

TYPE 2 DIABETES MELLITUS & LOW T3 SYNDROME, SYSTOLIC BLOOD PRESSURE, DIASTOLIC, BLOOD PRESSURE AND PR INTERVAL

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ABSTRACT: BACKGROUND: Thyroid abnormalities are common in Type 2 diabetes mellitus, severity of thyroid abnormalities accelerate coronary heart disease by several fold in patients with thyroid dysfunction. **OBJECTIVES:** The purpose of this prospective study is to determine the correlation between low T3 syndrome and Type 2 diabetes mellitus. **METHODS:** In this descriptive, prospective cross sectional study, all patients who presented to the Department of Medicine with Type 2 diabetes mellitus >5 years during this study period were included. Included clinical evidence of sepsis or cachexia or Concomitant presence of any predominant severe systemic disease including severe anaemia Hb% <5g%. Other major surgical procedures performed before or within 6 months after the time of thyroid sampling. **RESULTS:** Mean age of Type 2 diabetes mellitus patients was [60.50±6.15(SD) years], Fatigue and generalized weakness, dyspnoea on exertion, swelling of feet, cold intolerance, hair loss, hoarse voice and decrease libido were common symptoms of low T3 patients, Alcoholism was seen in (80%), Cardiomyopathy was seen in most patients (42%) and was common in the age group of 55-60 years (38%) in present study, Mean pulse rate was [104±6.9 (SD) beats/min]. Systolic blood pressure was [131±20.8 (SD) mm of Hg], diastolic blood pressure was [84.6±12.4 (SD) mm of Hg]. Mean blood urea level was [74.2±18.9 (SD) mg/dl], mean serum creatinine levels was [2.3±0.5 (SD) mg/dl], the estimated creatinine clearance was [25.8±8.5 (SD) ml/min]. Mean serum LDL was [104.4±3.7 (SD) mg/dl], Mean PR interval is was [0.21±0.023 (SD) sec, Systolic dysfunction on 2D Echo was (20%), Diastolic dysfunction on 2D Echo was (30%), Pericardial effusion was seen in 10%. Global hypokinesia was seen in 30%. Segmental hypokinesia was seen in 3%. Mean ejection fraction was [36.78±5.08 (SD) %]. The high pulmonary artery systolic pressure was seen 70% of patients. **CONCLUSION:** There is significant percentage of Type 2 diabetes mellitus patients having low T3 alone as biochemical parameter. It is important to recognize this condition in patients with Type 2 diabetes mellitus as it is associated with increased severity of heart failure, increased in evidence of renal failure which may need additional support of thyroid hormone administration to have a better outcome in patients with chronic heart failure. **KEYWORDS:** Type 2 diabetes mellitus, low T3 syndrome, systolic blood pressure, diastolic blood pressure and PR interval.

INTRODUCTION: A typical pattern of altered thyroid hormone metabolism characterized by low T3 circulating levels has been described in patients with acute conditions. A new study in rats is giving researchers hope that more aggressive treatment of hypothyroidism and borderline

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hypothyroidism will result in a reduction of worsening and progression of type 2 diabetes mellitus.¹

While further research is needed, results from a recent study entitled, "Low thyroid function leads to cardiac atrophy with chamber dilation, impaired myocardial blood flow, loss of arterioles, and severe systolic dysfunction," suggest that low thyroid function has the potential to cause heart failure.²

OBJECTIVES OF THE STUDY:

- To determine the patients of Type 2 diabetes mellitus by clinical and investigational methods.
- To screen patients by subjecting them to thyroid profile.
- To find an association between Low T3 syndrome and Type 2 diabetes mellitus.
- To determine the severity of Type 2 diabetes mellitus in low T3 syndrome patients.

METHODOLOGY:

Study Design: Prospective, cross sectional study.

Sample Size: 50 cases over a span of 6 months from April 2012- April 2013.

Method of Collection of Data: The data for the purpose of the study was collected in a predesigned and pretested proforma which include various socioeconomic parameters like age, sex, occupation, religion, etc. About 50 cases were selected on the basis of the simple random sampling method.

The statistically data was analyzed ANOVA, factor analysis and Chi-square test.

Inclusion Criteria: Patients with Type 2 diabetes mellitus with low T3.

Exclusion Criteria:

1. Included clinical evidence of sepsis or cachexia.
2. Patients with known thyroid abnormalities hyper or hypothyroidism who were diagnosed before the study were eliminated.
3. Concomitant presence of any predominant severe systemic disease including severe anemia Hb% < 5g%.
4. Other major surgical procedures performed before or within 6 months after the time of thyroid sampling.

