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Hypothyroidism as an Independent Risk Factor for Cardiac Diseases: A Cross-Sectional Study

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Abstract
Background and Objectives: *Hypothyroidism has significant cardiovascular manifestations. Inadequate number of studies and elusive nature of diagnosis of cardiovascular manifestations in hypothyroidism due to less prominence of symptoms and signs; attracted a great deal of investigatory endeavor. This study aims at studying the cardiovascular aftermath in hypothyroid patients by electrocardiography, lipid profile and echocardiography. The completely reversible nature of these complications, after starting treatment is well known.*
Methods*: 150 Subjects under the study included, out-patient and in-patient hypothyroid cases coming to Sri Siddhartha Medical College and Hospital, Tumkur. Study duration – 1st September 2012 to 31st August 2014. Patients were subjected to history, clinical examination and investigations like thyroid profile, electrocardiography, echocardiography and lipid profile. Data was analyzed using Epiinfo 7.*
Results; *Out of 150 cases, 97 had clinical hypothyroidism, 53 had subclinical hypothyroidism. 88.67% cases were females. 54% were in age group 21-40 yrs. Abnormal ECG in 26%, abnormal ECHO in 24%, Diastolic hypertension in 20%, Dyslipidemia in 34.67%, pericardial effusion in 14%, Ischemic heart disease in 1.33% and Anemia in 23.33% were seen in the study.*
Conclusion*: The hypothyroid patients present clinically with a myriad of symptoms and signs which are nonspecific. Hence a high index of suspicion is the key for the early diagnosis of hypothyroidism.*
The cardiac risk factors seen in the study are in the form of diastolic hypertension, bradycardia, dyslipidemia, T wave changes in ECG, diastolic dysfunction and pericardial effusion in ECHO.
After exclusion of the other risk factors for cardiac disease; various changes seen in hypothyroid cases in this study suggest that hypothyroidism is one of the independent risk factor for cardiac disease.
As the symptoms related to hypothyroidism and cardiac disease overlap, high index of suspicion should be considered for underlying cardiac disease; and these patients should undergo complete cardiac evaluation on diagnosis of hypothyroidism; so as to prevent the catastrophic cardiac outcomes.
Early diagnosis and correction of hypothyroidism is necessary; so that adverse effects on cardiac system can be minimized.
Studies have shown that with treatment of hypothyroidism the cardiovascular risk factors improve.
Keywords: *Hypothyroidism, ECG, ECHO.*

I. Abbrevations

AF	Atrial fibrillation.
AV	Atrioventricular
APC	Atrial premature contraction
BMI	Body mass index
BMR	Basal metabolic rate
CAD	oronary artery disease.
CCF	Congestive cardiac failure
CNS	Central nervous system
COPD	Chronic obstructive pulmonary disease
CVS	Cardio vascular system
ECG	Electrocardiography
ECHO	Echocardiogram
EF	Ejection fraction
ELISA	Enzyme linked immunosorbant assay
FT4	Free T4
FNAC	Fine needle aspiration cytology
GTT	Glucose tolerance test
Hb	Haemoglobin
HDL	High density lipoprotein
HOCM	Hypertrophic obstructive cardiomyopathy

IHD	Ischemic heart disease
I^{131}	Radioactive iodine
IVRT	Isovolumetric relaxation time
LBBB	Left bundle branch block
LDL	Low density lipoprotein
LVDD	Left ventricular diastolic dysfunction
LVEF	Left ventricular ejection fraction.
LVH	Left ventricular hypertrophy.
LVET	Left ventricle ejection time
LV	Left ventricle
MHC	Major Histocompatibility complex
mRNA	Messenger Ribonucleic acid
MPS	Mucopolysachharide
PEP	Pre ejection period
RBBB	Right bundle branch block
RBS	Random blood sugar
RIA	Radio immunoassay
RWMA	Regional wall motion abnormality
SIADH	Syndrome of inappropriate ADH production
SCH	Subclinical hypothyroidism
SD	Standard deviation
TGL	Triglyceride
TRH	Thyroid releasing hormone
TSH	Thyroid stimulating hormone
USG	Ultrasonography
VF	Ventricular fibrillation
VLDL	Very low density lipoprotein
VPC	Ventricular premature complexes
VT	Ventricular tachycardia

II. Aim And Objectives

Aim

To study cardiac manifestations in hypothyroidism.

Objectives:

1. To study the clinical profile of cardiac system in hypothyroidism.
2. To study the various ECG and echocardiographic changes in hypothyroidism.
3. To study the lipid profile in hypothyroidism.

III. Methodology

Source of data-

150 Subjects under the study included, out-patient and in-patient hypothyroid cases coming to Sri Siddhartha Medical College and Hospital, Tumkur.

Method of collection-

Patients with newly detected and un-controlled hypothyroidism were taken under study. Detailed history, clinical examination, cardiac system examination and investigations were done. Data was analyzed using Epiinfo 7.

Study duration –

1st September 2012 to 31st August 2014.

Inclusion criteria-

a. Newly detected hypothyroidism.
b. Old un-controlled hypothyroidism.

Exclusion criteria-

Those with congenital heart disease, rheumatic heart disease, diabetes mellitus, hypertension, smoking, alcohol, COPD and severe anemia.

Study design- Cross sectional study.

Investigations

The following investigations are needed to diagnose hypothyroidism and cardiac diseases.

