IOSR Journal of Dental and Medical Sciences (IOSR-JDMS)
e-ISSN: 2279-0853, p-ISSN: 2279-0861.Volume 16, Issue 8 Ver. XIII (Aug. 2017), PP 01-04
www.iosrjournals.org

Study of Heart Rate Variability in Subclinical Hypothyroidism

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I. Introduction

Heart Rate Variability (HRV) defined as degree of fluctuation of beat to beat differences in cardiac rhythm (1,2). It is non-invasive procedure & assess beat to beat variation in the heart.Beat to beat variation reflects time varying influence of autonomic nervous system (3). The loss of balance between sympathetic & parasympathetic system leads to cardiovascular disorders.Many hormones, including thyroid hormones (Tri-iodothyronine T3, Thyroxine T4) are thought to affect this balance. Hypothyroidism is deficiency of thyroid hormones or elevated TSH.Hypothyroidism is classified as,Overt and Subclinical hypothyroidism (SCH). SCH and cardiovascular risks are no yet correlated specifically as in that of overt.
Hence in this study, we focussed on HRV in SCH.

Aim: To study the Heart Rate Variability in subclinical hypothyroidism.

Objectives: To assess and compare Heart Rate Variability among the subjects of the SCH and euthyroid subjects.

Materials And Methods: A cross sectional study which was carried out in patients randomly coming to Thyroid OPD in the Period of study: July 2014 to April 2016.
Institute Ethics Committee (IEC) clearance was obtained before commencement of study.
Written informed consent was taken from each subject

Inclusion criteria for study group (n= 30)
Newly diagnosed case of subclinical hypothyroidism of age: 20 to 50 years with no history of any significant illness and autonomic nervous disorder.

Inclusion Criteria for Control Group:
Age and sex matched apparently healthy individuals.

Exclusion criteria for study & control group
Having known autonomic disorder.
Taking any drug modulating the autonomic nervous system.
Any heart disease or any other systemic diseases or factors except hypothyroidism in study group that may affect the autonomic reflexes.
Smokers and alcoholic subjects.

Heart Rate Variability

- ECG recording for 5 minutes in supine position
- ECG recording for 5 minutes in standing position

This data was analyzed by: 1) Time domain analysis2) Frequency domain analysis

Time domain variable	**Variable Units Value**	**Description of statistical measures**
SDNN	Ms	Standard deviation of all NN intervals
RMSSD	Ms	The square root of the mean of the sum of the squares of differences between adjacent NN interval
NN50	Count	Number ofpairs of adjacent NN intervals differing by more than 50ms in the entire recording.
pNN50	%	NN50 count divided by the total number of all NN intervals.

Variable	Units	Frequency	Description
TP(total power)	ms^2	<0.4	Total variance of N-N interval over the temporal segment
VLF	ms^2	<0.04	Absolute power in very low frequency range
LF	ms^2	0.04 to 0.15	Absolute power in low frequency range
LF norm	n.u.		LF power in normalised units[{LF/(TP-VLF)}X100]
HF	ms^2	0.15 – 0.4	Absolute power in high frequency range
HF norm	n.u.		HF power in normalised units[{HF/(TP-VLF)}X100]
LF: HF			Ratio of LF(ms^2)/HF(ms^2)