Routine investigations to assess thyroid function, clinically and investigational diagnose Type 2 diabetes mellitus.

Investigations are as Follows: The thyroid function profile: After rapid centrifugation of a venous sample:

1. Total T3 (TT3),
2. fT3, Total T4 (TT4),
3. fT4 and TSH will be measured.

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Questionnaires, physical, radiographic examination & echocardiography All these methods, however, have major limitations when used independently.

RESULTS: In this study titled "Type 2 diabetes mellitus & Low T3 syndrome-A prospective study." A cross sectional study comprising of 50 dilated Type 2 diabetes mellitus & Low T3 syndrome-A prospective study.

Table 1: Shows that majority of Type 2 diabetes mellitus & Low T3 syndrome patients are in the age group of 55-60 yrs (32%) followed by 60-65 yrs (22%) & 50-55 yrs (18%) in the present study. Majority of patients (90%) with low T3 dilated cardiomyopathy are within the age group 55-70 yrs.

The male: female ratio of patients in the present study was 3.56:2. This shows that male domination is seen in patients Type 2 diabetes mellitus & Low T3 syndrome.

Table 2: Shows pallor and edema were present in all patients with Type 2 diabetes mellitus. Skin changes were seen in 60% of low Type 2 diabetes mellitus ($p < 0.63$).

Mean pulse rate of patients with Type 2 diabetes mellitus low T3 was 95.8 ± 6.5 (SD) beats/minute in the present study. ($P < 0.000$). Diastolic blood pressure in was Type 2 diabetes mellitus [84.6 ± 12.4 (SD) mm of Hg], which was statistically not significant ($p < 0.093$). S3 was present in 60% of patients with Type 2 diabetes mellitus low T3.

Mean FBS was [180 ± 22.4 (SD) mg/dl], PPBS was [364 ± 42.4 (SD) mg/dl], mean HbA1c was [8.6 ± 2.4 (SD) %].

All patients with Type 2 diabetes mellitus low T3 had microcytic hypochromic anaemia. The estimated creatinine clearance in Type 2 diabetes mellitus low T3 is 25.8 ± 8.5 (SD) ml/min. Renal dysfunction was common in Type 2 diabetes mellitus low T3, with high mean blood urea [74.2 ± 18.9 (SD) mg/dl] high mean serum creatinine [2.5 ± 0.3 (SD) mg/dl], higher mean serum potassium [3.9 ± 0.2 (SD) mEq/l] and lower estimated creatinine clearance [25.8 ± 8.5 (SD) ml/min] as estimated by MDRD formula.

Mean PR Interval is prolonged in Type 2 diabetes mellitus low T3 [0.21 ± 0.023 (SD) sec]. 31.03% patients had Systolic dysfunction, 30% had diastolic dysfunction, 10% had pericardial effusion was seen in present study, 48.28% had Global hypokinesia 51.72 % had segmental hypokinesia, 70 % had high pulmonary artery systolic pressure in present study. Patients with Type 2 diabetes mellitus low T3 had a low mean EF of [34.8 ± 3.293 (SD) %]

DISCUSSION: It has been postulated that the low T3 state may produce a hypothyroid-like syndrome that contributes to the worsening or exacerbation of the intrinsic cardiac disease and worsening of Type 2 diabetes mellitus and its complications.³⁻⁶

Low thyroid hormone concentrations, in particular low serum T3 concentrations, are a common finding in patients with non-thyroidal illnesses, including cardiac disorders.⁷ Its pathophysiological role is not well understood, although the common belief is in favor of an adaptive mechanism to preserve energy.⁸⁻¹⁰ Nonetheless, based on the knowledge of the fundamental actions of T3 on both the heart and vessels, a direct relationship between low

circulating levels of T3 and adverse prognosis of cardiac patients has represented an attractive hypothesis in the last few years.¹¹⁻¹³

The low T3 circulatory levels were found in all of patients with Type 2 diabetes mellitus low T3 in the present study. Table.1 shows mean age for Type 2 diabetes mellitus low T3 patients was 60.50 ± 6.15 (SD) years, which shows that Type 2 diabetes mellitus low T3 occurs in more elderly patients with type 2 diabetes. Which was comparable to Joaono Paulo Solano, George Marzouka.¹⁴

Type 2 diabetes mellitus low T3 had more male predominance when compared the other studies, which was compared to George A C Marzouka. Table.4 shows The male: female ratio of patients in the present study was 3.56:2. Cardiomyopathy was most common etiology for dilated cardiomyopathy (42%) and was comparable to ACC 2011.¹⁵