1. Complete Blood Count: Hb%, TC, ESR, DC, peripheral Smear.
2. FBS/RBS
3. Blood urea and serum Creatinine.
4. Serum T_3 free T_4, T_3-
Serum T_4
Serum TSH
5. Chest x-ray
6. ECG
7. Lipid profile: Serum Cholesterol, Triglycerides, HDL, LDL, VLDL.
8. Echocardiogram
9. TMT (if needed)

Thyroid profile

A combination of a raised TSH concentration and a low T_4 concentration has great diagnostic value for primary hypothyroidism. In the present study for the measurement of TSH, $T_4$and T_3 radio-immunoassay was employed.

Electrocardiogram (ECG)

ECG was recorded in all the patients, in all the 12 standard leads, at a paper speed of 25mm per sec. At normal standardization. PR interval of >0.2 seconds was taken as prolonged, QRS complexes of less than 5mm in limb leads and less than 10mm in chest leads were taken as low voltage complexes.

Echocardiogram

In all the patients in the study echocardiogram was done on Siemens G. Sonoline G. 60S ultrasound imaging system. Cardiac 2D-Mode, M-mode and Doppler. Each case was specifically screened for cardiovascular manifestations like pericardial effusion ventricular dysfunction.

Statistical Methods

a. Graphical representation of the data.
b. Percentage of data.
c. Measures of central tendency.

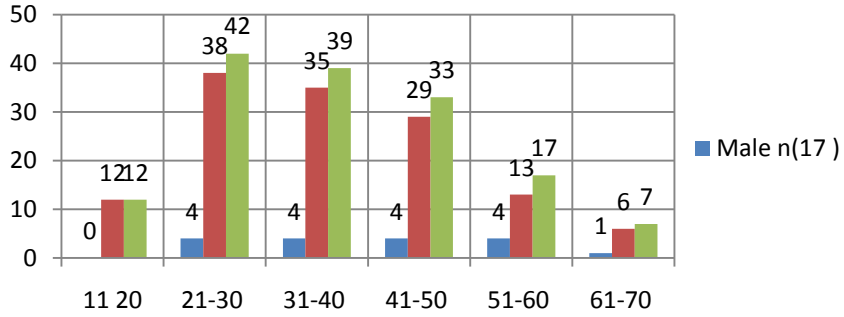
IV. Results

Age and Sex distribution:

Table-4: Distribution of cases according to Age and sex in the study population

Age group (yrs)	Male		Female		Frequency	
	n(17)	%	n(133)	%	n(150)	%
11-20	0	0	12	9	12	8
21-30	4	23.5	38	28.5	42	28
31-40	4	23.5	35	26.3	39	26
41-50	4	23.5	29	21.8	33	22
51-60	4	23.5	13	9.8	17	11.34
61-70	1	5.8	6	4.5	7	4.66
Total	17	100	133	100	150	100

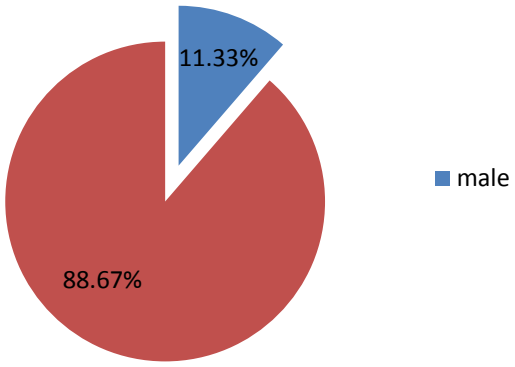
Maximum numbers of patients were in age group of 21-40yrs - 81(54%).



Graph 1: Age and Sex distribution

Table – 4a: Mean age and SD of the cases according to sex

Sex	Mean Age	SD
Male	43.23	11.76
Female	37.49	12.89



Graph 2: Sex distribution in Sample population

There was overall female preponderance in the study- 133 (88.67%). Males were 17 (11.67%).

Table 5: Sex distribution according to clinical and subclinical hypothyroidism

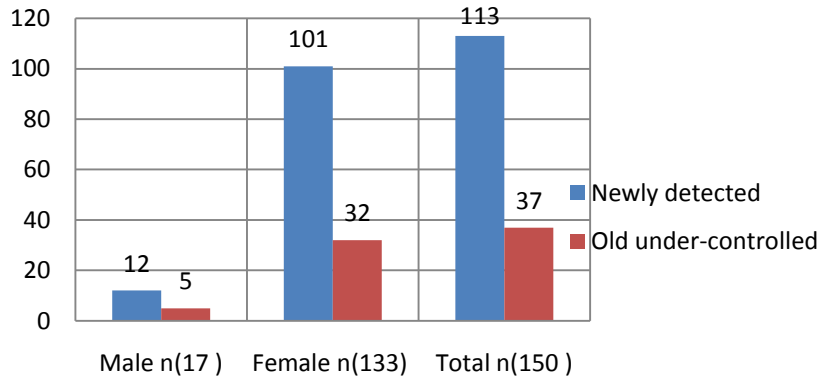
Hypothyroidism	Male		Female		Total	
	n(17)	%	n(133)	%	n(150)	%
Clinical Hypothyroidism	15	88.24	82	61.65	97	64.67
Subclinical Hypothyroidism	2	11.76	51	38.35	53	35.33
Total	17	100	133	100	150	100

97 (64.67%) patients had clinical hypothyroidism and 53 (35.33%) had subclinical hypothyroidism. 15 (88.24%) males had clinical hypothyroidism. In females 82 (61.65%) had clinical and 51 (38.35%) had subclinical hypothyroidism.

