



## Original Article

## Changes in Liver Function and Lipid Profile during Underactive Thyroid Phase in Patients after Subtotal Thyroidectomy

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## ABSTRACT

Underactive Thyroid Phase or Hypothyroidism is a very common biochemical complication after sub-total thyroidectomy. **Objectives:** To investigate lipid profile and liver function in patients who developed hypothyroidism following sub-total thyroidectomy. **Methods:** Total 100 individuals were selected for present study and divided them into two different groups i.e. Group-A in which 37 healthy individuals were placed whereas in Group-B 63 individuals were adopted surgical process, sub-total thyroidectomy. The study was conducted in Surgical and Medical Units of Ghurki Trust & Teaching Hospital, Lahore from December 2023 to April 2024. Thyroid-stimulating hormone (TSH) levels were extremely high in individuals in the hypothyroid stage. **Results:** The comparative findings of this study showed a significant ( $p < 0.05$ ) change in cholesterol, triglyceride, LDL and HDL blood serum levels of Group-B individuals as compared to the Group-A. While a significant ( $p < 0.05$ ) amplification in enzymes of liver such as aspartate aminotransferase (AST), alanine transaminase (ALT), and decrease in alkaline phosphatase (ALP) in Group-B subjects were seen as compared to normal individuals. **Conclusions:** Sub-total thyroidectomy is associated with hypothyroidism, which correlates with disruptions in liver enzyme activity and lipid metabolism, potentially leading to secondary hyperlipidemia and liver dysfunction.

## INTRODUCTION

The mode of action of thyroid hormone is to control the number of biochemical and physiological functions in biological system such as lipid metabolism, growth and liver functions. Hypothyroidism is the prevailing chronic outcome after complete thyroidectomy [1]. Thyroid hormone is crucial for the proper growth of various human tissues and controls the metabolic processes of almost all cells and organs in the human body throughout one's lifetime [2]. Hypothyroidism, a prevalent illness characterized by a shortage of thyroid hormones, is a frequently occurring ailment among the general

population. Primary hypothyroidism is a prevalent condition globally, mostly caused by iodine deficiency and Hashimoto thyroiditis [3]. The liver is involved in the conjugation, excretion, peripheral deiodination, and metabolism of thyroid hormones, which plays a significant role in the production of globulin that binds thyroxine. Previous investigations have demonstrated some anomalies in circulating hormone concentrations, despite the fact that nearly all patients with liver disease are clinically thyroid [4]. The thyroid gland and liver have a complicated interaction in both health and illness. Through

the selenium deiodinase enzyme system, the liver contributes to the activation and inactivation of thyroid hormones. It also produces transport proteins such as albumin, transthyretin, and thyroxine-binding globulin, which helps to increase the absorption of thyroid hormones [5]. Different researchers described after the findings of their studies that blood serum cholesterol, triglycerides, low density lipoproteins and high-density lipoproteins levels have correlation with thyroidectomy. During biosynthesis of cholesterol the step 3-hydroxy-3-methylglutaryl coenzyme A (HMG-CoA) reductase activity in the liver stimulated by Thyroid hormone [6]. Although blood total cholesterol and low-density lipoprotein cholesterol (LDL-C) concentrations drop due to improved LDL-C metabolism, cholesterol production rises in hyperthyroidism. Atherosclerosis resembles a plaque that has accumulated calcium, fat, cholesterol, and other compounds. As a result, while cholesterol production is elevated in hyperthyroidism, increased LDL metabolism causes a decrease in blood total cholesterol and LDL-C levels [7, 8]. This study is very important as it uniquely contributes to the existing scientific literature by being one of the first to systematically analyze the biochemical changes in the liver function and lipid metabolism in patients with hypothyroidism following subtotal thyroidectomy [9,10]. Whereas Previous studies have focused on general thyroid dysfunction, but this research uncovers specific outcomes of a commonly performed surgical procedure, hence providing valuable insights into the management and long-term care of these patients.

The present study aimed to uncover Biochemical and Physiological changes those leads to deficiency of thyroid hormones secretion, current research provided health awareness about low quantity secretion of thyroid hormones. Therefore, sub-total thyroidectomy, a common surgical procedure for managing thyroid disorders, often leads to hypothyroidism, affecting liver function and lipid metabolism. This study investigates these biochemical and physiological changes.

