International Journal of Clinical & Biomedical Research
Vol 8, Issue 1, 2022.

Sumathi Publications
Original Article

Effect of hyperglycemia on serum uric acid levels - A real world comparative study

Shivaraj S Hanchinal[1], Suresh Harsoor[2]

[1]Department of General Medicine, Mahavir Institute of Medical College, Vikarabad, India
[2]Professor Dept of General Medicine, Mahadevappa Rampure Medical College (MRMC) Kalaburagi, India

Abstract

Background: In the early stages of diabetes, the serum uric acid levels are high .as the diabetic status progresses, there is a gradual decline of uric acid levels in many patients. There is evidence that low serum uric acid levels may occur prior to the start of diabetic retinopathy. **Objective**: To determine the relationship between hyperglycaemia and uric acid levels. **Methods**: Patients with known diabetes or impaired glucose tolerance (IGT)/newly diagnosed diabetes treated on an outpatient basis or in patients admitted to B.T.G.H over a one-year period from April 2017 to March 2018. **Results**: Nineteen type 2 Diabetes Mellitus (DM) cases had hypouricemia while 6 in controls. Seven cases of impaired glucose tolerance had hyperuricemia, and six controls had hyperuricemia and none in patients with type 2 DM. **Conclusion**: Patients with type 2 diabetes have slightly lower serum uric acid levels. Patients with IGT had higher serum uric acid levels.

Keywords: Type 2 Diabetes Mellitus, Serum uric acid levels, Impaired Glucose Tolerance (IGT)

Introduction

It is estimated that 463 million adults are suffering from diabetes globally, according to the latest data (2019) from the International Diabetes Federation [1]. Diabetes prevalence is rapidly increasing. As per 2017 estimates, 425 million people are living with diabetes [2]. The number is projected to almost double by 2030. Several studies have shown there are evidence to suggest that low serum uric acid levels may precede the onset of diabetic retinopathy.

Plasma uric acid, an end product of purine metabolism [3]. Its levels are genetically determined, although a variety of environmental factors alters them. Recently, it has been demonstrated that there is a clear relationship between hyperglycemia and uric acid levels [4].

So far, studies have indicated that uric acid levels are high in the early stages of diabetes, and that as the diabetic condition improves, there is a steady drop in uric acid levels in many patients [5]. It has been observed that hypouricemia may also indicate future progression and hence be a sign of incipient nephropathy in Type 2 DM.

Material And Methodology

Study design: Comparative study

Study location: B.T.G.H

Ethics approval: B.T.G.H ethical committee

Study period: April 2017 to March 2018

Correspondence: Dr. Shivaraj S Hanchinal, Department of General Medicine, Mahavir Institute of Medical College, Vikarabad, India. Email: shivarajh27@gmail.com

eISSN: 2395-0471
pISSN: 2521-0394

Sample size: Approximately 100 patients, 50 with impaired glucose tolerance test and/or patients with diabetes mellitus newly detected or already on treatment, and 50 normal subjects

Inclusion criteria

Known diabetic or impaired glucose tolerance patients who are being treated outpatient and patients who have recently been diagnosed with diabetes or impaired glucose tolerance are already on treatment.

Exclusion criteria

- Patients with BMI >30
- Patients with a history of hypertension, alcoholic, myeloproliferative disorders, lymphoproliferative disorders, psoriasis
- Patients not capable of giving consent (psychiatric patients).
- Patients who are not willing to participate and refuse to give consent
- Pregnant and lactating women

Methodology:

Parameter used: Serum uric acid levels, Random blood sugar levels, Impaired glucose tolerance test [1].