Table 6: Sex distribution in hypothyroid cases

Hypothyroid	Male		Female		Total	
	n(17)	%	n(133)	%	n(150)	%
Newly detected	12	70.6	101	75.93	113	75.33
Old under-controlled	5	29.4	32	24.07	37	24.67
Total	17	100	133	100	150	100

113 (75.33%) were newly detected hypothyroid cases. 37 cases (24.67%) were known hypothyroid under controlled.

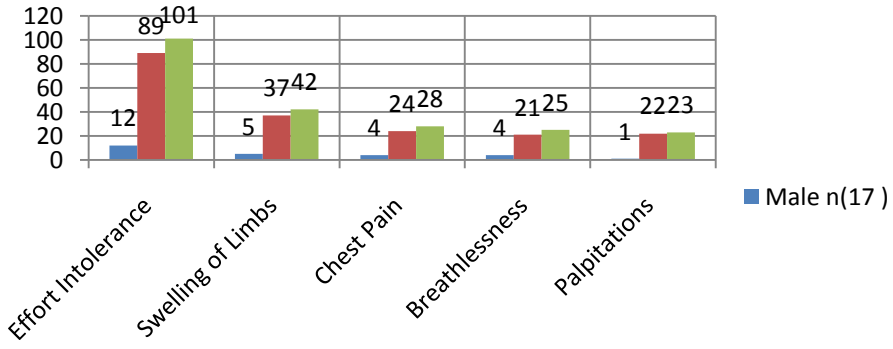


Graph 3: Sex distribution in hypothyroid cases

Symptoms at presentation:

Table 7: Cardiovascular symptoms at presentation

Cardiovascular Symptoms	Male		Female		Total	
	n(17)	%	n(133)	%	n(150)	%
Effort Intolerance	12	70.6	89	66.91	101	67.33
Swelling of Limbs	5	29.41	37	27.82	42	28
Chest Pain	4	23.52	24	18.04	28	18.67
Breathlessness	4	23.52	21	15.8	25	16.67
Palpitations	1	5.9	22	16.54	23	15.33

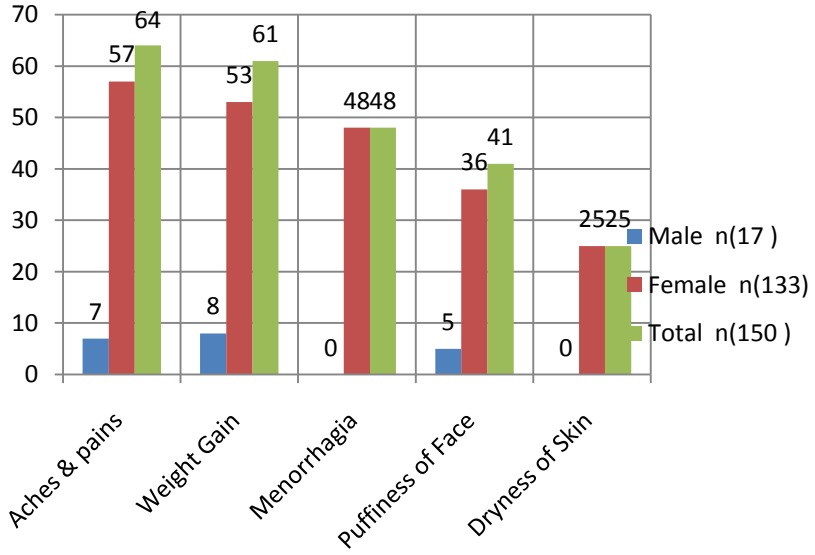


Graph 4: Cardiovascular symptoms at presentation

Most of the patients presented with multiple symptoms. The most common cardiac symptom was effort intolerance 101 (67.33%) in total, other symptoms were swelling of limbs 42 (28%), chest pain 28 (18.67%), breathlessness 25 (16.67%) and palpitations 23 (15.33%).

Table 8: Symptoms related to hypothyroidism

Hypothyroid Symptoms	Male		Female		Total	
	n(17)	%	n(133)	%	n(150)	%
Aches & pains	7	41.18	57	42.86	64	42.67
Weight Gain	8	47.06	53	39.85	61	40.67
Menorrhagia	0	0	48	36.1	48	32
Puffiness of Face	5	29.41	36	27.06	41	27.33
Dryness of Skin	0	0	25	18.8	25	16.67



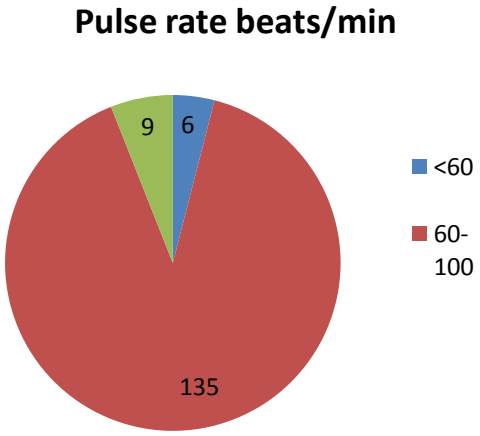
Graph 5: Symptoms related to hypothyroidism

Most patients presented with multiple symptoms. Most common symptoms were aches and pains 64 (42.67%), weight gain 61 (40.67%), Menorrhagia 48 (32%), puffiness of face 41 (27.33%) and dryness of skin in 25 (16.67%). Subclinical hypothyroid patients presented with very few symptoms.

