Original Research Article

A study of renal manifestations in hypothyroid patients found during pre anesthetic check up

Mahmood Mirza[1], Khaja Ali Hassan[2*], Jaweed Zaheer Siddique[3], Wajid Ali Khan[4], Mohammad Aejazul Haq[5]

[1]Assistant Professor, [2]Associate Professor, Department of Anesthesiology, DCMS, Hyderabad, Telangana, INDIA.
[3]Senior Resident, [4,5]PG, Deccan College of medical Sciences, Hyderabad, Telangana, INDIA.
Email: propofol123@gmail.com

Abstract

Background: Thyroid hormone influences renal development, kidney structure, renal heamodynamics, GFR, the functions of many transport system along nephron, sodium and water homeostasis Disorder of thyroid function can result from any abnormality that leads to insufficient synthesis of thyroid hormone. The most common primary hypothyroidism is linked to immune mediated glomerular injury and alteration in the production of thyroid hormone. The presence of hypometabolic state thus necessitates careful perioperative renal, cardiovascular monitoring and judicious use of anaesthetic drugs. **Aim:** The present study was aimed to analyse renal parameters – blood urea, serum and urinary creatinine, serum and urinary electrolytes in patients with history of hypothyroidism posted for elective surgery during the year 2016 at Deccan College of Medical Sciences. **Material and Method:** The following biochemical parameters derived were estimated glomerular filtration rate (eGFR) and fractional excretion of sodium (FeNa). 50 people were taken as controls that had no medical illness and 50 cases of incidental subclinical hypothyroidism were taken as case study group. Mean and Standard deviation was assessed and p value ≤0.05 was considered significant. **Result:** The mean and SD of blood urea (mg/dl) in controls is 28.2±4.75 as compared to 27.29±8.1 in cases. The P value is not significant. The mean and SD of serum creatinine (mg/dl) in controls was 0.7±0.15 as compared to 1.10±0.24 in cases. The P value was <0.01 which is significant. The mean and SD of electrolytes sodium, potassium and chlorides in controls were 140.4±2.15, 4.06±0.25 and 98.3±2.25 as compared to case study group of 147.93±6.98, 4.15±0.42 and 107.81± 10.35 The P value of serum sodium and chloride is <0.01 which is significant. The p value of potassium is not significant.

Key Words: Hypothyroidism, Renal Functions, Anesthesia.

[*]**Address for Correspondence:**
Dr. Khaja Ali Hassan, Associate Professor, Department of Anesthesiology, DCMS, Hyderabad, Telangana, INDIA.
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INTRODUCTION

Hypothyroidism can result from any of a variety of abnormalities that lead to insufficient synthesis of thyroid hormones. Overall primary hypothyroidism accounts for approximately 95% of cases and only 5% or less being suprathyroid origin[1]. The most common primary hypothyroidism is often autoimmune in nature, leading to myxedema in adults. Women are more affected than males. Thyroid hormone deficiency affects every tissue in the body so the symptoms are multiple. Pathologically, the most characteristic finding is the accumulation of glycosaminoglycans – mostly hyaluronic acid in the interstitial tissues, which increases the capillary permeability to albumin that accounts for interstitial edema. This accumulation is not due to excessive synthesis but due to decreased degradation of glycosaminoglycans[3]. Hypothyroidism is associated with gain in weight, partly due to water retention in tissues and partly to fat storage; which is evident in particular sites like head, neck, trunk but spares limbs[4]. Disease affecting the kidneys can often be detected even in asymptomatic patients from clues derived from routine clinical and laboratory examination. Hypothyroidism decreases cardiac output leading to decreased renal blood flow and

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decreased glomerular filtration rate and thereby decreases reabsorptive and secretary maxima of the kidneys. The ability to concentrate urine is slightly impaired and mild proteinuria may occur as a result of effect of hypothyroidism on kidneys[5]. Many case reports document increased levels of serum creatinine with hypothyroidism in humans.[6–11]. A person with impaired renal functions can live a normal life depending upon the severity of impairment of renal function. Hypothyroidism may also result in depression of myocardial function, decreased spontaneous ventilation, abnormal baroreceptor function, reduced plasma volume, anaemia, hypoglycaemia, hyponatraemia and impaired hepatic drug metabolism. The presence of hypometabolic state necessitates careful perioperative cardiovascular monitoring and judicious use of anaesthetic drugs.

MATERIALS AND METHODS

The study was carried out in Department of Anesthesia DCMS at pre anesthesia check up clinics. The diagnosed cases of subclinical hypothyroidism were selected from the department of surgery and obstretics coming for elective surgery. 50 people were taken as controls that had no medical illness and 50 cases of incidental subclinical hypothyroid were taken as case study group. The biochemical parameters of the above were compared to know the statistical difference.

Collection of Sample (Blood and Urine):

1. About 5 ml of blood is collected from cubital vein by vein puncture under aseptic conditions into a sterile bottle and allowed to clot. The serum is separated and used for estimation of the above parameters.
2. A spot urine sample is collected from the hypothyroid patients and this urine is used for the estimation of the above urinary parameters.
3. Semiauto analyzer and Electrolyte analyzer were used to assess the above parameters.
4. Levey *et al* in 1999 proposed a formula called Modification of diet in renal disease (MDRD) to assess the GFR which included plasma creatinine, age, sex and race.