Statistical analysis

Data were interpreted using paired and unpaired t-tests and chi-square tests using SPSS 16 software

Results

Table 1. Cases and Controls number and percentage with respect to gender

Sex	Type 2 DM		IGT		Controls	
	No.	%	No.	%	No.	%
Male	22	51.2	3	42.9	25	50
Female	21	48.8	4	57.2	25	50
Total	43	100	7	100	50	100

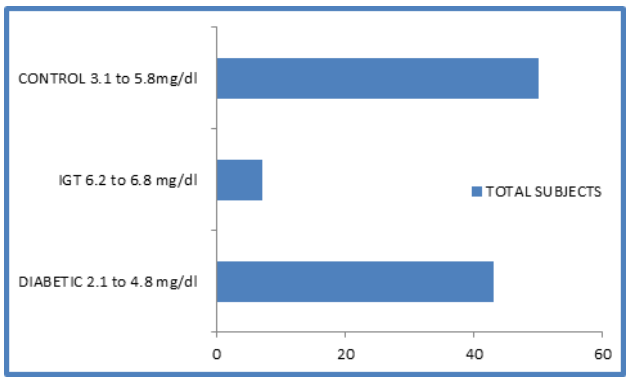

Figure 1. Baseline serum uric acid levels

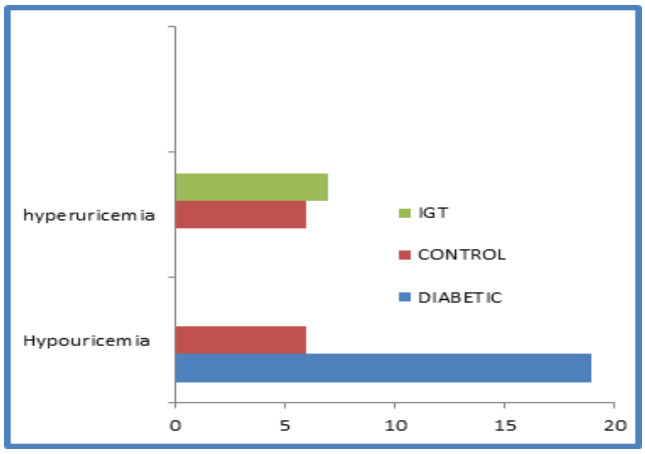

Figure 2. Subjects with Hypouricemia And Hyperuricemia

Table 2. Distribution of patients with type 2 DM, IGT in case and controls in relation to serum uric acid level

In relation to	Parameters	Cases	Control
type 2 DM	Serum uric acid (mg/dl)	3.54±0.82	4.398±0.76
IGT	Serum uric acid (mg/dl)	6.5±0.2	4.398±0.76

Table 3. Relation of candidal infection with clinical lesions of the cervix

		Type 2 DM	IGT	Controls
Hypouricemia	Positive	19	0	6
	Negative	24	7	44
Hyperuricemia	Positive	0	7	6
	Negative	43	0	44

This study included a total of 100 participants. Of the total 100 subjects, 43 were patients of type 2 DM, 7 were diagnosed with IGT, and 50 were controls. Among the 100 cases studied, there were 22 males and 21 females with type 2 DM. 3 males and 4 females were diagnosed to have IGT, and among 50 controls, there were 25 males and 25 females.

Serum uric acid in diabetic population and control varied from 2.1 to 4.8 and 3.1 to 5.8mg/dl respectively. The mean and standard deviation of uric acid among diabetics was 3.54±0.819 while in control it was 4.398±0.767, respectively.

Serum uric acid in patients with IGT and control varied from 6.2 to 6.8 and 3.1 to 5.8. The mean and standard deviation of uric acid among cases was 6.5±0.2, while in control, it was 4.398±0.767.

Hypouricemia defined as serum uric acid levels <3.5mg/dl in males and <3.0mg/dl in females. 19 cases of type 2 DM had hypouricemia while 6 in controls.

Hyperuricemia is defined as uric acid level>5.5mg/dl in males and 5mg/dl in females 7 cases of IGT had hyperuricemia, six controls had hyperuricemia and none in patients with type 2 DM.

Discussion

The present study of serum uric acid levels in patients with type 2 DM and those found to have impaired glucose tolerance was carried out in the department of general medicine. Basaveshwar Teaching and general hospital from April 2017 to March 2018.

The patients were: grouped into the study group (those with type 2 diabetes and those with impaired glucose tolerance) and the control group (normal participants). The purpose of the study was to compare blood uric acid levels in patients with type 2 diabetes and IGT to normal participants.

The main findings of our study were that plasma uric acid levels were elevated in men and women with impaired glucose tolerance. The lowest plasma uric acid levels were found in Diabetic patients. Several other investigations demonstrated a negative relationship between plasma uric acid and overt diabetes [6-9].