General Physical examination:

Table 9: Pulse rate in the study population

Pulse rate Per min	Male		Female		Total	
	n(17)	%	n(133)	%	n(150)	%
<60	2	11.76	4	3	6	4
60-100	13	76.48	122	91.73	135	90
>100	2	11.76	7	5.27	9	6



Graph 6: Pulse rate in the study population

Bradycardia (<60 beats/min) was seen in only 6 (4%) cases. Tachycardia (>100 beats/ min) was seen in9 (6%). Pulse rate was normal in 135 (90%).

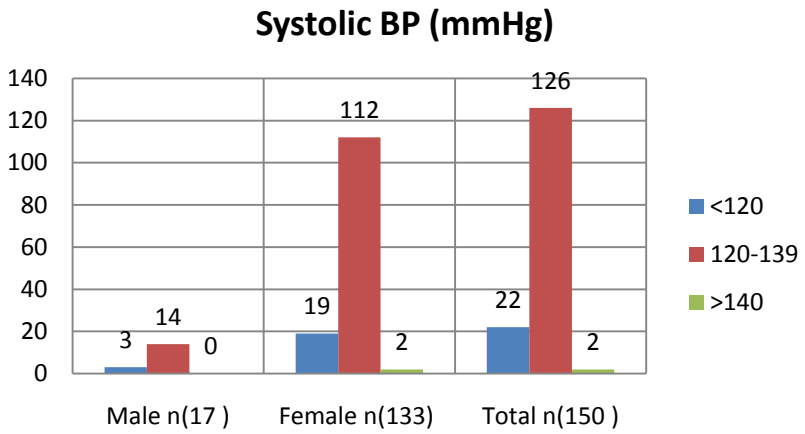
Mean pulse rate is 81.98. SD is 12.12 Mode is 86.

Median is 83.

Table 10: Systolic blood pressure in the study population

Systolic BP mmHg	Male		Female		Total	
	n(17)	%	n(133)	%	n(150)	%
<120	3	17.65	19	14.29	22	14.67

120-139	14	82.35	112	84.21	126	84
>140	0	0	2	1.5	2	1.33

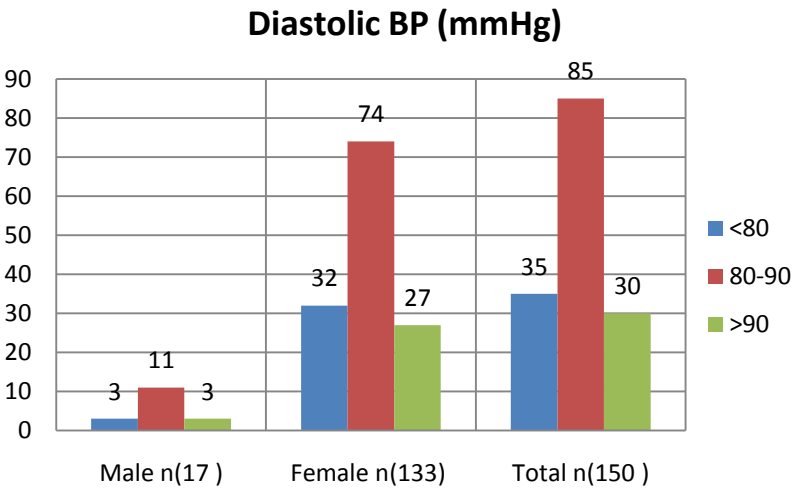


Graph 7: Systolic blood pressure in the study population

Normal systolic blood pressure in 22 (14.67%), pre hypertension in 126 (84%) cases and stage 1 hypertension in 2 (1.33%) cases on presentation according to JNC 7 criteria.[35]

Table 11: Diastolic blood pressure in the study population

Diastolic BP mmHg	Male		Female		Total	
	n(17)	%	n(133)	%	n(150)	%
<80	3	17.65	32	24.06	35	23.33
80-90	11	64.7	74	55.64	85	56.67
>90	3	17.65	27	20.3	30	20

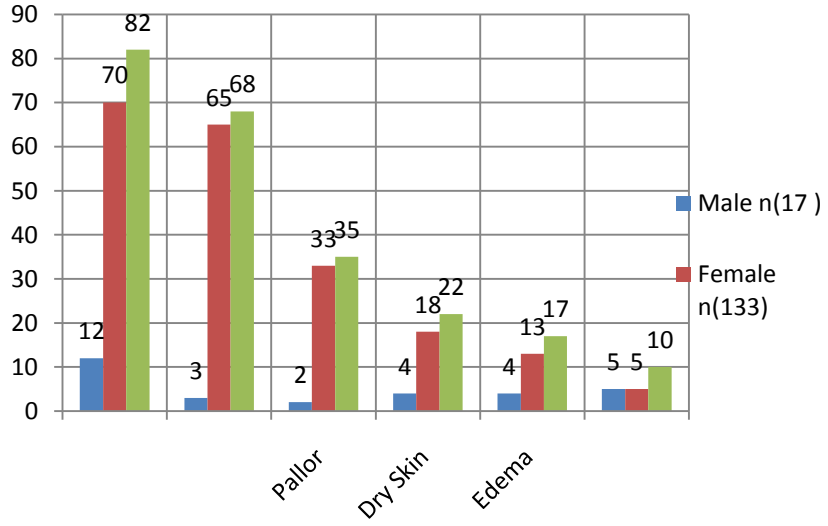


Graph 8: Diastolic blood pressure in the study population

Diastolic blood pressure >90mmHg was found in 30 (20%) of patients.

