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Original Research Paper

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EVALUATION OF HEPATIC PARAMETERS OF HYPOTHYROID PATIENTS: A STUDY FROM RURAL TERTIARY CARE CENTRE OF CENTRAL INDIA

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ABSTRACT Thyroid hormones play a crucial role in regulating various metabolic processes within the liver. Changes in thyroid hormone levels, as seen in hypothyroidism, can significantly impact liver function. Therefore, assessing liver function provides insights into the broader metabolic effects of thyroid dysfunction. Correlating thyroid hormone levels with liver function parameters allows researchers to determine the relationship between thyroid dysfunction and hepatic changes. The liver produces albumin, a protein that indicates how well the liver is functioning. Thyroid hormones influence both the creation and breakdown of albumin. Albumin also carries thyroid hormones in the blood. Low thyroid hormone levels can reduce albumin production. Therefore, albumin levels are a useful measure of liver health.

KEYWORDS : Thyroid Hormones, Metabolic Processes, Liver Function, Hypothyroidism, Thyroid dysfunction, Hepatic changes.

INTRODUCTION

As an endocrine gland, the thyroid releases hormones like thyroxine,triiodothyronine, and calcitonin into the bloodstream. the thyroid gland is essential for many bodily functions, including metabolism, growth, and development, thanks to the release of T3 and T4 hormones into the bloodstream. Our bodies rely heavily on the thyroid gland for metabolism, growth, and development, which it achieves by releasing T3 and T4 hormones into the blood.[1] .The production of T3 and T4 is governed by the pituitary-thyroid axis. The hypothalamus releases TRH, which acts on the pituitary gland, causing it to secrete TSH. TSH then stimulates the thyroid gland to release T3 and T4.2 T4 (thyroxine) and T3 (triiodothyronine), the thyroid's primary metabolic hormones, are produced through a series of steps involving iodine. First, the thyroid absorbs iodine, which is then used to create MIT and DIT. These molecules then combine: one MIT with two DITs forms T3, and two DITs form T4.3 Medical professionals are concerned with any abnormalities in the thyroid gland. Symptoms arise when thyroid hormone levels are too high (hyperthyroidism) or too low (hypothyroidism). Additionally, a lack of iodine can cause the thyroid gland to enlarge, a condition known as goitre. A lack of sufficient thyroid hormone in the blood plasma results in hypothyroidism. This condition presents in two forms: subclinical and overt. Subclinical Hypothyroidism. Subclinical hypothyroidism is a milder form of hypothyroidism where the thyroid gland is starting to underperform, but not to the extent that it significantly lowers the levels of the primary thyroid hormones, T3 and T4. Hormone Levels: o TSH (Thyroid-Stimulating Hormone): Elevated.

The pituitary gland is trying to stimulate the thyroid to produce more T3 and T4, so it increases TSH output. o T3 (Triiodothyronine) and T4 (Thyroxine): Within the normal reference range. This indicates the thyroid is still producing enough hormones to maintain normal levels, despite the increased TSH. Symptoms: Many individuals with subclinical hypothyroidism experience no noticeable symptoms. Others might have subtle symptoms, such as mild fatigue, slight weight gain, or minor changes in mood. Because symptoms may be mild, this condition may go undiagnosed. Clinical Significance: Even though T3 and T4 levels are normal, elevated TSH can still have negative health implications over time, including increased risk of cardiovascular disease, especially in women. Management: Treatment decisions are based on the degree of TSH elevation, the presence of symptoms, and other risk factors.