## METHODS

The present comparative cross-sectional study was conducted in Surgical and Medical Units of Ghurki Trust & Teaching Hospital, Lahore from December 2023 to April 2024. Ethical Approval Certificate (ERC) (Ref no. ERC/2023/28B) was taken from Ethical Review Board of Lahore University of Biological & Applied Sciences (Lahore-UBAS) a project of Lahore Medical & Dental College Lahore, Pakistan. All patients provided informed consent form prior to their participation in the study, open EPI software was used for sample size calculation. Regarding inclusive criteria all participants were in between 18-60 years and only those patients were selected who adopted the procedure of sub-total thyroidectomy. To

examine acute or subacute phase changes, patient inclusion criteria was restricted to individuals who underwent surgery within a specified timeframe prior to the study, such as within the last six months. Those who have a medical history of thyroid disorders other than Hashimoto's thyroiditis, Graves' disease, or thyroid malignancy are excluded from the study. Due to the potential hazards associated with study procedures and the variable effects of pregnancy on thyroid function, pregnant women are frequently excluded. The study used a purposive sampling technique for the selection of participants. The study was conducted from December 2023 to April 2024. During this period, all patients who underwent sub-total thyroidectomy and met the inclusion and exclusion criteria were enrolled in the study. Group-A in which 37 healthy individuals were placed whereas in Group-B 63 individuals were adopted surgical process, sub-total thyroidectomy. Auto-analyzer was used for the biochemical tests of blood serum cholesterol, triglycerides, LDL, HDL and liver enzymes such as ALT, AST and ALP levels measurements. While independent t-test was applied to compare biochemical biomarkers between the groups. Raw data were analyzed by SPSS version 27.0. For continuous variables, the mean and standard deviation were calculated. While continuous variables such as age, BMI, triglycerides, cholesterol, LDL, HDL, ALT, AST, and ALP blood serum levels were compared between Group A and Group B by applying independent t-tests. To compare categorical variables, including gender, age and BMI between the two groups, chi-square tests were applied whereas ( $p \leq 0.05$ ) value considered as statistical significance.

## RESULTS

A significant ( $P < 0.05$ ) changes in cholesterol, triglycerides, Low density lipoprotein, high density lipoprotein blood serum levels in Group-B individuals were seen as compared with individuals of Group-A. While a significant ( $P < 0.05$ ) increase of blood serum alanine transaminase, aspartate aminotransferase and decrease in alkaline phosphatase levels were concluded in Group-B as compared with Group-A participants. Mean standard Deviation and chi-square tests were applied and P- Value as ( $p \leq 0.05$ ) was considered for the considering Criteria of significance (Table 1).

**Table 1:** Characteristics of Group-A and Group-B Individuals

Parameter	Group-A (n=37)	Group-B (n=63)	Statistical Test	P-value
Age (Years, Mean $\pm$ SD)	52.04 $\pm$ 4.02	53.01 $\pm$ 4.01	Independent t-test	0.01
Gender	-	-	Chi-square test	0.01
Male (n, %)	19 (51.4%)	35 (55.6%)	-	0.01
Female (n, %)	18 (48.6%)	28 (44.4%)	-	0.02
BMI (kg/m <sup>2</sup> , Mean $\pm$ SD)	19.11 $\pm$ 1.01	30.05 $\pm$ 1.01	Independent t-test	0.01

(Continuous Variables (Age, BMI) Independent t-test was applied and Mean and Standard deviation was used between group A and B, Categorical variable (Gender) chi-square test was applied,  $p \leq 0.05$ )

Blood serum cholesterol, Low density lipoprotein, triglycerides, high density lipoprotein, aspartate aminotransferase, alanine transaminase, aspartate aminotransferase and alkaline phosphatase levels of Group-B ( $298.10 \pm 23.1$ ,  $219.01 \pm 21.3$ ,  $167.4 \pm 7.2$ ,  $37.04 \pm 1.03$ ,  $25.10 \pm 3.01$ ,  $35.12 \pm 1.04$ ,  $105.10 \pm 2.04$ ) showed a significant ( $P \leq 0.05$ ) change than Group-A. Further comparative description of Group-A and Group-B were elaborated by applying independent t-test for response of two groups and test findings were significant ( $P \leq 0.05$ ). Blood serum cholesterol, triglycerides, Low density lipoprotein, high density lipoprotein of Group-B presented a significant ( $P \leq 0.05$ ) increase and alkaline phosphatase levels indicated significant ( $P \leq 0.05$ ) decreased as compared than Group-A respectively. P-value, independent t-test with mean standard deviation were applied for the Comparative description of data separately (Table 2)