Table 12: General signs related to hypothyroidism in study population

Signs	Male		Female		Total	
	n(17)	%	n(133)	%	n(150)	%
BMI >25 Kg/m^2	12	70.59	70	52.63	82	54.67
Thyromegaly	3	17.65	65	48.87	68	45.34
Pallor	2	11.76	33	24.81	35	23.33
Dry Skin	4	23.53	18	13.53	22	14.67
Edema	4	23.53	13	9.77	17	11.34
Delayed ankle jerk	5	29.41	5	3.76	10	6.67



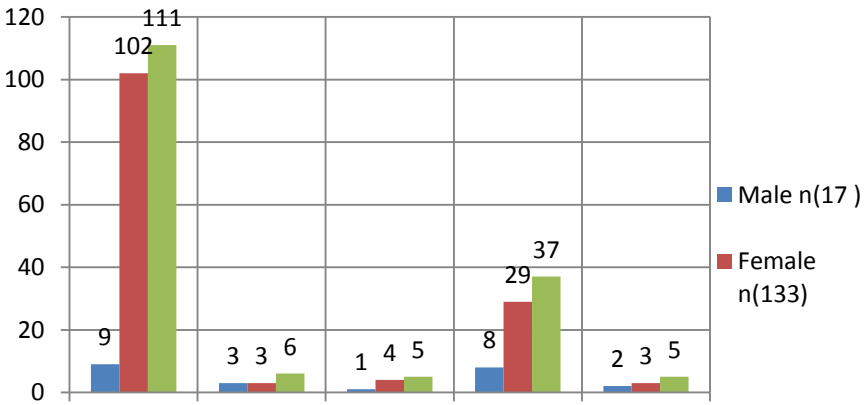
Graph 9: General signs related to hypothyroidism in study population

The most common sign was high body mass index (BMI) >25 kg/m^2 in 82 (54.67%). Thyromegaly was seen in 68 (45.34%) cases. Pallor in 35 (23.33%), dry skin in 22 (14.67%), edema in 17 (11.34%) and delayed ankle jerk in 10 (6.67%).

Electrocardiographic changes:

Table 13: Electrocardiographic changes in the study population

ECG changes	Male		Female		Total	
	n(17)	%	n(133)	%	n(150)	%
Normal	9	52.94	102	76.7	111	74
Bradycardia	3	17.65	3	2.25	6	4
Low voltage complex	1	5.89	4	3	5	3.34
T wave (Flat / Inverted)	8	47.06	29	21.8	37	24.67
ST segment changes	2	11.76	3	2.25	5	3.34



Graph 10: Electrocardiographic changes in the study population

Electrocardiography was normal in 111 (74%) cases and abnormal in 39 (26%) cases. Most had multiple changes like bradycardia in 6 (4%), low voltage complex in 5 (3.34%), T wave changes in the form of flattening or inversion in 37 (24.67%) and ST segment changes in 5 (3.34%).