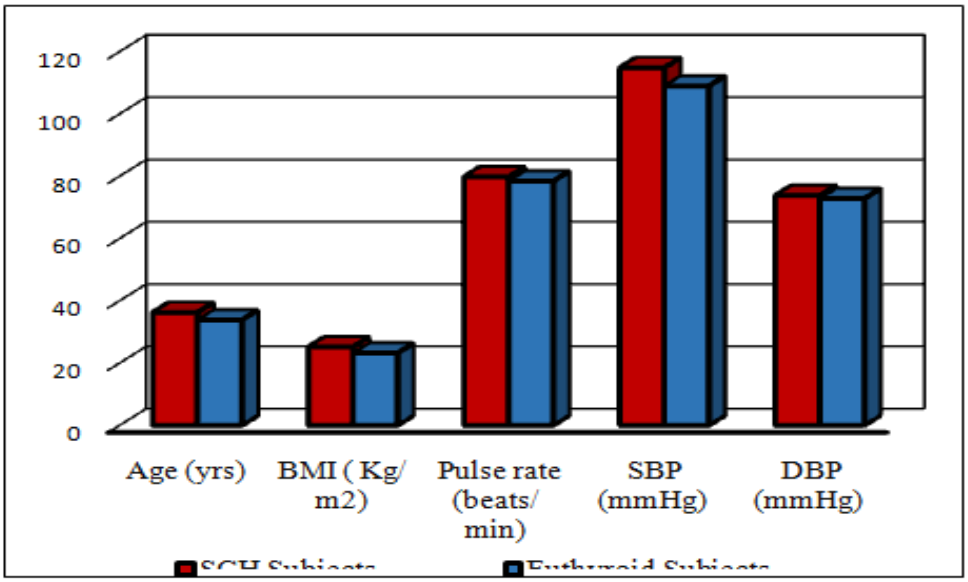
II. Statistical Analysis

Data analysis was performed by using RMS Polyrite -D machine Statistical analysis was done by using SPSS 17 and Microsoft Office Excel 2007 statistical software.All the data were expressed as Mean + SD. The student's t-test was used.

P-value < 0.05 was accepted as statistically significant.

Comparison of age, anthropometric and basal cardiovascular parameters between SCH and Euthyroid subjects

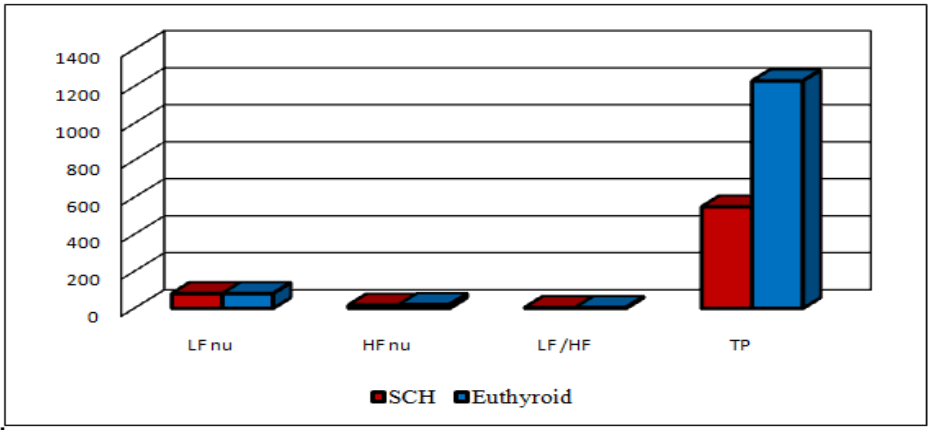
Anthropometric and basal cardiovascular parameters	SCH Subjects		Euthyroid Subjects		P Value
	Mean	SD	Mean	SD	
Age (Yrs)	36.23	8.57	33.83	7.92	0.26
BMI (Kg/ m2)	25.16	5.04	23.16	3.01	0.23
Resting pulse rate (beats/ min)	79.8	7.49	78.4	9.25	0.52
Resting SBP (mmHg)	114.8	10.88	108.93	8.73	0.02*
Resting DBP (mmHg)	73.8	5.64	72.8	4.25	0.44



Comparison of Frequency Domain parameters of HRV between SCH and Euthyroid subjects

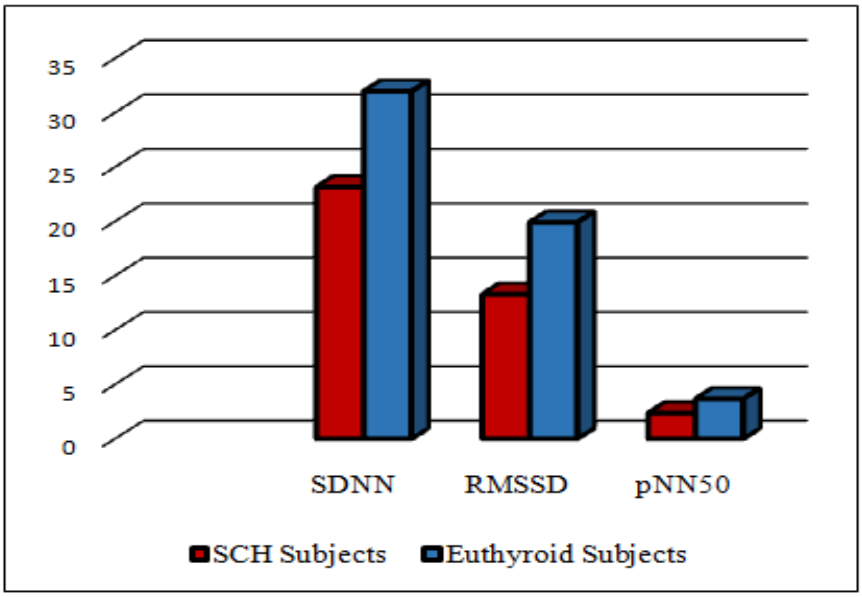
Frequency domain parameters of HRV	SCH Subjects		Euthyroid subjects		P Value
	Mean	SD	Mean	SD	
LF (nu)	79.93	8.44	79.77	9.17	0.47
HF (nu)	17.27	4.96	20.55	9.65	0.05*
LF /HF	5.37	3.71	5.31	2.72	0.47
TP	548.53	888.52	1229.30	1596.39	0.04*

Figure 2: Distribution and Compararison of Frequency Domain Parameters of HRV between Control and Study groups.



