathyanarayana Rao KN, Jeganathan PS. Influencing factors of QTc among the clinical characteristics in type 2 diabetes mellitus. *Diabetes Res Clin Pract*. 2010 Jun, 88(3):265-72.
- [18] Yssier Belot CV. Tobacco consumption and cardiovascular risk. *The Journal of Internal Medicine* 1997, 18(9):702-708
- [19] Barnay C, Taieb J, Morice R, Jouve B, Rahal Y, Benchaa T, Alfares A, Lenaers C, Boulain L, Pizigo E. Acquired long QT: an invasive problem? [Acquired long QT syndrome: a dominant problem?]. *Ann Cardiol Angeiol (Paris)*. 2006 Nov, 55(6):321-27
- [20] Malik M. Errors and misconceptions in ECG measurement used for the detection of drug induced QT interval proplongation. *J Electrocardiol*. 2004, 37:25–33
- [21] Schouten EG, Dekker JM, Meppelink P, Kok FJ, Vandenbroucke JP, Pool J. QT interval prolongation predicts cardiovascular mortality in an apparently healthy population. *Circulation*. 1991 Oct, 84(4):1516-
- [22] Ouellet G, Moss AJ, Jons C, McNitt S, Mullally J, Fugate T et al. Influence of diabetes mellitus on outcome in patients over 40 years of age with the long QT syndrome. *Am J Cardiol*. 2010 Jan 1, 105(1):87-9.