Table 2 shows Skin changes on general examination were seen in 60% of patients with Type 2 diabetes mellitus low T3. The mean pulse rate was 95.8 ± 6.5 (SD) beat/minute which was comparable to Veronique L.Roger.¹⁶

Table 3 shows pulse rate was $[104 \pm 6.9$ (SD) beats/min]. Mean systolic blood pressure in present study was $[131 \pm 20.8$ (SD) mm of Hg], which was comparable to ACC 2011. Mean diastolic BP in present study was $[84.6 \pm 12.4$ (SD) mm of Hg, which was comparable to ACC 2011. This shows that higher blood pressure both systolic and diastolic was common in patients with Type 2 diabetes mellitus low T3 patients.¹⁷

Table 5 shows mean FBS was $[180 \pm 22.4$ (SD) mg/dl], PPBS was $[364 \pm 42.4$ (SD) mg/dl], mean HbA1c was $[8.6 \pm 2.4$ (SD) %] which was comparable to Raman.et.al.¹⁶⁻¹⁸ This showed that control of type 2 diabetes mellitus was more in present study.

Table 6 shows Third heart sound was present in (60%) of patients. This showed that Type 2 diabetes mellitus low T3 patients had severe degree of heart failure, which was comparable to Veronique 2011.¹⁸

Mean PR interval was $[0.21 \pm 0.023$ (SD) sec] which was comparable to Veronique L.Roger and H M Shankar.¹⁹

The systolic dysfunction & diastolic dysfunction on 2D Echo was severe in present study. Pericardial effusion was seen in (30%).

The mean ejection fraction of patients with Type 2 diabetes mellitus low T3 patients in the present study was $[36.78 \pm 5.08$ (SD) %] which was comparable to Deborah and Joa Paulo Solano, George Marzouka.

Mean ejection fraction was lower in patient with Type 2 diabetes mellitus low T3 patients $[34.8 \pm 3.293$ (SD)%]. This showed that the severity of heart failure was higher in patients with Type 2 diabetes mellitus low T3 patients.

The high pulmonary artery systolic pressure was seen in (70%) of patients with Type 2 diabetes mellitus low T3 patients, this shows increase in severity of right heart failure in patients with Type 2 diabetes mellitus low T3 patients in the present study.²⁰

LIST OF ABBREVIATIONS:

2D	-	Echo - 2 Dimensional Echocardiography.
ECG	-	Electrocardiogram.
EF	-	Ejection Fraction.
FBS	-	Fasting Blood Sugar.
PPBS	-	Post Prandial Blood Sugar.
HbA1C	-	Glycosylated hemoglobin.
fT3	-	Free Triiodothyronine.
fT4	-	Free Tetraiodothyronine.
Hb	-	Hemoglobin.
HDL	-	High Density Lipoprotein.
IHD	-	Ischemic Heart Disease.
JVP	-	Jugular Venous Pressure.
BP	-	Blood pressure.
SD	-	Standard Deviation.
TT3	-	Total Triiodothyronine
TT4	-	Total Tetraiodothyronine.
TSH	-	Thyroid Stimulating Hormone.

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Age groups (yrs)	No. Patients (%)	Type 2 diabetes mellitus low T3	
		Male	Female
45-50	7(14%)	7	0
50-55	9(18%)	8	1
55-60	16(32%)	9	7
60-65	11(22%)	4	7
65-70	7(14%)	4	3
Total	50	32	18

Table 1: Table showing age and sex distribution according to groups in present study

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GPE	Type 2 diabetes mellitus & Low T3 syndrome	P-value
	No. (%)	
FBS	50 (100%)	--
PPBS	9 (6.9%)	<0.63
HbA1C	50 (100%)	--

Table 2: Table showing Signs on General physical examination in present study

(p < 0.63)

	Véronique L. Roger 2010	ACC 2011	Present study
Pulse rate in min	88± 10	76±15/min	95± 6.5/min

Table 3: Table shows comparative of pulse rate

Deborah D.ascheim 2002	George marzouka 2004	ACC 2011	Present study
6:2	4:2	4:2	3.56:2

Table 4: Table shows comparative of sex ratio

Blood sugar	Present study	Raman.et.al
	No. (%)	No. (%)
FBS	180 ± 22.4	178 ± 18.4
PPBS	364 ± 42.4	320 ± 46.4
HbA1C	8.6 ± 2.4	7.8 ± 1.6

Table 5: Table shows comparative of blood sugar

S3	ACC 2011	Present study
	26%	30%

Table 6: Table shows comparative study of S3 on clinical examination

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