Overt Hypothyroidism: Overt hypothyroidism is a more pronounced form of hypothyroidism where the thyroid gland is significantly underactive, resulting in a clear deficiency of T3 and T4. Hormone Levels: o TSH (Thyroid-Stimulating Hormone): Significantly elevated. The pituitary gland is working hard to stimulate the failing thyroid. o T3 (Triiodothyronine) and T4 (Thyroxine): Below the normal reference range. The thyroid is unable to produce sufficient hormones to maintain normal levels. Symptoms: Individuals with overt hypothyroidism typically experience a range of symptoms, including: o Fatigue o Weight gain o Constipation o Dry skin and hair o Cold intolerance o Depression o Muscle weakness Clinical Significance: Overt hypothyroidism can have significant impacts on overall health and quality of life if left untreated. Management: Treatment typically involves thyroid hormone replacement therapy with levothyroxine, a synthetic form of T4. Regular monitoring of TSH and T4 levels is a vital part of managing hypothyroidism effectively and ensuring optimal health.[5] By controlling catabolic and anabolic reactions within carbohydrate, lipid, and protein metabolism pathways, thyroid hormones are the key regulators of basal metabolism. [6] Through the regulation of hepatocytes, liver function, growth, development, and the control of hepatic metabolism and action, thyroid hormones significantly affect the liver.[7] While thyroid hormones affect nearly all tissues, the heart is particularly sensitive. Studies consistently show that changes in thyroid hormone levels significantly impact cardiac function. Thyroid hormones regulate cardiac output and heart rate, with T3 having a direct effect on the heart. Imbalances in thyroid hormones can lead to various cardiac issues, including changes in systolic and diastolic pressure, hypertension, and arterial stiffness.8

MATERIAL AND METHODS

Patients aged 20-60 years Diagnosed with either hypothyroidism or hyperthyroidism. Study Location: Patients attending Outpatient Department (OPD) and Inpatient

Department (IPD) of Index Medical College Hospital & Research Centre, Madhya Pradesh, India. Study design – A cross-sectional study. Study Period: This study was conducted after the approval from College Research Committee (CRC) and Institutional Ethical Committee (IEC). Study Participants: 150 individuals included in the research. Selection of patients: Patients attending medicine OPD & IPD.

Inclusion Criteria

The study included patients, all between the ages of 21 and 59, who had been diagnosed with hypothyroidism (TSH > 4.5 μIU/ml). These individuals were recruited from the outpatient and inpatient medicine services at IMCH & RC and had agreed to participate.[60,61]

Exclusion Criteria

patients with any of following systemic disorders were excluded from the study, pregnancy or lactation, renal disorders, bone disorders, diabetes, cardiac disorder, liver disorder.

Sample Selection

5 ml of venous blood was drawn from the patients with overnight fasting from an antecubital vein (under aseptic conditions) and was stored in a plain vial. Sample collected was further centrifuged at 3000RPM for 5 minutes and the serum separated was used for the analyte estimation. The levels of serum ALT, AST, ALP, ALBUMIN, BILURUBIN and PROTEIN in the thyroid profile parameters (TSH, T3, T4) was measured in the sample.