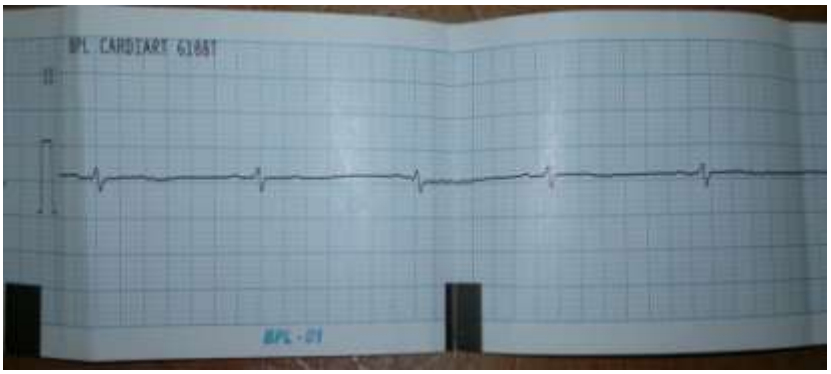


Figure 3: ECG showing Bradycardia

Figure 4: ECG showing anterior wall myocardial infarction in a patient

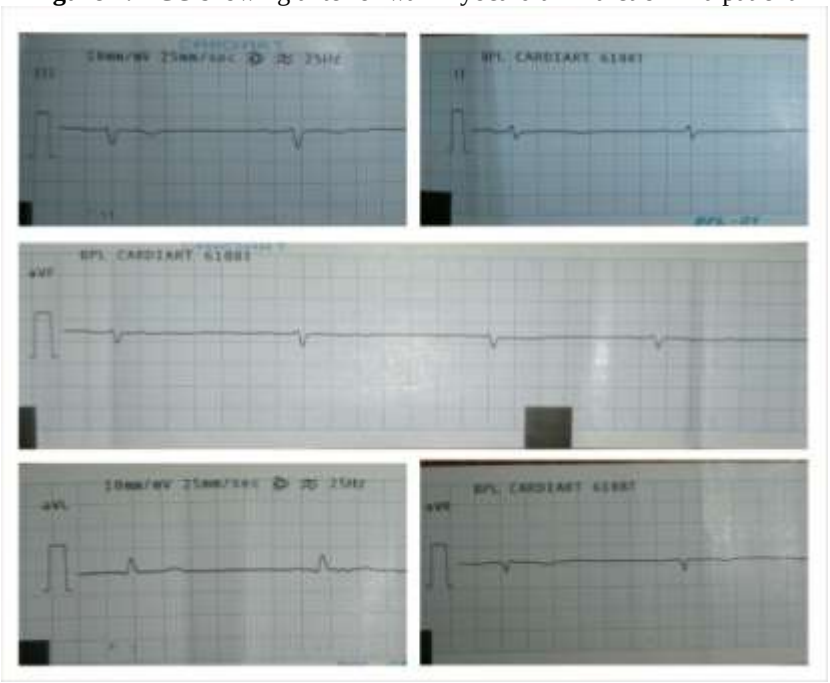
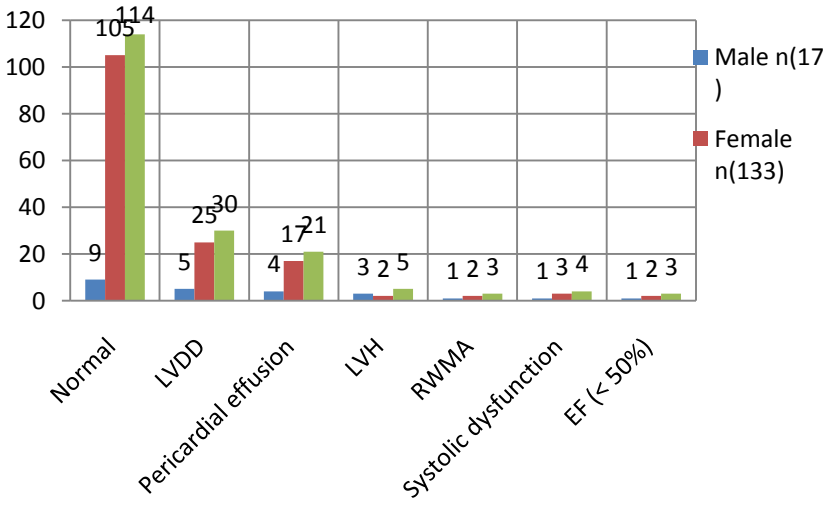


Figure 5: ECG showing low voltage complex in a patient

Echocardiographic changes:

Table 14: Echocardiographic changes in the study population

ECHO changes	Male		Female		Total	
	n(17)	%	n(133)	%	n(150)	%
Normal	9	52.94	105	78.94	114	76
LVDD	5	29.41	25	18.8	30	20
Pericardial effusion	4	23.53	17	12.79	21	14
LVH	3	17.65	2	1.5	5	3.34
RWMA	1	5.89	2	1.5	3	2
Systolic dysfunction	1	5.89	3	2.25	4	2.67
EF (< 50%)	1	5.89	2	1.5	3	2



Graph 11: Echocardiographic changes in the study population

Echocardiography was normal in 114 (76%) of cases and abnormal in 36 (24%) of cases; with most common finding being left ventricular diastolic dysfunction (LVDD) in 30 (20%), others are pericardial effusion in 21 (14%), left ventricular hypertrophy (LVH) in 5 (3.34%), regional wall motion abnormalities (RWMA) in 3 (2%) and systolic dysfunction in 4 (2.67%). EF<50% in 3 (2%).

Figure 6: ECHO showing pericardial effusion

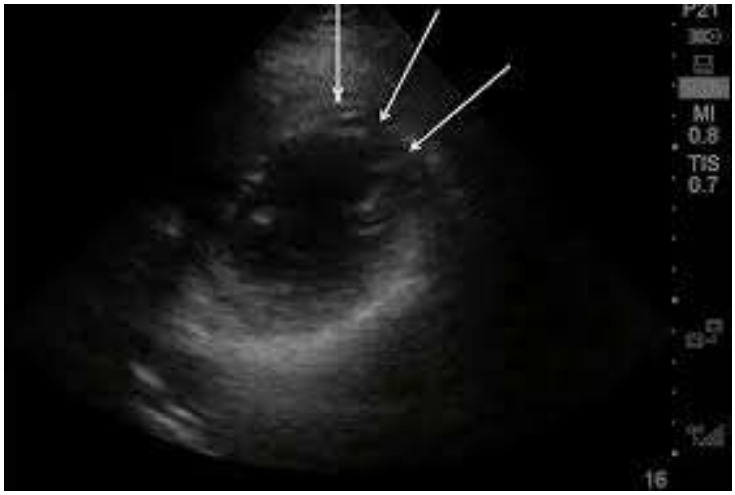


Figure 7: ECHO showing Regional wall motion abnormality

Figure 8: Chest Xray of a patient with hypothyroidism showing "money bag" appearance of cardia due to pericardial effusion

Lipid profile:

Table 15: Lipid profile changes in the study

Lipid Profile (mg/dl)		Male		Female		Total	
		n(17)	%	n(133)	%	n(150)	%
Serum Cholesterol	>200	9	53	43	32.23	52	34.67
LDL	>130	8	47.05	37	27.82	45	30
TGL	>200	6	35.3	7	5.27	13	10.67
HDL	<40	3	17.65	14	10.52	17	11.34

Dyslipidemia was seen in 52 (34.67%) cases. Most patients had multiple abnormalities. Commonest being hypercholesterolemia in 52 (4.67%); others were high levels of low density lipoprotein (LDL) in 45 (30%) and hypertriglyceridemia in 13 (10.67%).