**Table 2.** Differences in lipid profile and liver enzymes of Group-A and Group-B Individual

Parameter	Units	Group-A (n=37)	Group-B (n=63)	T-Test	P-value ( $P \leq 0.05$ )
Serum Cholesterol levels	mg/dl	$220.2 \pm 12.2$	$298.10 \pm 23.1$	0.05	0.01
Serum triglycerides levels	mg/dl	$149.02 \pm 15.5$	$219.01 \pm 21.3$	0.04	0.02
Serum LDL	mg/dl	$139.2 \pm 8.6$	$167.4 \pm 7.2$	0.014	0.01
Serum HDL	mg/dl	$43.19 \pm 1.06$	$37.04 \pm 1.03$	0.03	0.02
Serum ALT	IU/L	$16.12 \pm 2.04$	$25.10 \pm 3.01$	0.017	0.05
Serum AST	IU/L	$22.11 \pm 1.01$	$35.12 \pm 1.04$	0.013	0.03
Serum ALP	U/L	$132.01 \pm 2.03$	$105.10 \pm 2.04$	0.021	0.04

## DISCUSSION

Ming J *et al.*, in their study claimed that Sub-Total thyroidectomy is a major type of thyroidectomy before complete thyroidectomy, which can lead to significant morbidity and increased costs. Previous research has connected secondary dyslipidemia to thyroid problems, and acute hypothyroidism following thyroid surgery might negatively impact lipid profile and endothelial function [11, 12]. An analysis of sixteen observational studies revealed that clients with subclinical hypothyroidism had significantly higher levels of total cholesterol, Low density lipoprotein, and triglycerides compared to those with euthyroidism. This suggests a link between hypothyroidism and higher lipid profile. Even in those with clinically normal thyroid function, little variations in TSH levels can elevate fat findings and raise the risk of hypercholesterolemia [13]. The only traditional serum lipid confounding factors taken into account in these studies were BMI, gender, and age. Hypothyroid individuals have significantly higher blood lipid levels compared to healthy controls. Subclinical hypothyroidism can lead to higher TC and LDL-C levels, as well as higher TG and lower HDL-C levels, according to certain research [14]. In line with earlier research, TSH levels and total and low-density lipoprotein cholesterol levels were shown to be strongly

positively correlated in the current investigation. The data of different studies indicate that even within the normal range, blood thyroid hormone levels significantly impact serum lipid levels [15]. Thyroid hormones may significantly impact the connection between lipid indicators and TSH. It's important to evaluate the influence of TSH on lipid profiles, independent of thyroid hormone level. Without taking these parameters into account, the correlation between TSH and lipid profile is questionable [16, 17]. Increased levels of ALT or AST activity in the serum were more common in patients with  $TSH \leq 0.2$  IU/l. These results were mostly unchanged when age, gender, fasting hyperglycemia, and lipid characteristics were taken into account. TSH influences TC levels by means of thyroid hormones, both directly and indirectly [18, 19]. The finding of present research have similarities with the findings of previous studies by different researchers [20]. Research found considerably lower blood alkaline phosphatase levels ( $P < 0.001$ ) in hypothyroid individuals compared to controls. The current study found a decrease in serum ALP levels in hypothyroid patients, which is consistent with previous findings by other researchers [21].

## CONCLUSIONS

The results of the current study suggest that sub-total thyroidectomy is associated with the development of hypothyroidism in most patients of Group B, which in turn correlates with altered liver enzyme activity and lipid metabolism. Patients who underwent sub-total thyroidectomy exhibited higher serum cholesterol, triglycerides, LDL, liver enzymes (ALT and AST), and lower HDL and ALP levels. These biochemical alterations suggest a potential link between sub-total thyroidectomy and secondary hyperlipidemia and possible hepatotoxicity in hypothyroid patients.

## Authors Contribution

Conceptualization: MNS, AI

Methodology: ZH, SUSZ,

Formal analysis: MU, MSA

Writing, review and editing: ABW, MSA, MU

All authors have read and agreed to the published version of the manuscript.

## Conflicts of Interest

The authors declare no conflict of interest.

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