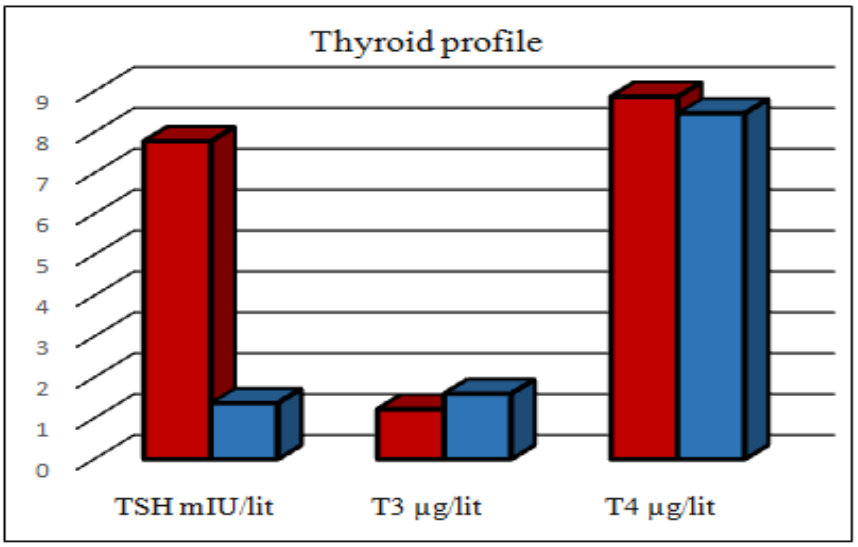
Comparison of Time Domain parameters of HRV between SCH and Euthyroid subjects

Time domain parameters	SCH Subjects		Euthyroid Subjects		P Value
	Mean	SD	Mean	SD	
SDNN	23.15	7.32	31.96	17.41	0.01*
RMSSD	13.28	7.52	19.9	10.03	0.01*
pNN50	2.36	4.96	3.66	8.25	0.46



Comparison of Thyroid Profile parameters between SCH and Euthyroid subjects

Thyroid profile	SCH I (n=30)		EH II (n=30)		P Value
	Mean	SD	Mean	SD	
TSH mIU/lit	7.78	1.35	1.37	0.67	0.00*
T_3 µg/lit	1.22	0.88	1.6	0.68	0.07
T_4 µg/lit	8.87	2.28	8.46	1.64	0.44



III. Discussion

The difference in pulse, SBP and DBP in SCH subjects compared to euthyroid subjects was due to symaptho-vagal imbalance. The sympathetic nervous system (SNS) and thyroid hormones regulatenumber of metabolic processes in a complementary fashion [(4)].Thyroid hormones regulate the sympathetic nerve activity, and therefore, it modulates serum and tissue levels of catecholamines[(5)]. The hypothyroid patients have elevated plasma norepinephrine levels, to compensate for reduced adrenergic sensitivity of the receptors[(6,7)]. TSH level in

SCH subjects were found to be higher than euthyroid subjects. T3 and T4 levels had no significant difference which was keeping pace with definition of SCH.HRV is thought to reflect the heart's ability to adapt to changing circumstances. The normal variability in HR is due to autonomic neural regulation of the heart and the circulatory system [(8)].Akselrod et al introduced power spectral analysis of heart rate fluctuations to quantitatively evaluate beat to beat cardiovascular control [(9)].It consists of LF, HF, LF/ HFratio and TP.LF/ HF ratio was used as an indirect index of sympathovagal imbalance [(1)]. Galetta *et al* had reported an increase in LF/HF frequency in heart rate variability reflecting higher sympathetic activity in subclinical hypothyroid patients [(1)]. Kahaly GJ et al [(10)] suggested Low HF value there is a reduction in vagal tone [(4)].Significant reduction in TP of HRV in hypothyroid group, as TP in general indicates the vagal modulation of cardiac function [(11,12)]There was reduction of RMSSD, SDNN, pNN50 in patients with SCH. Similar results were found by Matia Ahmed et al [(13)]. A significant decline in RMSSD and pNN50 compared to the healthy people this indicates on weakening of the parasympathetic ANS influence [(14)].