Overall changes seen during study:

Table 16a: Abnormalities seen during study according to sex

Changes	Male		Female		Total	
	n(17)	%	n(133)	%	n(150)	%
ECG Changes	8	47.06	31	23.31	39	26
ECHO Changes	8	47.06	28	21.05	36	24
Dyslipidemia	10	58.82	42	31.58	52	34.67
Diastolic Hypertension	3	17.64	27	20.30	30	20
IHD	1	5.9	1	0.75	2	1.33
CCF	1	5.9	4	3.01	5	3.34
Anemia	2	11.8	33	24.81	35	23.33

In this study; electrocardiographic changes were seen in 39 (26%), echocardiographic changes in 36 (24%), dyslipidemia in 52 (34.67%), diastolic hypertension in 30 (20%), ischemic heart disease in 2 (1.33%), congestive cardiac failure in 5 (3.34%) and anemia in 35 (23.33%).

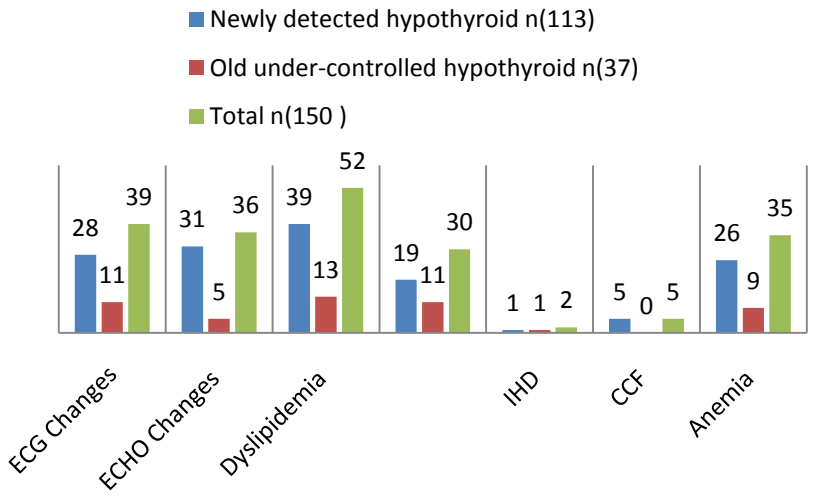
Table 16b: Abnormalities seen during study according to Serum TSH level

Serum TSH µIU/L	Sr TSH >10 µIU/L		Sr TSH 6-10 µIU/L		Total	
	n(97)	%	n(52)	%	n(150)	%
ECG Changes	30	30.92	9	17.30	39	26
ECHO Changes	29	29.9	7	13.46	36	24
Dyslipidemia	37	38.14	15	28.84	52	34.67
Diastolic Hypertension	19	19.6	11	21.15	30	20
IHD	2	2.06	0	0	2	1.33
CCF	4	4.12	1	1.92	5	3.34
Anemia	26	26.80	9	17.30	35	23.33

The abnormalities seen in the study in relation to serum TSH values >10 µIU/L (clinical hypothyroidism) were more than that for serum TSH 6-10 µIU/L (subclinical hypothyroidism) except diastolic hypertension which was 21.15% in subclinical hypothyroid patients compared to 19.6% in clinical hypothyroid patients.

Table 16c: Abnormalities seen in hypothyroid cases during study

Changes	Newly detected hypothyroid		Old under-controlled hypothyroid		Total	
	n(113)	%	n(37)	%	n(150)	%
ECG Changes	28	24.78	11	29.73	39	26
ECHO Changes	31	27.43	5	13.51	36	24
Dyslipidemia	39	34.51	13	35.13	52	34.67
Diastolic Hypertension	19	16.81	11	29.73	30	20
IHD	1	0.9	1	2.7	2	1.33
CCF	5	4.42	0	0	5	3.34
Anemia	26	23	9	24.32	35	23.33



Graph 12: Abnormalities seen in hypothyroid cases during study

As seen from the table the changes seen in the study were more in old under-controlled hypothyroid patients compared to the newly detected hypothyroid cases.

V. Discussion

The present study was conducted at Shri Siddhartha Medical College and Hospital, Tumkur. Total numbers of patients were 150. Study period being Sept 2012 to 31st Aug 2014 (24 months).

Age and sex distribution-

Patients were in the age group of 18-70 yrs. 54% were in age group of 21-40 yrs. Out of 150, 133 were females and 17 were males.

Table 17: Comparison of percentage of females

Present Study (n=150)	Minshed AJ et al[36] 2010 (n=36)	Shah SK et al[37] 2013 (n=30)
88.67%	86.1%	73.33%

There was a female preponderance seen in this study- 88.67% compared to other study 86.1% Minshed AJ etal[36] which was almost same.

Table -18: Comparative study of Symptomatology of hypothyroidism

Symptom	Present Study (n=150) %	Watanakunakorn 1965[38] %	Shah SK et al[37] 2013 (n=30) %
Aches and pains	42.67	15.25	-
Weight gain	40.67	47	76.66
Menorrhagia	32	-	59
Puffiness of face	27.33	67	-

Weight gain was 40.67% in present study and 47% in Watanakunakorn 1965[38].

Table -19: Comparative study of cardiovascular symptoms in hypothyroidism

Symptom	Present Study (n=150) %	Watanakunakorn 1965[38] %	Minshed AJ et al[36] 2010 (n=36) %
Effort intolerance	67.34	69.75	88.9
Chest pain	18.67	8.25	-
Breathlessness	16.67	12.5	75
Swelling of limbs	28	-	11.1

Effort intolerance the most common symptom was 67.34% in present study and 69.75% in Watanakunakorn 1965[38].

