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Original Research Article

An Association between Uric Acid and Hypothyroidism – A Retrospective Case Control Study

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Conflict of interest: Nil

Abstract:

Background: Hypothyroidism affects kidney function to alter the level of uric acid in blood and hence has an impact on serum uric acid level.

Method: The study included 50 known hyperuricemia cases and equal number of age and sex matched control. Serum uric acid, TSH, FT4, urea, creatinine data were collected from the record of patients who attended the department of Biochemistry, SCCGMCH, Uluberia.

Result: Uric acid is positively associated with thyroid disease as Odds of exposure among cases are higher than control with Odds Ratio – 6. Statistically significant difference in UA, TSH, FT4 level was observed between case and control but there's no significant difference observed in the urea and creatinine concentration although mean for urea and creatinine of case were slightly on higher side.

Conclusion: Hypothyroid individual irrespective of treatment status is associated with increased Uric acid concentration.

Keywords: Thyroid disorder, Hypothyroidism, Uric acid.

Introduction

Thyroid Disorders not only affect purine metabolism but also kidney function to alter the level of uric acid in blood and hence has an impact on serum uric acid level. (1)(2)

Uric acid is the result of endogenous and dietary purine metabolism in humans and blood levels depend on the balance between consumption of dietary purines & purine production, and the elimination of urate by the kidney. [3]

A complex cascade of glomerular filtration, proximal tubule reabsorption via the urate transporter-1 (URAT-1), and active re-secretion contribute to the highly coordinated renal excretion (66% of total- renal+ intestine) of uric acid.[3]

Hyperuricemia may lead to deposition of monosodium urate crystals in joints and tissues from supersaturated body fluids resulting in Gout, [4] which is characterised by episodic acute arthritis or chronic arthritis [5] The elevated levels of serum uric acid are also accompanied with other co-morbid conditions including hypertension, metabolic syndrome, chronic kidney disease and type 2 diabetes mellitus. [6–8]

Thyroid disorders mainly primary hypothyroid is very common in India.

Thyroid disorders affect uric acid concentration, there is reduced renal perfusion and glomerular filtration (GFR) in primary hypothyroid individuals and enhanced purine metabolism in primary hyperthyroidism. [1]

Thyroid issues and hyperuricemia, a significant risk factor for the development of gout, have been linked in two studies. [9,10] Increased uric acid values are quite prevalent in both hyperthyroidism and hypothyroidism. [9,10] A number of case series offered proof that hypothyroidism and gout may be related. [11–13]

There are conflicting findings about the relationship between thyroid disorders and uric acid metabolism. [1]

This study focuses on establishing the association between the two.

Material & Method

Data were collected from patients who attended the department of biochemistry, SCCGMCH, Uluberia for analysis of blood sample. Written informed consent cannot be obtained from the participants, as this was a retrospective study, and all data was anonymized.

Cases were selected at random who had abnormal uric acid level (BRI - >18yrs: M – 3.4-7 mg/dl ; F -2.4-5.7 mg/dl) , in the past 6 month (Jan -Jun 2023) , having uric acid level higher or lower than Reference Interval , with following exclusion criteria, , drugs causing hypo/hyperuricemia (uricosuric drugs), pre-eclampsia, alcohol intake, leukaemia, myeloma, radiotherapy, chemotherapy, trauma, psoriasis, acute or chronic kidney disease, thiazide diuretic ,Trisomy 21 (Down syndrome), severe hepatocellular disease, cancer chemotherapy with 6-mercaptopurine or azathioprine) which can alter the level of Uric acid, pregnancy. [4]

Age and Sex matched Controls were selected at random who did not have abnormal uric acid level in their record in the past 6 month (Jan -Jun 2023)

Same exclusion criteria were applied to controls as to cases.

Patients were classified as having Primary Hypothyroid who had TSH value above reference interval (BRI -> 20yrs: Both M/F - 0.27-4.2 mIU/l) and/or FT4 below reference interval (BRI -> 20yrs: Both M/F - .93-1.70 ng/dl) appropriate for age along with those who were on treatment with levothyroxine.

Analytical measurement was done on autoanalyzer.

Statistical analysis was done using Microsoft Excel and GraphPad Prism Software.