RESULTS

Thyroid hormones play a crucial role in overall bodily function, including liver health, by regulating growth, development, and metabolic processes. Deficiencies in these hormones can disrupt liver cell function. This study aimed to assess liver function in hypothyroid patients by measuring levels of albumin, bilirubin, total protein, AST, ALT, and ALP. Data was collected and analysed using Microsoft Excel and SPSS, employing comparison and correlation tests to evaluate the relationship between thyroid profiles and liver parameters. The study included hypothyroid patients aged 19 to 60, a range selected to capture individuals from physiological maturity to those potentially experiencing age-related metabolic changes.[59] Results show that the maximum patients of hypothyroidism are females in every age group. Women are very commonly diagnosed with hypothyroidism due to genetic, hormonal & autoimmune factors. The data presented reveals that hypothyroidism predominantly affects females, regardless of age. This is attributed to genetic, hormonal, and autoimmune influences, with Hashimoto's disease playing a significant role. This autoimmune disorder, more prevalent in females due to their stronger immune systems, targets the thyroid gland. Consequently, women with hypothyroidism may experience menstrual cycle disruptions and pregnancy-related issues. Pandey R eta: l in 2013 also concluded in their studies that out of 110 hypothyroid patients there were 72 females (65.45%) & 38 are males (34.54%) it shows that the females are more prone to hypothyroidism. [72] the data in reveal that the 46-60 age bracket experiences the highest rates of hypothyroidism. This vulnerability is attributed to factors such as hormonal changes, lifestyle, genetics, and environmental influences. Notably, the reduced efficacy of immune system regulation at this age increases the risk of autoimmune disorders, with Hashimoto's disease being the most common cause of hypothyroidism. Our study's findings are consistent with existing research. In a study of 110 hypothyroid patients, Binaya Tamang reported a median age of 45. 55 The age distribution by gender is shown in Table 3, which also indicates that women are more likely than men to develop hypothyroidism at all age ranges due to a number of biological, genetic, and hormonal factors. For example, the primary cause of hypothyroidism, Hashimoto's thyroiditis, occurs when the thyroid gland are attacked by the immune system, and it is more common in women. Throughout their lives, women experience hormonal changes such as menstruation, pregnancy, menopause, and more. The thyroid hormone levels in females are altered by these hormonal oscillations. One of the primary female oestrogen hormones that affects thyroid hormones During the female reproductive years, oestrogen levels are elevated, which affects thyroid hormone levels and results in hypothyroidism. also, as a result of lifestyle and environmental variables, such as the chemicals in various self-care products that interfere with the endocrine system. . Younger individuals often experience hormonal imbalances that affect thyroid function. In middle age, metabolic shifts necessitate adjustments in thyroid hormone levels to meet the body's changing demands. Additionally, the increased prevalence of autoimmune responses, particularly between ages 30-40, contributes to these variations. This age-related pattern aligns with findings by Hyun-Kyung Oh in 2018, who reported a U-shaped relationship between thyroid profile and age.73 Using Pearson correlation, Table 6 demonstrates significant associations between thyroid and liver parameters in females. Specifically, T3 was negatively correlated with albumin ($p < 0.05$), and TSH was positively correlated with AST ($p < 0.05$). Given albumin's role as a carrier protein for thyroid hormones, this suggests that liver function, which influences albumin levels, can indirectly affect thyroid hormone availability. This aligns with a 2022 study by Zhang Y, which similarly found a significant negative correlation between albumin and thyroid hormones in females.10 Aspartate aminotransferase (AST), a liver enzyme crucial for amino acid and protein metabolism, is influenced by thyroid hormones. Thyroid hormones stimulate liver function, directly affecting hepatocytes. Department of Biochemistry Page 72 Consequently, hypothyroidism can disrupt liver function, leading to changes in liver enzyme levels. This explains the observed positive correlation between AST and thyroid hormones. Similar findings have been reported in other studies, including a 2013 publication by Ogunro SP, Ajala M, and Fasanmade OA, which demonstrated a positive correlation between TSH and AST levels.54 T3 was negatively correlated with albumin in the 19-30 year group ($p < 0.05$), positively correlated with ALP in the 31-45 year group ($p < 0.05$), and TSH was positively correlated with AST and ALT in the 46-60 year group ($p < 0.05$). These findings suggest that thyroid hormone deficiencies can cause age related changes in liver metabolism and function, impacting liver enzyme levels.7 The regulatory influence of thyroid hormones on liver function is highlighted by both our study and Ambiger S's 2019 research. They found that AST and ALT levels correlate with TSH, indicating that alterations in liver function, stemming from thyroid hormone imbalances, affect liver enzymes in hypothyroid patients of both sexes. 52 A significant negative correlation exists between T3 and albumin, while T3 positively correlates with bilirubin, total protein, AST, ALT, and ALP. As highlighted albumin's function as a transport protein connects it to thyroid hormone levels. Given that thyroid hormones regulate liver synthetic functions, including protein production, deficiencies can impair liver function and alter enzyme levels. Consistent with this, Ogunro SP, Ajala M, and Fasanmade OA's 2013 research found a positive correlation between bilirubin and liver enzymes in hypothyroid patients, demonstrating the impact of thyroid hormone changes on liver parameters. positive correlations with albumin, AST, ALT, and ALP, and non-significant negative correlations with total protein and bilirubin in TSH correlated with albumin.

DISCUSSION

Our research underscores the prevalence of hypothyroidism, especially in women, with the 35-45 age group being particularly vulnerable. We recommend heightened vigilance and timely thyroid testing for individuals in this demographic exhibiting potential symptoms. This study examined the interplay between thyroid and liver function, analysing

parameters such as albumin, bilirubin, total protein, AST, ALT, and ALP. We observed elevated bilirubin, AST, ALT, and ALP levels, coupled with decreased albumin and total protein, and identified correlations between T3 and albumin, and TSH and AST. These results confirm that hypothyroidism disrupts liver function, affecting enzymatic, degradative, and synthetic activities. Addressing the inconsistencies in previous studies, which likely stemmed from variations in hypothyroidism severity, our research provides a clear correlation between thyroid and liver profiles. This can inform clinical practice, enabling better assessment and monitoring of affected parameters and facilitating earlier diagnosis.

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