



COMPARATIVE STUDY OF ECG IN HYPOTHYROID PATIENTS AND CONTROLS

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ABSTRACT

Hypothyroidism as an endocrine disorder is becoming quite common these days. It is due to insufficient secretion of thyroid hormone from thyroid gland, deficiency of thyroid hormone has got myriad effect all over the body including cardiovascular system. This study was designed to find out relevant electrophysiological and ionotropic effects on heart produced by insufficient thyroid hormone using ECG. A total of 60 subjects in the age group of 18 to 60 years were taken from the society and civil hospital, Ahmedabad, of which 30 were known cases of hypothyroidism and 30 were controls who were matched for age and gender. Study showed that cases of hypothyroidism had clinically significant cardiovascular changes. ECG changes seen were sinus bradycardia, prolonged PR interval, QT interval and few cases of low voltage complexes. On the basis of results of this study, we can conclude that cases of hypothyroidism should be monitored for cardiovascular derangement, so that timely intervention could be taken for the prevention of cardiovascular complications associated with hypothyroidism.

KEYWORDS : hypothyroidism , ECG, cardiovascular changes, interval

INTRODUCTION

The thyroid gland produces hormones, namely thyroxine (T4) and triiodothyronine (T3). Acting through α and β receptors, these hormones play a critical role and have multitude effects on cardiovascular system. This is accomplished by direct and indirect mechanisms.

1) Vasodilation and increased blood flow to tissues is caused by rapid utilization of oxygen and increased production of heat and carbon dioxide indirectly and directly by decreased systemic vascular resistance. 2) Blood volume is increased by the effect of vasodilation produced and by activating Renin-Angiotensin-Aldosterone Axis. 3) Tachycardia is caused by increased excitability of heart directly and via adrenergic stimulation indirectly. 4) Force of Cardiac contraction is increased due to direct effect of thyroid hormones on cardiac muscle and via adrenergic stimulation. Myocardial calcium uptake and adenyl cyclase are increased and enhance contractile force. 5) Cardiac output is also increased as a result of increased blood volume, increased heart rate and increased force of contraction which occurs both by direct and indirect effects of hormone. 6) Systolic blood pressure is increased due to increased strength and rate of heart beat whereas diastolic blood pressure is decreased due to peripheral vasodilation.

Thyroid disease has become quite common nowadays and since thyroid hormone has both ionotropic and chronotropic effects on heart, variations in this hormone leads to ECG changes.

Hypothyroidism induces change in cardiac gene expression leading to increased systemic vascular resistance and decreased contractility and cardiac output. Hypothyroidism also causes increased cardiac oxidative stress and mucopolysaccharide accumulation leading to myocardial interstitial fibrosis. Our aim in this study was to compare ECG findings in patients of hypothyroidism and healthy adults who were matched for age, sex and socioeconomic background.

MATERIAL AND METHODS

The present study was conducted on a total of 60 subjects in the age group of 18 to 60 years, who were taken from society and OPD of civil hospital, Ahmedabad. Of these, 30 were newly diagnosed patients of hypothyroidism and 30 were healthy volunteers as control group who were matched for age and

gender. ECG was conducted at physiology department, B.J. Medical College, Ahmedabad. ECG equipment used was of Allengers company, model no-PISCES A 103. **INCLUSION CRITERIA:** 1) newly diagnosed primary hypothyroid patients as study group. 2) Age ranged from 18-60 years. **EXCLUSION CRITERIA:** 1) patients with known cardiac disease. 2) patients with endocrine disorder. 3) patients with history of respiratory infections. 4) patients on drugs that have stimulatory or inhibitory effect on thyroid function for example β blocker, lithium, oral contraceptive pills etc.

Written informed consent was taken from all the individuals of study and control group in accordance with the protocol. Basic clinical assessment was done and recorded in a case proforma for all the subjects. The subjects were made familiar to the machine and were taught its usage. ECG was done with subjects relaxed and in lying down position. Objective was to get a clear ECG strip after all the leads were correctly placed and baseline was obtained. The parameters were RR interval, QT interval, PR interval and low voltage complexes if present or not among cases.

STATISTICAL ANALYSIS

Student t test was used to find the difference in ECG findings between healthy control and cases. P value of less than 0.05 was considered significant.

RESULT

| ECG FINDINGS | STUDY GROUP (n=30) MEAN \pm SD | CONTROL GROUP (n=30) MEAN \pm SD | P VALUE | RESULT |
|---------------------|-------------------------------------|---------------------------------------|-------------------------|-------------|
| RR INTERVAL (mm) | 29.83 \pm 6.28 | 22.26 \pm 3.5 | 4.89 * 10 ⁻⁷ | Significant |
| QT INTERVAL (ms ec) | 484.03 \pm 94.10 | 385.23 \pm 42.27 | 3.17 * 10 ⁻⁶ | Significant |
| PR INTERVAL (ms ec) | 201.36 \pm 53.51 | 142.43 \pm 24.36 | 1.3 * 10 ⁻⁶ | Significant |

DISCUSSION

In our study, we found statistically significant difference in RR interval of cases as compared to control group. This shows that bradycardia is seen in patients of hypothyroidism as adrenergic activity is decreased and partly due to down

regulatory effect of deficient thyroid hormone on sodium pump density and Na^+/K^+ current channel. Statistical significant difference in QT interval of cases was also seen. The underlying mechanism may be decreasing I_{Kr} channel. Though the exact mechanism is not known it may also be because of dyselectrolytaemia (low Mg) as seen in hypothyroidism, so phase 2 of cardiac action potential curve becomes slow leading to ST segment prolongation, hence QT prolongation. PR interval was prolonged and result was significant. PR Interval prolongation occurs due to factors that lead to disturbance in AV node conduction such as AV node inflammation, infiltration or certain drugs. Although such factors like sarcoidosis, amyloidosis, hemochromatosis etc were ruled out in exclusion criteria, age related AV node calcification could probably be the reason as more number of cases of PR prolongation was seen in elderly which may predispose to first degree AV node block.

In hypothyroidism low voltage complexes can be seen due to both severe thyroid hormone deficiency and large pericardial effusion. In addition, elderly patient over 60 years has low voltage complexes more frequently than do the patients under 50 years. Low voltage complexes is defined as net QRS voltage $< 0.5\text{mV}$ in all limb leads and/or $< 1\text{mV}$ in precordial leads. In our study we found only 3 out of 30 cases with low voltage complexes. This could be explained with myxedema associated with increased permeability of capillaries and subsequent leakage of protein into the interstitial spaces which could result in pericardial effusion.

CONCLUSION

The findings of our study are in conformity with earlier studies. Within the limitations of this study we can conclude that Hypothyroidism has been found to predispose patients towards cardiovascular complications. Hence, it is important to investigate ECG profile in hypothyroid patients.

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