IV. Conclusion

The increase in pulse, systolic & diastolic BP in SCH subjects compared to euthyroid subjects was suggestive of symaptho-vagal imbalance (SVI). Increase in LF nu, LF/HF and significant decrease in HF nu was suggestive of SVI with increased sympathetic tone. Significant decrease in TP was also pointing towards decreased HRV.Significant decrease in SDNN, RMSSD support SVI with increase in sympathetic tone.
Increase in TSH in SCH subjects with no significant difference in T3 and T4, was keeping pace with SCH definition. SCH is associated with ANS imbalance with increased sympathetic tone, which is predisposing factor for cardiovascular risks. Hence early intervention in SCH causes prevention of cardiovascular diseases & progression to overt hypothyroidism.

References

[1]. F Galetta, F Franzoni, P. Fallahi, M. Rossi, A.Carpi, D Rubello HRV & QT dispersion in patients with subclinical hypothyroidism. Biomedicine & pharmacotherapy 2006; 60: 425-430
[2]. Malik M., Camm AJ HRV clin.chem.43 1997; 52: 8.
[3]. Kamath MV, Fallen EL, Power spectral analysis of HRV a non-invasive signature of cardiac autonomic function. Rev Biomed Eng. 1993; 21: 245- 311.
[4]. RashmiMullur, Yan-Yun Liu, and Gregory A. Brent. Thyroid Hormone Regulation of Metabolism. Physiol Rev. 2014 April; 94(2): 355–382.
[5]. Tatiana L. Fonseca,1 Marilia B. C. G. Teixeira,1 Manuela Rodrigues-Miranda,1 Marcos V. Silva,1 Gisele M. Martins,1 Thyroid hormone interacts with the sympathetic nervous system to modulate bone mass and structure in young adult mice. Am J PhysiolEndocrinolMetab 2014; 307: E408–E418.
[6]. Manhem P, Bramnert M, Hallengren B, Lecerof H, Werner R. Increased arterial and venous plasma noradrenaline levels in patients with primary hypothyroidism during hypothyroid as compared to euthyroid state. J Endocrinol Invest. 1992; 15: 763–5.
[7]. Bilezikian JP, Loeb JN. The influence of hyperthyroidism and hypothyroidism on a and b adrenergic receptor system and adrenergic responsiveness. Endocrine Rev. 1983; 4: 378–85.
[8]. Hueston WJ, Pearson WS. Subclinical hypothyroidism and the risk of hypercholesterolemia. Ann Fam Med. 2004; 2(4): 351.
[9]. Akselord S, Gorden D, Ubel FA. Power spectral analysis of heart rate fluctuation: a quantitative probe of beat-to-beat cardiovascular control. Science 1981; 213: 220-2
[10]. Kahaly GJ. Cardiovascular and atherogenic aspect of subclinical hypothyroidism. Thyroid.2000; 10: 665–79
[11]. Task Force Report: Task Force of the European Society of Cardiology and the North American Society of Pacing and Electrophysiology. Heart Rate Variability: standards of measurement, physiological interpretation and clinical use. European Heart Journal 1996; 17: 354-81.
[12]. Acharya UR, Joseph KP, Kannathal L, Lim CM, Suri JS. Heart Rate Variability: A review. Med Bio EngComput 2006; 44: 1031-51.
[13]. Matia Ahmed, Noorjahan Begum, Sultana Fardosi Assessment of autonomic functions in hypothyroid by time domain method of HRV. Journal of Bangladesh soc. of physiologist 2012; 5(2): 53-59.
[14]. GulnarMoldabek, Heart Rate Variability Indicators in patients with hypothyroidism Medical and Health Science Journal, MHSJ ISSN 2011; 6: p.127-131.
[15]. Manhem P, Bramnert M, Hallengren B, Lecerof H, Werner R. Increased arterial and venous plasma noradrenaline levels in patients with primary hypothyroidism during hypothyroid as compared to euthyroid state. J Endocrinol Invest. 1992; 15: 763–5.
[16]. Bilezikian JP, Loeb JN. The influence of hyperthyroidism and hypothyroidism on a and b adrenergic receptor system and adrenergic responsiveness. Endocrine Rev. 1983; 4: 378–85.

*Dr. Sataree Kothadia . "Study of Heart Rate Variability in Subclinical Hypothyroidism." IOSR Journal of Dental and Medical Sciences (IOSR-JDMS) 16.8 (2017): 01-04