Result

50 known cases of abnormal uric acid concentration with age and sex matched controls were evaluated using Microsoft excel and Prism software with simple statistical methods.

Results where applicable are expressed in mean +/- SD and percentage.

Difference statistically significant at p <.005 when compared with healthy controls.

Table 1: Patients in the study group

Group	No. of Patients
Case	50
Control	50
Total	100

Table 2: Mean age of the patients among the study population (in years)

Gender	Case Mean +/- SD	Control Mean +/- SD	t-test	'p' value
Male	49.53 +/- 12.77	48.59 +/- 12.34	.2289	.8205
Female	50.11 +/- 12.36	49.76 +/- 10.57	.1190	.9056
Overall	49.94 +/- 12.36	49.36 +/- 11.67	.2143	.8099

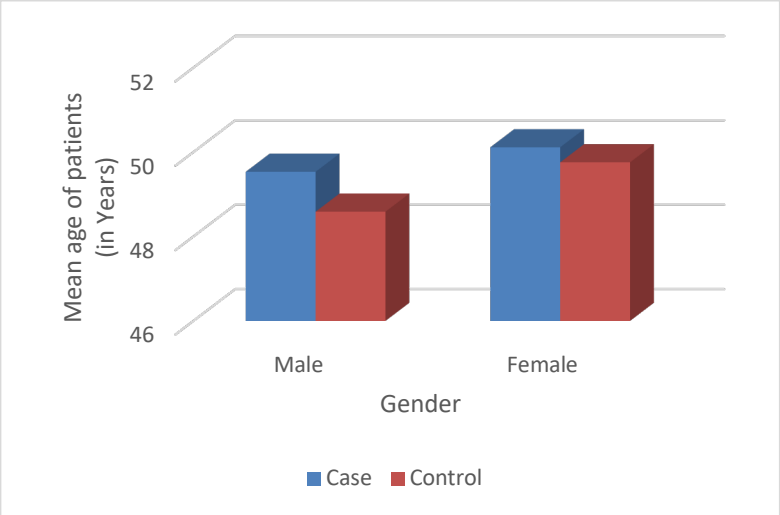

Chart 1: Bar Diagram of comparison of mean age of patients between the study groups

Table 3: Age Distribution among the study population

Age (in years)	Case		Control		$\chi 2$	P value
	No of patients	Percentage	No of patients	Percentage		
>20yrs - <60yrs	38	76	37	74	.0533	.8174
>=60yrs	12	24	13	26	.0533	.8174
Total	50	100	50	100		

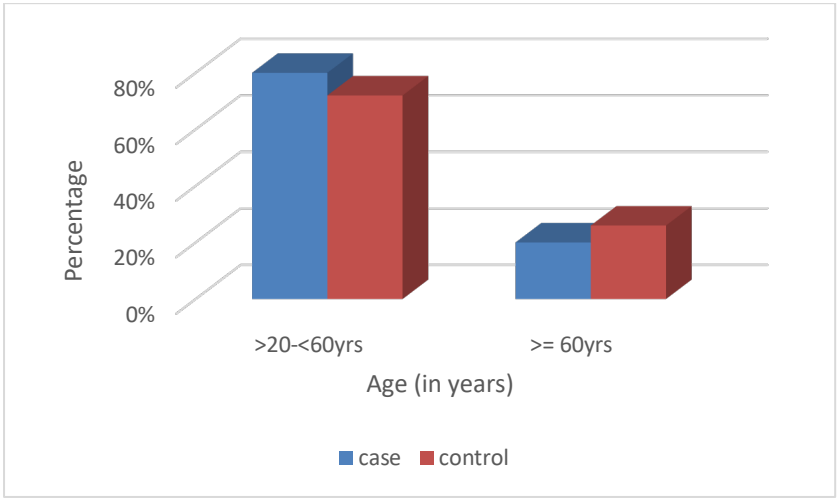

Chart 2: Bar Diagram of comparison of age distribution between the study groups

Table 4: Gender Distribution in the study

Age (in years)	Case		Control		$\chi 2$	P value
	No of patients	Percentage	No of patients	Percentage		
Male	15	30%	17	34%	.1838	.6681
Female	35	70%	33	66%	.1838	.6681
Total	50		50			