MDRD formula is as follows:-

GFR (ml / min / 1.73 m2) = 186
X [Plasma creatinine (mg/dL)]
X [Age]-0.203
X [0.742 if patient is female]
X [1.210 if patient is black]

Fractional excretion of sodium:-(1)

Estimation of the fractional excretion of sodium (FeNa) relates sodium clearance to creatinine clearance which differentiates prerenal failure from postrenal failure.

$$FeNa = \frac{\text{Urinary sodium} \times \text{Plasma creatinine}}{\text{Plasma sodium} \times \text{Urinary creatinine}} \times 100$$

Estimation of Urea and Creatinine Blood Urea and Serum Creatinine were estimated using the standard kit by Berthelot, End Point Assay and Jaffe's method

Data are expressed as mean±standard deviation (SD). The significant difference between the test group and the control group were analyzed using ANOVA. Data were analyzed using the SPSS software. A value of $p<0.05$ was set as the level of significance.

Estimation of electrolyte (Sodium, Potassium and Chloride) by electrolyte analyzer principle: The AVL 9180 analyzer methodology is based on the ionselective electrode (ISE). They are three different electrodes used in AVL 9180 analyzer (Sodium, Potassium and Chloride). Each electrode has an ionselective membrane that undergoes a specific reaction with the corresponding ions contained in the sample being analyzed. The ion concentration in the sample is then determined by using a calibration curve determined by measured points of standard solutions with precisely known ion concentration.

Statistical Analysis: Mean and standard deviation (S.D) of all variables were calculated and calculated and compared with those of controls. Statistical significance was assessed and P-value <0.05 were considered significant.

Exclusion Criteria

Diagnosed cases of hypothyroidism on treatment. Emergency cases. Known cases of electrolyte imbalances. Known cases of diabetes and hypertension

RESULTS

Table 1:

Sl. No	Investigation		Control Subjects	Test subjects
		Mean		27.29
		SD	4.75	8.1
1	Blood urea(mg/Dl	SEM	2.82	
		t-test	0.31	
		P	NS	
		Mean	0.75	1.10
		SD	0.15	0.24
2	Serum creatinine(mg/dL)	SEM	0.08	
		t-test	3.35	
		P	<0.01	
		Mean	140.4	147.93
		SD	2.15	6.98
3	Serum sodium(mEq/L)	SEM	1.99	
		t-test	3.4	
		P	<0.01	
		Mean	4.06	4.15
		SD	0.25	0.42
4	Serum potassium(mEq/L)	SEM	0.04	
		t-test	1.15	
		P	NS	
		Mean	98.3	107.81
		SD	2.25	10.35
5	Serum chloride(mEq/L)	SEM	3.35	
		t-test	2.82	
		P	<0.01	
		Mean	75	76.5
		SD	14.18	15.28
6	Urine creatinine(mg/dL)	SEM	5.95	
		t-test	0.75	
		P	NS	
		Mean	164.4	120.78
		SD	27.7	62.85
7	Urine sodium(mmol/L)	SEM	21.17	
		t-test	2.03	
		P	<0.05	
		Mean	22.9	21.86
		SD	5.78	5.53
8	Urine potassium(mmol/L)	SEM	2.28	
		t-test	0.45	
		P	NS	
		Mean	116.2	106.94
		SD	39.7	44.75
9	Urine chloride(mmol/L)	SEM	17.31	
		t-test	0.70	
		P	NS	
		Mean	134.5	81.38
		SD	14.01	21.05
10	Estimated glomerular rate(eGFR)1.73m2/ ml/min	SEM	7.26	
		t-test	7.18	
		P	<0.01	

SD = Standard Deviation, SEM = Standard Error Mean

The results of table 1 shows the P-value of eGFR, Serum Creatinine, sodium and chloride are highly significant and p-value of Urinary sodium is significant and p-value of the remaining biochemical parameters were considered as statistically not significant.

DISCUSSION

Hypothyroidism characterized by decreased production of thyroid hormones, affects the functions of various organs like muscle, kidney, reproductive system, central nervous system and hemopoetic system due to its effect on various metabolic pathways in the body. The reports of few studies conducted in this direction indicates, there is decreased renal blood flow, glomerular filtration rate and tubular reabsorptive and secretory maxima is reduced, and urine flow is reduced. Delay in water excretion appears to be due to decreased volume delivering to the distal diluting segment of nephron as a result of decreased renal blood flow. The impaired renal excretion of water and the retention of water in the interstitial ground substance results in increased total body water and reduced plasma volume. Occasionally hyponatremia is also reported which is associated with severe hypothyroidism. The amount of exchangeable potassium is usually normal in relation to lean body mass. It is also reported no change in the levels of non – protein nitrogen substances like urea, creatinine and uric acid. In present study, in addition to estimation of blood urea and serum creatinine, two important renal function tests i.e. eGFR and FeNa are done to find out the renal hemodynamics and sodium handling capacity of the kidney in hypothyroid state. The use of fractional excretion of sodium has become popular test as a more accurate means to differentiate prerenal failure from renal and post renal failure. The fractional excretion of sodium represents the fraction of filtered sodium that is ultimately excreted in the urine. If the value is less than 1%, it indicates prerenal, and greater than 2% indicates 2% renal causes. The result of the two tests indicates that out of 50 cases of hypothyroid patients investigated, 32 cases have reduction in eGFR values than control group (64%) and in 50% cases fractional clearance of sodium being less. The mean serum sodium levels in hypothyroid patients are also high as compared to control group, where as K+, urea and creatinine values do not differ from control group. Similarly urinary potassium values are same as that of control value.

CONCLUSION

From this results it can be concluded that hypothyroid state affects renal functions in significant percentage of affected subjects as indicated by decreased glomerular filtration rate, decreased urinary sodium excretion and decreased fractional clearance of sodium resulting in water retention in the body. As these changes in kidney functions are reversible, it is necessary to identify hypothyroid state in person at the earliest and institute treatment immediately.

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