

# Serum Creatinine and Uric Acid Levels of Hypothyroid Patients

A Haque Khan<sup>1</sup>, I Majumder<sup>2</sup>

<sup>1</sup>Department of Biochemistry, Enam Medical College, Savar, Dhaka

<sup>2</sup>Department of Medicine, Sir Salimullah Medical College, Dhaka

## ABSTRACT

Hypothyroidism is a clinical syndrome resulting from a deficiency of thyroid hormones which, in turn, results in a generalized slowing down of metabolic processes. It is associated with many biochemical abnormalities including increased serum creatinine and uric acid levels. We reviewed more than 30 articles and a good number of textbooks to evaluate serum creatinine and uric acid levels in hypothyroid patients. We found both these parameters are significantly higher in hypothyroid patients. Chronic kidney diseases (CKDs) also affect thyroid function in many ways leading to decreased T<sub>3</sub> and T<sub>4</sub>. So, it is important for clinicians to differentiate between chronic kidney diseases and hypothyroidism with respect to their causal and consequential entities.

**Key Words:** Hypothyroidism, Creatinine, Uric Acid, Hyperuricemia

### Introduction

Hypothyroidism is a clinical syndrome resulting from a deficiency of thyroid hormones which, in turn, results in a generalized slowing down of metabolic processes<sup>1</sup>. It is a common metabolic disorder in general population<sup>2</sup>. The thyroid dysfunction increases with age, especially in women<sup>3</sup>.

Iodine deficiency remains the most common cause of hypothyroidism worldwide<sup>4</sup>. In most parts of the world, iodine is a scarce component of soil, and hence it is little in food<sup>5</sup>. In area of iodine sufficiency, autoimmune disease (Hashimoto's thyroiditis) and iatrogenic causes are the most common causes of hypothyroidism<sup>4</sup>.

Spontaneous atrophic hypothyroidism, surgical or radiational ablation of thyroid, and the hypothyroidism of Hashimoto's thyroiditis account for over 90% of cases of primary hypothyroidism in those parts of the world which are not significantly iodine-deficient<sup>6</sup>. Hypopituitarism and hypothalamic diseases are the important secondary causes of hypothyroidism<sup>4</sup>.

Hypothyroidism is associated with many biochemical abnormalities including increased serum creatinine and uric acid levels. The serum creatinine concentration increases in hypothyroid patients due to reduction of glomerular filtration

rate because of hemodynamic changes in severe hypothyroidism<sup>7</sup>. Serum creatinine level may also be increased due to hypothyroid myopathy. In hypothyroidism, associated autoimmune diseases may also play role in modifying the underlying renal problem. Hypothyroidism, although rare, has been reported as a definite and authentic cause of rhabdomyolysis. As a result, hypothyroidism must be considered in patients presenting with acute renal failure and elevated muscle enzymes<sup>8</sup>.

Hypothyroidism is associated with hyperuricemia. In comparison to the prevalence reported in the general population, a significant increase of both hyperuricemia and gout was found in the hypothyroid patients<sup>9</sup>. In hypothyroidism the hyperuricemia is secondary to a decreased renal plasma flow and impaired glomerular filtration<sup>7,9</sup>. Many studies were done regarding the biochemical status of hypothyroid patients, including serum creatinine and uric acid levels. We have designed review for evaluation of serum creatinine and uric acid levels in hypothyroid patients and that might be helpful for clinical management of hypothyroid patients with hyperuricemia and hypercreatininemia.

### Prevalence of hypothyroidism

Hypothyroidism is a common metabolic disorder in general population. The prevalence of primary

hypothyroidism is 1:100, but it may be 5: 00 if patients with subclinical hypothyroidism (normal T<sub>4</sub>, raised TSH) are included<sup>6</sup>. According to a study done by Sawin et al. (cited by Duntas<sup>3</sup>), hypothyroidism is a common disorder with a prevalence rate up to 20%. In another cross-sectional study on twelve hundred and twelve subjects of both sexes and age 20-60 years, the incidence of subclinical hypothyroidism was 19.7%<sup>10</sup>.

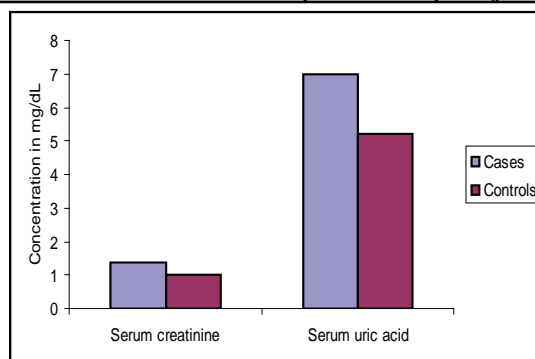
#### Hypothyroidism and biochemical abnormalities

**Hypothyroidism is associated with many biochemical abnormalities including high serum creatinine and uric acid levels. It is of paramount clinical importance. So, proper knowledge of these abnormalities and their consequential effects are very important and useful for clinical management of the patients.**

#### Hypothyroidism and hypercreatinemia

Kreisman and Hennessey in their study found that mean serum creatinine level in hypothyroid cases was significantly greater in comparison to euthyroid value<sup>11</sup>. In another study on 14 newly diagnosed hypothyroid patients in Switzerland mean serum creatinine level was found elevated and decreased after thyroxine replacement therapy<sup>12</sup>. Treatment of hypothyroidism resulted in a significant and sustained reduction of their serum creatinine levels in 2 (two) cases indicating that TSH should be considered in screening procedures of patients with chronic renal failure presenting with recent accelerated aggravation of renal function<sup>13</sup>. Serum creatinine concentration in hypothyroid patients increases due to reduction of glomerular filtration rate because of hemodynamic changes in severe hypothyroidism.<sup>8</sup> Serum creatinine level may also increase because of associated autoimmune diseases that might play a role in modifying the underlying renal problem<sup>13</sup>.

In one study done in the Biochemistry department of Bangabandhu Sheikh Mujib Medical University serum creatinine value was found significantly higher in cases compared to controls (Fig. 1)<sup>14</sup>.



**Figure 1:** Serum creatinine and uric acid levels of study subjects

#### Hypothyroidism and hyperuricemia

Uric acid was found significantly elevated in primary hypothyroidism<sup>7</sup>. In some other studies also serum uric acid level was found elevated in hypothyroid patients<sup>15,16</sup>. In a study on 12 (twelve) induced hypothyroid rabbits, mean serum uric acid level was found higher in hypothyroid condition than in euthyroid condition<sup>17</sup>. In an epidemiological study in northern Finland in 1969, hyperuricemia was found in rural, urban and hospital admitted hypothyroid patients<sup>18</sup>. In hypothyroidism the hyperuricemia is secondary to a decreased renal plasma flow and impaired glomerular filtration<sup>7,9</sup>.

In a case-control study done in the Biochemistry department of Bangabandhu Sheikh Mujib Medical University, Dhaka, Bangladesh serum uric acid level has been found significantly higher in cases compared to controls<sup>14</sup>.

#### Conclusion

In our review analysis, serum creatinine level has been found to be significantly higher in hypothyroid patients. So, hypothyroidism should be taken into account in patients presenting with chronic kidney diseases. On the other hand, chronic kidney diseases also affect thyroid function in many ways leading to decreased T<sub>3</sub> and T<sub>4</sub>. Therefore, it is important for the clinician to differentiate between chronic kidney diseases (CKDs) and hypothyroidism with

respect to their causal and consequential entities. This review analysis has also found hyperuricemia in hypothyroid patients. Therefore, patients presenting with these biochemical abnormalities are recommended to be investigated for hypothyroidism.

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