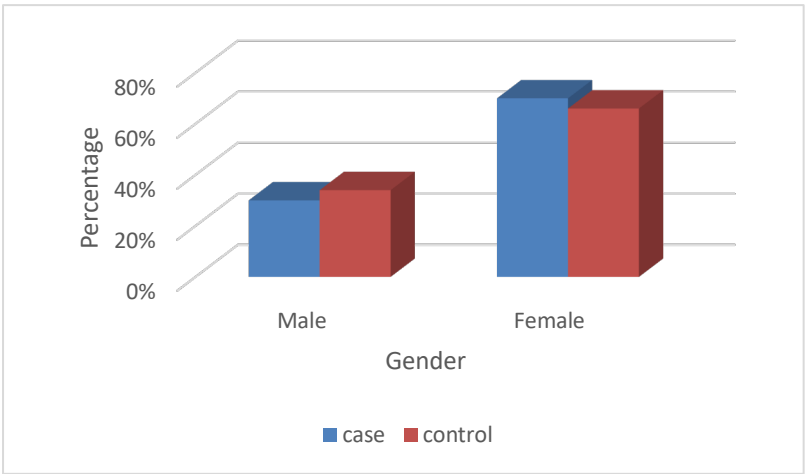

Chart 3: Bar Diagram of comparison of Gender distribution between the study groups

Tabel 5:

	Case	Control	Total
Exposed	30	10	40
Not Exposed	20	40	60
Odds Ratio	6		

Table 6:

		Case		Control		t-test	P-Value
		Mean	SD	Mean	SD		
Uric Acid	Overall	7.07	1.71	5.02	0.85	7.594	<0.0001
	Male	7.15	2.55	5.45	0.86	2.593	0.0146
	Female	7.04	1.23	4.83	0.77	8.911	<0.0001
	>20-<60 yrs	7.06	1.67	5.04	0.88	6.508	<0.0001
	>= 60yrs	7.13	1.90	4.98	0.79	3.756	0.0010
TSH	Overall	4.66	2.77	2.92	1.33	4.003	0.0001
	Male	4.80	3.58	2.87	1.18	2.099	0.0444
	Female	4.59	2.40	2.94	1.42	3.435	0.0010
	>20-<60 yrs	4.67	3.09	2.76	1.21	3.497	0.0008
	>= 60yrs	4.61	1.40	3.35	1.6	2.081	0.0488
FT4	Overall	1.07	0.24	1.23	0.19	3.654	.0004
	Male	0.99	0.28	1.15	0.20	2.171	.0379
	Female	1.11	0.25	1.27	0.17	3.180	.0022
	>20-<60 yrs	1.06	0.27	1.21	0.18	2.797	.0066
	>= 60yrs	1.10	0.18	1.29	0.20	2.550	.0179
Urea	Overall	26.13	7.80	24.76	7.20	.9172	0.3631
	Male	27.39	6.51	24.75	7.33	1.069	0.2935
	Female	25.59	8.314	24.76	7.24	.4470	0.6609
	>20-<60 yrs	25.48	7.04	24.05	6.73	.8967	0.3728
	>= 60yrs	28.20	9.90	26.75	8.37	.3948	0.6966
Creatinine	Overall	0.93	0.18	0.87	0.17	1.674	0.0973
	Male	1.01	0.14	0.92	0.15	1.723	0.0952
	Female	.89	0.18	0.84	0.17	1.148	0.2552
	>20-<60 yrs	.93	0.18	0.87	0.17	1.358	0.1787
	>= 60yrs	.92	0.18	0.86	0.14	.9690	0.3426

