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Pattern of Cardio-vascular dysfunctioning in Patients of Hypothyroidism

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Abstract
Background: The sign and symptoms produced by hypothyroidism is a major cause of morbidity but the effect of hypothyroidism on cardiovascular system and its complication can be the cause for one's morbidity & mortality if they goes unnoticed and if not addressed in a proper way and at appropriate time.
Aims and objectives: To determine the pattern of cardiao-vascular complications in hypothyroid patients.
Materials and Methods: Two hundred newly diagnosed hypothyroid patients were studied from January 2017 to June 2018 at the Hamidia Hospital of Bhopal city. All the patients were subjected to medical examinations for thyroid profile, blood pressure, lipid profile, electrocardiography, color Doppler heart, chest x-ray PA were performed.
Results: Dyslipidemia was more prevalent and more severe in overt hypothyroidism (OH) patients with respect to total cholesterol, low density lipoprotein (LDL), high density lipoprotein (HDL) except for triglycerides, the derangement of which is having similar prevalence in both overt hypothyroidism (OH) and subclinical hypothyroidism (SH). In subclinical hypothyroid patient 27.27% and 54.44% had patients had increased blood pressure. A total 22.22% of overt hypothyroid patients and 7.27% of subclinical hypothyroid patient have pericardial effusion. More than half of patients (55.56%) of overt hypothyroidism had bradycardia in their ECG while only 4.55% in subclinical group showed it. 48.89% in overt hypothyroid group and 11.82%in subclinical group showed low voltage complex in their ECG ($p<0.001$).
Conclusion: Hypothyroidism is evidently linked with cardiao-vascular complications which are more prevalent and more severe in overt hypothyroidism cases, hence should be considered while management of it.

Keywords: thyroid function test, hypothyroidism

Introduction

Hypothyroidism is one of the most common endocrinal problems encountered in our clinical practice. The prevalence of hypothyroidism in Indian context is around 10.95% with significantly high proportion of females affected than males (15.86 versus 5.02%) [1].

The sign and symptoms produced by hypothyroidism is a major cause of morbidity but the effect of hypothyroidism on cardiovascular system and its complication can be the cause for ones morbidity and mortality if they goes unnoticed and are not addressed in a proper way & at appropriate time [2, 3].

On the basis of understanding the cellular mechanism of action of thyroid hormones on heart, vascular smooth muscles, various body's metabolism and other vital organ systems it is possible to explain the change in cardiac output, cardiac contractility, blood pressure, vascular resistance, dyslipidemias and rhythm disturbances all that results from thyroid dysfunction as in hypothyroidism. These all disturbances in the body can be detected by various means of investigations like in ECG we can find sinus bradycardia, low voltage complexes, ST-T changes, various alterations in conduction causing RBBB, any type of ventricular arrhythmias, sometimes life-threatening one like Torsade-pointes (long QT) [4, 5].

Materials and Methods

Current observation study was conducted on 200 subjects who were newly diagnosed with hypothyroid. Patients with known cardiac disease, hypertension, diabetes, smokers, patients on anti-thyroid drugs or steroid and pregnant patients were excluded from current study. An informed and written consent was secured from all the participating patients before the commencement of this study.

All the patients who had TSH value more than 5.5microIU/ml were grouped as: Patients having raised TSH (>5.5microIU/ml) but normal T3 (08-2.1ngm/ml) and T4 (5-13microgm/dl) are considered subclinical hypothyroid. Patients having both raised TSH(>5.5microIU/ml) and T3(>2.1ngm/ml), T4(>13microgm/dl) are considered overt hypothyroid.

All the subjects of these groups were subjected to medical examinations for Thyroid profile [T3, T4, TSH], Blood pressure, Lipid profile [total cholesterol, triglycerides, LDL, HDL], Electrocardiography [ECG], Color Doppler heart [CD-ECHO], Chest x-ray PA. Additional physical parameters like weight, height, BMI also recorded.

The assessment used MS Excel 2007, MS word 2010 and statistical calculations were done by

Epi-info7 software. The variables were expressed using percentages and wherever necessary Mean ±SD for

quantitative data. The simple statistical test chi-square was performed for comparison between two groups and p-value less than 0.05 was taken as significant. The dummy variables also were used like 0,1,2 wherever necessary during excel chart preparation.

