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Correlation of thyroid function test with severity of liver dysfunction in cirrhosis of liver

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Abstract

The liver plays the dominant role in the metabolism of thyroid hormones. In cirrhosis, T3 and T4 diminish due to inefficient hepatic deiodinization and defective hepatic cellular uptake. T4 level decreases, most likely because of an inefficient production of thyroid binding globulin or due to the action of peripheral binding inhibitors. Degree of thyroid dysfunction in cirrhosis is found to have consistently low FT3 in the face of a normal TSH and a clinical euthyroidism. Not only the free hormone level has been delineated as an indicator of thyroid dysfunction, but FT3 level has also been correlated with the degree of liver dysfunction.

Introduction

The liver plays the dominant role in the metabolism of thyroid hormones. It is here that 5'deiodinase enzyme act to convert part of T4 to T3. The rT3, mainly derived from T4, appear to be a major inhibitor of T4 and T3. Thus, if r T3 increases, the metabolic effect of T3 and T4 decreases. In the course of some chronic systemic disease (hepatic cirrhosis) rT3 increases simultaneously with the decrease of T3 level. In cirrhosis, T3 and T4 diminish due to inefficient hepatic deiodinization and defective hepatic cellular uptake. T4 level decreases, most likely because of an inefficient production of thyroid binding globulin or due to the action of peripheral binding inhibitors. During acute liver disease and primary biliary cirrhosis one can observe an increase of T4 and TBG together with an increase of the acute phase proteins. Such complex hormonal mechanisms are not influenced by TSH, which appear normal or inhibited, as the TRH stimulation test is normal. The explanation can be found in an enhanced conversion of T4 to T3 in the pituitary gland.

The biological and clinical significance of these mechanisms might be that of creating a "protective"

state of an organ in a catabolic state by reducing the circulating thyroid hormone T3. A relation has been found between circulating hormone level particularly the T3, rT3, and rT3/ T3 ratio, and the hepatic functional insufficiency. The most consistent thyroid hormone profile in patients with cirrhosis are a low total and free T3 and an elevated rT3, probably reflecting a reduced deiodinase type 1 activity resulting in reduced conversion of T4 to T3. This results in an increase in conversion of T4 to rT3 by the deiodinase type 3 system and an increase in the rT3 to T3 ratio. The plasma T3/rT3 ratio has a negative correlation with the severity of cirrhosis when assessed in non-alcoholic cirrhotic. Since T3 and rT3 bind to the same plasma proteins, the T3/rT3 ratio provides a parameter of liver function that is largely independent of protein binding. Both the T3/rT3 ratio and free T3 levels in plasma thus provide a correlation of liver function in cirrhosis, and are of prognostic value, albeit seldom used. In cirrhosis of liver several hormones may be affected, including insulin and glucagon due to deamination defects, glucocorticoid and gonadal steroids due to a conjugation defects, and thyroid hormone due to an iodination defect. Studies in different populations vary in their findings with respect to the type and degree of thyroid dysfunction in cirrhosis, but found to have consistently low FT3 in the face of a normal TSH and a clinical euthyroidism. Not only the free hormone level has been delineated as an indicator of thyroid dysfunction, but FT3 level has also been correlated with the degree of liver dysfunction.

Materials and Methods

Source of Data: The study will be conducted on 50 consecutive patients admitted to Government Rajaji Hospital & Madurai Medical College during the study period from February 2020 to October 2020.

Inclusion Criteria

1. Patients with Clinical, Biochemical and Radiological Evidence of Cirrhosis of Liver
2. Patients Who Himself of His / Her Relatives Gave Consent

Exclusion Criteria

1. Diabetic Patients
2. Pregnant Females
3. Patients with Prior H/O Thyroid Disease
4. Patient Receiving Drugs That May Interfere with Thyroid Hormone Metabolism and Function
5. Patient with Any Other Chronic Illness (Except Liver Cirrhosis)

Anticipated Outcome

1. Inverse Correlation Between Serum Level of Free T3, Freet 4 And Tsh With Severity of Cirrhosis
2. These Parameters Can Be Used as Markers of Severity of Cirrhosis

Data Collection

Informed consent will be obtained from all patients to be enrolled for the study. In all the patient's relevant information will be collected in a predesigned proforma.

Laboratory Investigations

complete blood count, renal function test, liver function test, free t3 & free t4 tsh,hiv1 & 2,hbsag,hcv,prothrombin time , aptt and inr, serum protein usg abdomen, electrocardiogram

Design of Study: Prospective Cross Sectional study.

Period of Study: 6 Months (June 2022 To Decemer 2022)

Collaborating Departments

1. Department of Medical Gastroenterology
2. Department of Radiology
3. Department of Biochemistry
4. Department of Microbiology

5. Department of Endocrinology

Participants: 50 cirrhotic liver disease patients at Chettinad General Hospitals Kelambakam, Chennai.

Results

An observational study was conducted with 50 study participants to find the relationship of thyroid function with severity of liver dysfunction in cirrhosis of liver in tertiary care hospital. My study describes the association of TSH values with child plug scores by chi square test and kendals correlation at 5% level of significance. There were 62.6% positive correlation between abnormal TSH values with child plug score, which implies that when TSH values are abnormal they tend to score higher values in child plug (chi sq = 19.31, P = 0.0001). By spearman rank correlation, this study explains that there was significant negative correlation of gender with TSH values (-54.7%) and child plug score (-79%) where in positive correlation with FT4 (58.1%). There was positive correlation between FT3 and FT4 (61.4%), which implies as one increases the other also increases. But there was significant negative correlation with child plug score with thyroid function, FT3 (-46.1%) and (-65%) with FT4. on the other hand, child plug score had positive correlation with age (39%) and TSH (65.7%) with p &lt 0.01.

Discussion

In this cross-sectional study, it was seen that prevalence of hypothyroidism in cirrhotic patients was 62%, that is 31 out of 50 cirrhotic patients had increased TSH level. The prevalence of hypothyroidism increases proportional to the severity of liver cirrhosis. All 31 patients did not have signs of hypothyroidism and there TSH level was in subclinical range of hypothyroidism.46% of patients with hypothyroidism were male indicating that hypothyroidism is more common in male cirrhotics. In relation to the etiology of cirrhosis in those with hypothyroidism, my study found alcoholic cirrhosis to be the most common etiology. This study also showed that as severity of liver disease increases indicated by child pugh grade A to C, the prevalence of reduced serum T3 increased. This study showed that all cirrhotics had their serum T4 within the normal limit. Furthermore, serum T3 levels appear to parallel the severity of liver dysfunction. This study also shows that as the severity of liver disease increases which is indicated by child pugh score A to C the prevalence of reduced serum FT3(p value=0.001). Alteration in serum T3 and FT3 levels correlate well with the disease severity and this may be useful in assessing the course and prognosis in cirrhotic patients. Free T3 was found to be a more sensitive marker than total T3 for assessing severity of liver disease. Serum FT3 has strong negative correlation with child Pugh score and MELD score, it is an important prognostic marker in cirrhosis of liver and it also correlates well with serum bilirubin, albumin, prothrombin time. Thyroid function tests should be done regularly in cirrhotic patients to reduce morbidity and mortality.

Conclusion

According to this study, all cirrhotic patients should undergo thyroid function evaluation as these patients are definitely associated with the development of hypothyroidism. As the study suggests significant inverse correlation between serum levels of FT3 and FT4 and TSH with severity of cirrhosis. These parameters can be used as markers of severity of cirrhosis.

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