



**ORIGINAL RESEARCH PAPER**

**Medicine**

**"A STUDY ON CORRECTED QT INTERVAL AS VITAL MARKER IN CARDIAC COMPLICATIONS IN HYPOTHYROIDISM- CASE CONTROL STUDY"**

**KEY WORDS:** QTd- QT dispersion, QTc- QT corrected, ECG- Electrocardiogram

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**ABSTRACT**

**INTRODUCTION:**Thyroid diseases are common conditions seen worldwide. According to projection from various studies, nearly 42 million people are suffering from various thyroid disorders. Among the endocrine disorders, the most commonly encountered disease is hypothyroidism.Thyroid hormone plays an important role in regulating the cardiovascular system and causes electrophysiological changes in the heart's conducting system. We have assessed whether Corrected QT serve as tool for knowing the status of cardiac functioning, its recovery and variations in hypothyroidism. Measuring QTc in hypothyroidism patients is a simple, inexpensive, and non-invasive method of measuring cardiac changes. It also serves an index of inhomogeneity of ventricular repolarization and heart rate. It can be assessed as a measure of cardiac autonomic modulation in patients with clinical hypothyroidism.

**METHODS :**A total of 128 participants were included in the study with 64 were hypothyroid patients and 64 healthy individuals. In the study, Corrected calculated by Bazett's formula from ECG and Statistical significance were compared between above two groups.

**RESULTS :**A total of 64 hypothyroid patient and 64 healthy individuals were studied . The average age of the hypothyroid group was 39.65 Years (SD+/-11.52) and Euthyroid group was 36.03Years (SD+/-7.59) .The average QTc interval for the study group was 0.436 S (SD+/-0.0517) and that of the control group was 0.402 S (SD+/- 0.030),This was statistically significant with P-value <0.001

**CONCLUSION :**Thus study will emphasize on clinical evaluation of hypothyroidism and value of electrocardiography in hypothyroid patients and clinicians to correlate the thyroxine effects with the ventricular functionality using Corrected QT as vital marker of cardiac assessment in Hypothyroid patient at the bedside.

**INTRODUCTION**

Thyroid diseases are common conditions seen worldwide. According to projection from various studies, nearly 42 million people are suffering from various thyroid disorders. Among the endocrine disorders, the most commonly encountered disease is hypothyroidism. The prevalence of hypothyroidism in India is 11% compared to developed countries like UK (2%) and USA (4-6%). Even though the treatment is inexpensive, many of the cases go undetected and untreated. So it is important for primary physicians to aim for an early diagnosis and treatment of the disease.

Primary hypothyroidism accounts for 99% of all cases. Lack of iodine in the diet is the commonest etiological factor involved in the development of primary hypothyroidism1. it influences metabolism of the body and also affects heart rate and cardiac parameters.It has been noted that hypothyroidism can cause cardiac abnormalities such as impaired cardiac contractility, decreased cardiac output, increased systemic vascular resistance, and changes in cardiac electrical activity. Thyroid hormone plays an important role in regulating the cardiovascular system and causes electrophysiological changes in the heart's conducting system. ECG changes in hypothyroid patients show sinus bradycardia, low voltage QRS, ST segment depression, QT interval lengthening, and flat or inverted T waves in the hypothyroid state. We have assessed whether QTc serve as tool for knowing the status of cardiac functioning, its recovery and variations in hypothyroidism. Measuring QTc in hypothyroidism patients is a simple, inexpensive, and non-invasive method of measuring cardiac changes. It also serves an index of inhomogeneity of ventricular repolarization and heart rate. It can be assessed as a measure of cardiac autonomic modulation in patients with clinical hypothyroidism.

**MATERIALS AND METHODS**

The study was conducted on patients attending the outpatient department (OPD) and inpatients admitted in Yenepoya Hospital. The study was conducted on 64 cases and 64 individual controls. Informed written consent was obtained from cases and controls for participation in the study and for conduction of investigations. The study was conducted between the period of December 2016

and December 2017 . All the participants who had primary hypothyroidism were included with age group 18 to 60 years and associated with others disease like diabetes mellitus, cardiac disease, chronic kidney disease, dyselectrolytemia, rheumatoid arthritis, genetic disorders and drug causing Qt prolongation were excluded<sup>2</sup>.

Heart rate is calculated by "box counting method" ( 1500/N ).QT intervals will be measured manually in all the 12 leads in from the onset of the QRS complex to the end of the T wave. When U waves are present, the QT interval will be measured to the nadir of the trough between the T and U waves. If the end of the T wave could not be identified, the lead will not included.With use of Bazett's formula(QTc = QT interval / √ RR), QTc was calculated in each participants.All ECG's was analyzed twice by one observers, because of the known difficulties concerning definition of the end of the T wave. Patients were advised to avoid smoking, intake of alcohol or taking any drugs and to be at rest before taking ECG. ECG was taken at any point of time of the day.