Result

Table 1: Clinical variables of the subjects as per the thyroid status

Character	Overt Hypothyroidism (n=90)	Subclinical Hypothyroidism (n=110)	P value
Sex (M/F)	19/71	20/90	0.7332
Age (in years)	36.82±7.94	36.53±7.10	0.4463
BMI (kg/m^2)	25.40±3.71	22.60±1.91	0.0000*
Total cholesterol(mg/dl)	246±74.37	177±44.76	0.0000*
LDL (mg/dl)	118.61±35.36	85.15±18.71	0.0000*
HDL (mg/dl)	44.66±13.33	51.25±9.48	0.0000*
Triglycerides(mg/dl)	156.27±28.60	148.90±28.90	0.3746
Systolic B.P. (mmHg)	122.66±15.33	112.38±11.11	0.0000*
Diastolic B.P. (mmHg)	75.82±10.80	68.30±7.44	0.0000*
Bradycardia	55.56%	4.55%	0.0000*
Low voltage complex	48.89%	11.82%	0.0000*
ST-T changes	23.33%	15.45%	0.218
Conduction abnormalities	3.33%	12.73%	0.0344*
Pericardial effusion	22.22%	7.27%	0.0047*
Diastolic dysfunction	18.89%	8.18%	0.0531
Increased IVSD	27.78%	5.45%	0.0000*

Data is expressed as mean ± standard deviation, (*) shows statistically significant values; p<0.05.

Current study has42.12% patients of overt hypothyroidism have their total cholesterol value raised and most of them (27.78%) have mild to moderate hypercholesterolemia while in subclinical group it was only 12.73% with most patients being mild to moderate rise. Also 53.33% patients among overt group and 43.45% patient in subclinical group have their plasma triglyceride level raised, maximum patients being in the range of severe(>175mg/dl) triglyceride in both the groups.

Overt group shows the maximum 61.11% subjects having raised LDL chE, being only 16.67% in severely raised range while in subclinical group most patient (91.82%) have normal level of LDL chE, only 8.18% shows a mild increase. The difference between both groups is statistically significant (p<0.001).

In subclinical hypothyroid patient 27.27% patients having increased blood pressure whereas in overt group this number is 54.44% in which most of the patients (37.78%) are in hypertensive range while 16.67% are in elevated pressure range. Also in overt group 42.22% patients have normal BP whereas 57.78% having their BP above normal in which 17.78% each in elevated and stage-2 HTN and 22.22% are in stage1 HTN criteria. In subclinical group 26.36% patients are above normal BP range in which maximum (21%) have their BP in elevated criteria.

A total 22.22% of overt hypothyroid patients whereas only 7.27% of subclinical hypothyroid patient have pericardial effusion. Most of the patients in subclinical group (92.73%) have no effusion reported. The difference between two groups is statistically significant (p=0.0047).

More than half of patients (55.56%) of overt hypothyroidism have reported bradycardia in their ECG while only 4.55% in subclinical group shows it. Most of the patients (95.45%) in subclinical group have no bradycardia. This difference is statistically significant (p=0.000).

A large no. of patient, 48.89% in overt hypothyroid group shows low voltage complex in their ECG while only 11.82%in subclinical group reported the same. Most patients in subclinical group, about 88.18% have normal voltage recordings. This difference is statistically significant (p=0.000).

In the present study, 23.33% overt hypothyroid patient and in subclinical group only 15.45% patient have ST-T changes in their ECG recording while 76.67% in overt and 84.55% in subclinical group reported no changes. This difference is statistically non-significant (p=0.2180).

In the present study, subclinical group have 12.73% patients reported conduction abnormalities, mostly RBBB while in overt group only 3 patient (3.33%) reported the same. No conduction abnormality is reported in 96.67% and 87.27% patients in overt and subclinical group respectively. This difference is statistically significant (p=0.0344).

CD ECHO showed that increased IVSD thickness and pericardial effusion was significantly higher in overt hypothyroidism patients as compared to subclinical hypothyroidism (p<0.001).