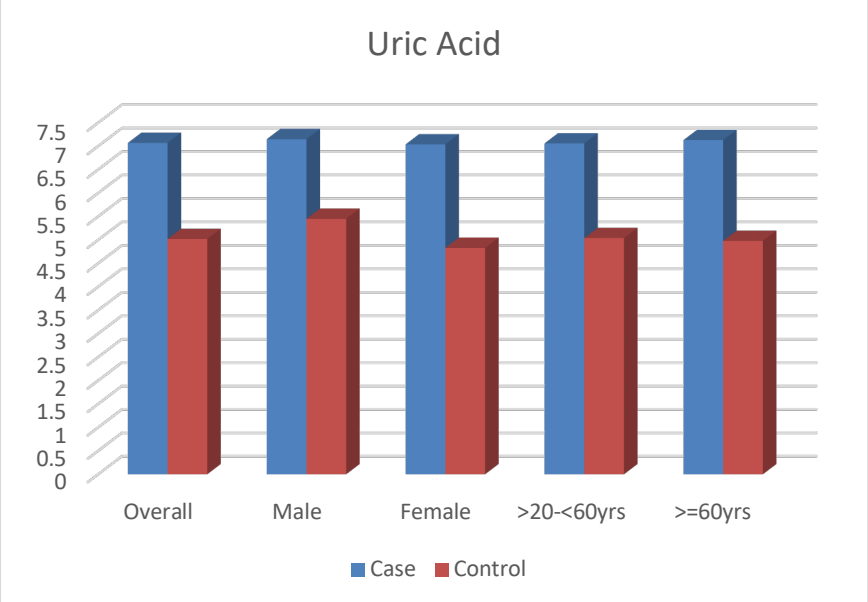

Chart 4: Bar Diagram of comparison of Uric acid between the study groups

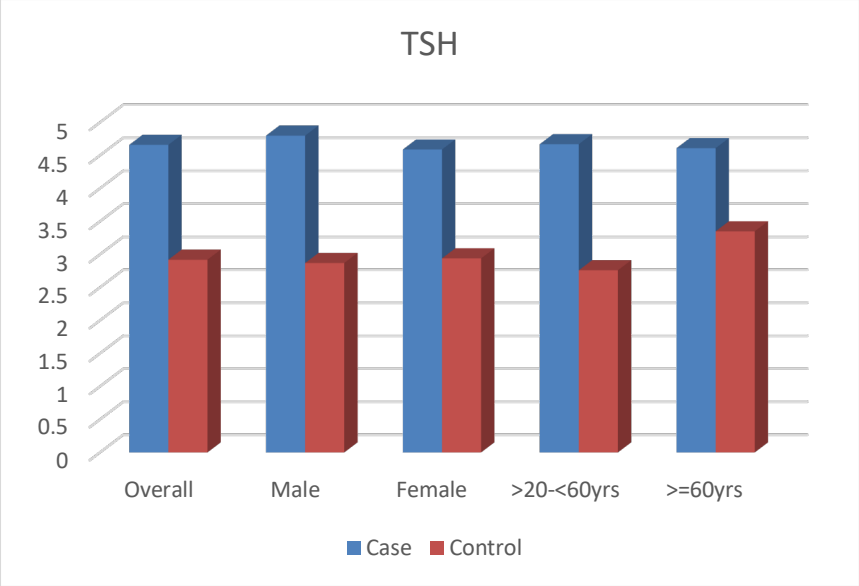

Chart 5: Bar Diagram of comparison of TSH between the study groups

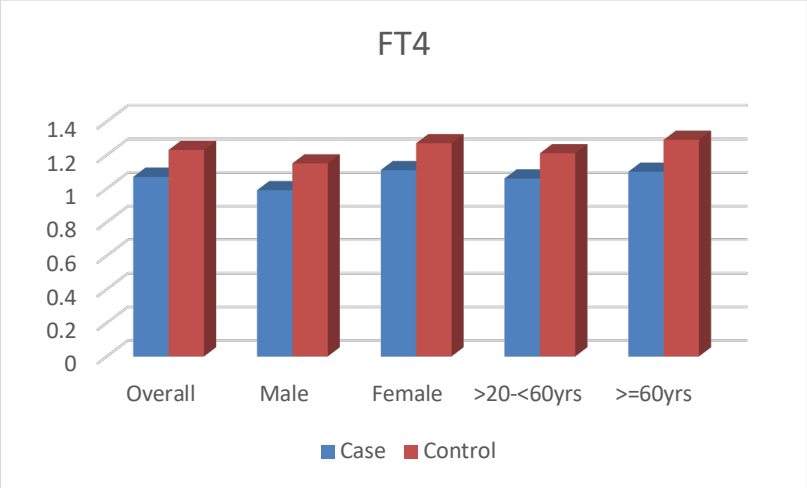

Chart 6: Bar Diagram of comparison of FT4 between the study groups

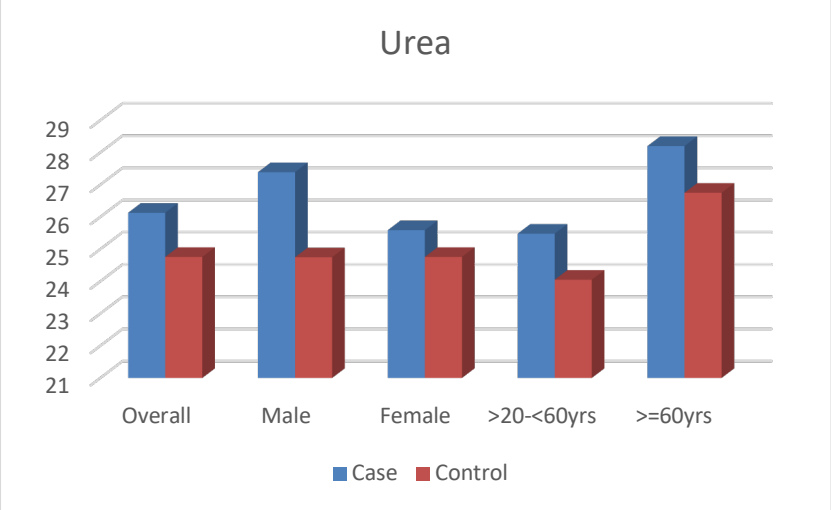

Chart 7: Bar Diagram of comparison of Urea between the study groups

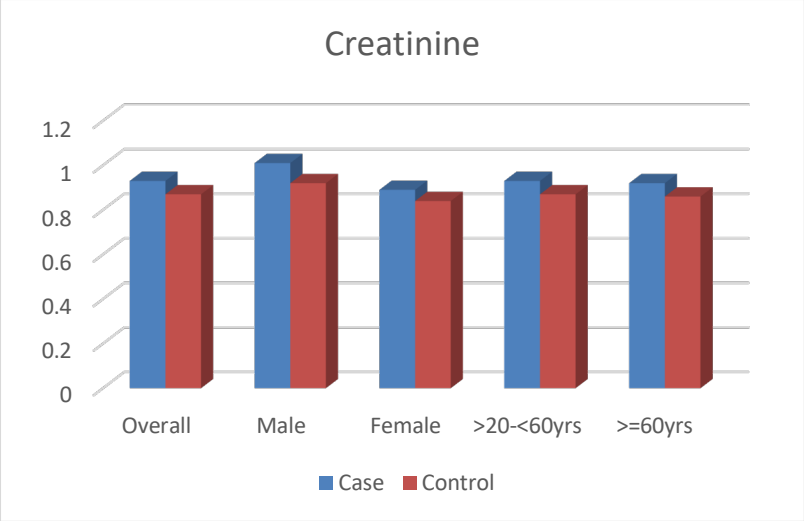

Chart 8: Bar Diagram of comparison of Creatinine between the study groups

Discussion & Conclusion

In this study we explored the risk of having abnormal uric acid concentration in previously diagnosed hypothyroid individual. There is statistically significant association between hypothyroid and abnormal uric acid concentration (increased uric acid concentration in our study) which is a finding consistent with previous study. [2,9,10]

Although the explanation to the increased uric acid in hypothyroid due to reduced renal perfusion and glomerular filtration (GFR) couldn't be explained as mean of urea and creatinine between case and control was not statistically significant.

Limitation of the study is data for drug history were taken from the prescription available and treatment status may not be available for all the patients. 6 patients were undergoing treatment in the control group and 8 patients were undergoing treatment in the case group. Hence, all the individual couldn't be classified as new case of hypothyroid. Potential risk factors for gout such as dietary habits or physical activities was not adjusted.

However, we can still conclude that hypothyroid individual irrespective of treatment status is associated with increased uric acid concentration from the above statistics as uric acid is positively associated with thyroid disease as Odds of exposure among cases are higher than control with Odds Ratio – 6 and would suggest a study to estimate uric acid in a newly diagnosed case followed by level of uric acid post treatment.

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