**TABLE 1:EUROPEAN GUIDELINES CATEGOTIZATION OF QTc INTERVAL CHART**

QTc interval	Men	Women
Normal	< 430 ms	< 450 ms
Borderline	430 – 450 ms	450 – 470 ms
Prolonged	> 450 ms	> 470 ms

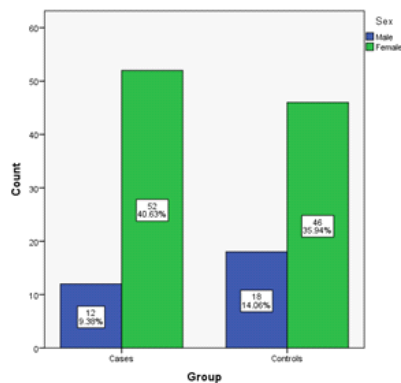
**RESULTS**

In the study we had mean age 39.65 years in cases and 36.03years in controls respectively with standard deviation of 11.52 and 7.59 respectively. Thus age was matched in both groups in the study. Total number of participants in study including both male and female with 30 males and 98 females among 128 participants in the study. Gender was nearly matched in both case and controls. Thyroid function test were done all participants both in case and control and thyroid stimulating hormone was analyzed in study ,we found that mean TSH level in control were 2.55 mIU/L and 35.88 mIU/L in cases respectively.Standard deviation and standard error mean was calculated for corrected QT in both controls and

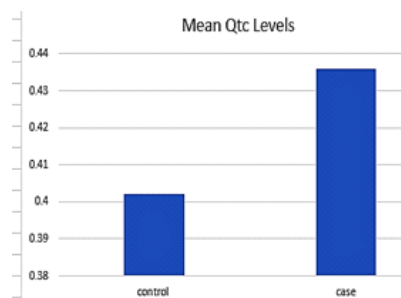
cases. The average QTc interval for the study group was 0.436 S (SD+/-0.0517) and that of the control group was 0.402 S (SD+/-0.030).

Independent student T-tests were performed and group statistics were analyzed in detail. Corrected QT showed P-value of <0.001 which was statistical significant after analysis.

**FIGURE 1: GENDER DISTRIBUTION IN CASES AND CONTROLS**



**FIGURE 2: MEAN CORRECTED QT IN CASES AND CONTROLS**



**TABLE 2: GROUP STATISTICS AND P-VALUE**

Qtc	Group	Mean	S.D	Standard error mean	P-value
	Case(64)	0.436	0.051	0.0064	<0.001
	Control(64)	0.402	0.030	0.0038	

**DISCUSSION**

As seen from the earlier research on hypothyroidism it is clear that QT-Prolongation assessment and other Electrocardiography changes play an important role in diagnosing the cardiac complications occurring in hypothyroidism. Since several research and studies in Corrected QT has done and also found electrocardiographic changes has significance in diagnosing cardiac complications by hypothyroidism. In our present study conducted on 64 primary hypothyroidism patient's and 64 normal healthy individuals, totally 128 participants were observed in detail for various blood parameters with consideration of inclusion and exclusion criteria and findings were recorded along with ECG for the analysis of Corrected QT interval.

Age and gender were nearly matched in study with age, there was no significant difference in mean age of subjects of both the groups. Age was between 18 to 59 in cases and 22 to 56 in controls with mean age 39.65 and 36.03 respectively. Thus age matching was done in the study we had 30 male participants and 88 female participants with male comprised of 9.38% and female comprised of 40.63% in case group, likewise in control group we had 14.06% male participants and 35.94% female participants, this showed gender matching approximately. Accordingly, we found that TSH levels varied from 5.05 mIU/L to 100 mIU/L in cases and controls it varied from 0.9 mIU/L to 4.5 mIU/L which was graded according to our lab parameters and upper and lower limit classified according to NHANES III study<sup>3</sup>. The mean TSH level comparison between both had significant difference. Mean TSH

level of control was 2.55 mIU/L and case were 30.56 mIU/L which is 25 times more than controls. This finding is similar to the earlier studies done by Karthik et al<sup>10</sup>, which statistically significant difference mean TSH levels. Our sample population was similar to previous study in literature like study done by Darshan et al<sup>8</sup> which compared corrected QT interval both non-hospitalized hypothyroid and normal healthy individual, but we have increase sample size double of that study and also analyzed the relevance of QTc prolongation and dispersion in same individuals. Study done by Kweon et al<sup>5</sup> on the effects of L-thyroxine treatment on corrected QT in primary hypothyroidism only included 18 participants in study, but study followed the L-thyroxine effects later and found significance after that, unlike our study we had more participants but cross-sectional data were only analyzed.

In a study done by Galetta et al on Heart rate variability and QT dispersion<sup>9</sup> in hypothyroid subjects, the mean value of mean R-R interval was significantly increased in hypothyroid's compared to that of euthyroid's, this was co-relating without study and found similar findings. Thus making QT-prolongation significant change in hypothyroid patient as R-R Interval variations influences the QTc values. Study done by Xing et al concluded that increased sympathetic activity in patients with hypothyroidism similar results were concluded with study by Cacciatori et al,<sup>11</sup> and Poliker et al<sup>12</sup>. All these studies showed abnormalities in autonomic function in overt short-term and long-term hypothyroidism. Parasympathetic activity is predominant<sup>4</sup>, there is occurrence of bradycardia and when sympathetic activity predominates can cause arrhythmia's. Thus abnormality in the QTc interval predicts the cardiovascular aetiology for mortality, coronary atherosclerosis and cardiac arrhythmia's.

In our study, we mainly aimed at analysis of QT corrected in hypothyroidism patient. The mean value of corrected QT were prolonged in the hypothyroid then Euthyroid groups. We found that mean corrected QT interval in cases and controls were 0.436 seconds and 0.402 seconds respectively. Comparison of corrected QT in both groups has significant difference. Further more data was analyzed with independent student T-test and group statistics was done. It was found that Corrected QT had P-value <0.001 and was statistical significant. Thus making Corrected QT as important marker of cardiac changes in hypothyroidism for prevention of complications like arrhythmia's<sup>7</sup>.

**CONCLUSIONS**

There was clear evidence of Corrected QT being significantly prolonged in hypothyroid patients. This study has given a better understanding of the effect of reduced thyroid hormones on the cardiovascular functionality, especially on the ventricular repolarization. This study emphasizes the value of electrocardiography in hypothyroid patients and on clinicians to correlate the thyroxine effects with the ventricular functionality using Corrected QT as vital marker of cardiac assessment in hypothyroid patients at the bedside.

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