Discussion

Dyslipidemia is an established factor associated with hypothyroidism. In a study by Tumbanatham *et al*. a significant difference (p<0.05) was observed in the mean values of total cholesterol, triglycerides and LDL levels between clinical and subclinical hypothyroidism [1]. In another study by K. Ramesh and Balaji Nayak there was increase of total cholesterol (15%), LDL (32%), triglycerides (100%) and decrease of HDL (82.5%) in patients of hypothyroidism [2]. Also data from the NHANES III revealed increased levels of TC in SH patients (n=215) vs. controls (n=8013). Our findings also have similar findings of increase in total cholesterol (42.12% in overt group and 12.73% in subclinical), triglycerides (53.33% in overt & 43.45% in SH),LDL (61.11 in overt & 8.18 in SH)and decreases in HDL(23.33% in overt & 0.91 in SH).

Blood pressure alterations (increases in both systolic and diastolic BP) was also noted in various previous studies. The direct action of thyroid hormone on the heart and blood vessels is responsible for this effect. In a study by Tumbanatham *et al*, 8.1% of the participants in subclinical hypothyroidism group and 3.2% of the participants in clinical hypothyroidism were hypertensives.[1]Another study by Klein in his study of 907 patients of hypothyroidism found the incidence of Hypertension to be 21%. [4]A metaanalysis of all cross-sectional studies comparing between the patients of SH and healthy controls there is significant increase in both SBP and DBP in SH patients (p<0.05). Current study also shows similar trends of increased systolic blood pressure (54.44% patients in OH & 27.27% in SH group), diastolic blood pressure is also found to be raised (34.38 in OH & 8.18% in SH).

In a study conducted by Shashikanth[6], bradycardia was reported in 14.3%, by Kumar *et al*. 13.7%, by Preshant *et al*, 35.5% in hypothyroid patients whereas in our study it was 23.05% more in OH than SH which is statistically significant (p=0.000) [7]. Present study also recorded low voltage complex in 23.5% patients which is 48.89% in OH and 11.82% in SH i.e. much more in OH group.

ST-T wave changes also found in hypothyroidism like T wave flattening, T wave inversion, ST segment depression.

In a previous study by Preshant *et al*. [7] the incidence of T wave inversion was 7.8% whereas by Sharath shah it was 3.1% [8]. In our study the collective ST-T changes found to be in 19% of the patient most of them have T wave inversions. In OH group the changes were present in 23.335 and in SH 15.45% which is statistically insignificant (p=0.2180).

Diastolic dysfunction by R. Verma and Shashikanth[6] was reported in 27% & 18% respectively whereas in our study this was found in 13% patients,18.89% in OH and 8.1% in SH group but the difference is insignificant(p=0.05351).

Ventricles wall thickness changes due to alterations in the cardiovascular hemodynamics. We took the interventricular septal wall thickness in diastole in our study. Increased IVSD thickness is found in 16.6% by Preshant *et al*. and in 10% by Shashikanth [6] whereas in our study increased thickness is found in a total of 15.5%, 27.78% in OH & 5.45% in SH which is very significant(p=0.000) [9].

Pleural effusion is an unusual finding in hypothyroidism, most of the time it is associated with the effusions of other cavities like ascites, pericardial effusion. A very few studies till now were performed on the association of pleural effusion and hypothyroidism. We found only 8 patients out of 200 who had effusions in CXR or in chest ultrasound but the associations of this effusion with the other disease of cardiac or other organ system have to be established to eliminate the bias. In a study Verma R [9] found pericardial effusion in 45% hypothyroid patients, another study by Shashikanth [6] this was in 18% patients only. In many other studies the incidence of PE is found in between 10 to 50%. We found PE in about 14% patients in which 22.22% was in OH and 7.27% in SH group, the difference is statistically significant (0.0047).

Cross sectional nature and small sample size was the main limitations of the present study; There is need of a large randomized clinical trial to strengthen the present study findings.

Conclusion

Observation of current study concludes that the cardiovascular parameters are affected by hypothyroid state. The changes in homeostasis are more affected in overt hypothyroidism. Therefore the risk of developing these complications should be considered while dealing with a new case of hypothyroidism or during its natural history or if there is under-treatment stage so that it can be investigated and treated accordingly. Also vice-versa i.e. in case of evidence of these complications patients should be screened for thyroid status. This holistic approach of management of thyroid will help to reduce the unexplained morbidity related to the hypothyroidism.

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