Table -20: Comparative study of signs in hypothyroidism

SIGN	Present Study (n=150) %	Shah SK et al[37] 2013 (n=30) %	Minshed AJ et al[36] 2010 (n=36) %
Bradycardia	4	40	47.2
Diastolic HTN	20	23.33	19.5
BMI > 25 Kg/m^2	54.67	76.67	-
Thyromegaly	45.34	10	-
Edema	11.34	20	11.1
Pallor	23.33	26.67	-

Diastolic hypertension was 20% in present study and 19.5% in Minshed AJ etal[36]. Edema was 11.34% in present study and 11.1% in Minshed AJ etal[36].

Table -21: Comparative study of ECG changes

Changes	Present Study (n=150) %	Shah SK et al[37] 2013 (n=30) %	Minshed AJ et al[36] 2010 (n=36) %
Bradycardia	4	40	47.2
Low voltage complex	3.34	33.3	33.3
T wave changes	24.67	-	27.8
ST segment changes	3.34	26.6	-

T wave changes were most common 24.67% in the present study compared to 27.8% in Minshed AJ etal[36].

Table -22: Comparative study of ECHO changes

Changes	Present Study (n=150) %	Shah SK et al[37] 2013 (n=30) %	Gupta M.M. et al[39] 2000 %
LVDD	20	26.67	-
Pericardial effusion	14	26.67	15
LVH	3.34	-	-
RWMA	2	-	-
Systolic dysfunction	2.67	6.67	-

Pericardial effusion was 14% in present study and 15% in Gupta MM etal[39].

Lipid profile

Dyslipidemia was found in 34.67%. Most common abnormalities were hypercholesterolemia in 34.67% and high LDL in 10.67%. Similar changes were in study done in NRI General Hospital, Guntur[12].

Incidence of ischemic heart disease was 1.33% in present study compared to 11.75% in Watanakunakorn 1965.[38]

VI. Summary

This study was conducted on 150 hypothyroid patients with an objective to study cardiovascular changes. Study period being Sept 2012 to 31st Aug 2014.

- Total of 113 cases were newly detected hypothyroid cases and 37 were old uncontrolled hypothyroid cases.
- Patients were in the age group of 18-70 yrs. 54% were in age group of 21-40 yrs.
- Out of 150, 133 (88.67%) were females and 17(11.33%) were males.
- 64.67% patient had clinical hypothyroidism and 35.33% had subclinical hypothyroidism in the study.
- The most common cardiac symptom was effort intolerance 67.33%, others were swelling of limbs 28%, chest pain 18.67%, breathlessness in 16.67% and palpitations in 15.33%.
- Other symptoms were aches and pains 42.67%, weight gain 40.67% and Menorrhagia 32%.
- Subclinical hypothyroid patients presented with very few symptoms.

- Diastolic blood pressure >90mmHg was found in 20% of patients. Bradycardia (<60 beats/min) was seen in only 4% cases.
- BMI >25 kg/m^2 in 54.67%, Thyromegaly was seen in 45.34% cases, pallor in 23.33%, dry skin in 14.67%, edema in 11.34% and delayed ankle jerk in 6.67%.
- Electrocardiography was abnormal in 26% cases. Most common finding being T wave changes in the form of flattening or inversion in 24.67%, then bradycardia in 4%, low voltage complex in 3.34% and ST segment changes in 3.34%.
- Echocardiography was abnormal in 24% of cases; with most common finding being left ventricular diastolic dysfunction (LVDD) in 20%, others are pericardial effusion in 14%, left ventricular hypertrophy (LVH) in 3.34%, regional wall motion abnormalities (RWMA) in 2% and systolic dysfunction in 2.67%. EF <50% in 2%.
- Dyslipidemia was seen in 34.67% cases. Most common being hypercholesterolemia in 34.67%; others were high levels of low density lipoprotein (LDL) in 30% and hypertriglyceridemia in 10.67%.
- In this study; Ischemic heart disease was found in 1.33%, congestive cardiac failure in 3.34% and anemia in 23.33%.
- Out of 37 known under-controlled hypothyroid cases; electrocardiographic changes were seen in 11 cases, echocardiographic changes in 5 cases, dyslipidemia in 13 cases, diastolic hypertension in 11 cases, ischemic heart disease in 1 case and anemia in 9 cases.

VII. Conclusion

- The hypothyroid patients present clinically with a myriad of symptoms and signs which are nonspecific. Hence a high index of suspicion is the key for the early diagnosis of hypothyroidism.
- Most of the symptoms like effort intolerance, lower limb swelling and breathlessness which hypothyroid patients presents with are similar to that of cardiac failure symptoms, hence the cardiac disease is masked and unrecognised.
- The cardiac risk factors seen in the study are in the form of diastolic hypertension, bradycardia, T wave changes in ECG, diastolic dysfunction and pericardial effusion in ECHO.
- Dyslipidemia seen in the study is also a risk factor for ischemic heart disease.
- After exclusion of the other risk factors for cardiac disease; various changes seen in hypothyroid cases in this study suggest that hypothyroidism is one of the independent risk factor for cardiac disease.
- As the symptoms related to hypothyroidism and cardiac disease overlap, high index of suspicion should be considered for underlying cardiac disease; and these patients should undergo complete cardiac evaluation on diagnosis of hypothyroidism; so as to prevent the catastrophic cardiac outcomes.
- Early diagnosis and correction of hypothyroidism is necessary; so that adverse effects on cardiac system can be minimized.
- Studies have shown that with treatment of hypothyroidism the cardiovascular risk factors improve.

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