Our results confirm this finding Despite methodological discrepancies and different diagnostic criteria for diabetes mellitus utilized in these studies. A diabetic man had lower plasma uric acid levels than a pre-diabetic man, who had higher levels than a non-diabetic man, according to a prospective study of 10,000 Israeli men [10, 11].

None of the previously published epidemiologic studies of plasma uric acid and diabetes has used the WHO classification for impaired glucose tolerance and diabetes mellitus.our study used the WHO criteria and showed that patients with impaired glucose tolerance have the highest plasma uric acid level. An interesting finding in our study was that plasma uric acid levels Were clearly reduced in Diabetic patients when compared with nondiabetic patients.

In this study mean serum uric acid levels were less in patients with poorly controlled diabetes when compared to patients with well controlled Diabetes. The mean serum uric acid level was 3.09 ± 0.123 and 3.94 ± 0.619 poorly controlled and well-controlled diabetic patients.

Derek G Cook et al. found a positive relationship between serum glucose and uric acid concentrations at higher levels of glucose serum uric acid concentrations decreased. He found that serum uric acid most likely represents the biochemical interaction between serum glucose and purine metabolism, with increased uric acid excretion during hyperglycemia and glycosuria [12]. In our study, the mean serum uric acid was high in all patients with IGT when compared to controls and diabetic subjects and the difference was statistically significant.

Kodama S et.al. assessed systematical evaluation of the association between serum uric acid levels and subsequent development of type 2 DM and concluded that serum uric acid level is positively associated with the development of type 2 DM regardless of various study characteristics [13].

In this study, patients with poor metabolic control and diabetes for a longer period of time were more likely to develop complications such as hypouricemia. Our study also found that patients with a longer history of diabetes had lower serum uric acid levels than those with a shorter period of diabetes, 3.02 1.089 (>9yrs) versus 4.11 1.072. (0 to 4 years). The difference was statistically significant. The reason could be related to increased uric acid excretion with time and dietary changes in renal illness.

In this study, all 100% (7) patients of IGT had raised serum uric acid levels compared to only 12% (6) in the control group and 0% in patients with type 2 DM. The mean value of mean serum uric acid level was 3.54 ± 0.819, 6.5 ± 0.2 and 4.398 ± 0.76 in patients with type 2 DM patients with IGT and controls respectively, and the results were statistically significant.

Conclusion

Serum uric acid concentration is slightly reduced in patients with type 2 DM, particularly in patients with poor glycemic control. This may be due to increased excretion of uric acid during hyperglycemia and glycosuria and modification of diet in renal disease. Serum uric acid concentration is elevated in IGT patients, and the factors that contribute to this are still unknown.

Conflict of interest: Nil

References

1. International Diabetes Federation. IDF Diabetes Atlas, 9th edn. Brussels, Belgium: 2019. Available at: https://www.diabetesatlas.org. Accessed 14 February 2020
2. International Diabetes Federation. IDF Diabetes Atlas, 8th edn. Brussels, Belgium: 2019. Accessed 14 February 2020

3. George J, Struthers AD. Role of urate, xanthine oxidase and the effects of allopurinol in vascular oxidative stress. Vasc Health Risk Manag. 2009;5:265–72
4. Pasalic D, Marinkovic N, Feher-Turkovic L. Uric acid as one of the important factors in multifactorial disorders – facts and controversies. Biochemia Medica. 2012;Vol (Issue):63-75
5. Xiong Q, Liu J, Xu Y. Effects of Uric Acid on Diabetes Mellitus and Its Chronic Complications. International Journal of Endocrinology. 2019;Vol (Issue):1-8
6. Yamada H, Gabuzda TG. Article title. J. Lab Clin. Med; 1974; 83:477-88
7. American Diabetes Association. Report of the expert committee on the diagnosis and classification of diabetes mellitus Diabetic Care 1998; 21 (Suppl 1):5-19
8. Steele T, Rieselbach R. The renal mechanism for urate homeostasis in normal man. The American Journal of Medicine. 1967;43(6):868-75
9. Fanelli GM. Urate Excretion. Annual Review of Medicine.1977;28:349-54
10. Steele TH, Rieselbach RE. The renal mechanism for urate homeostasis in normal man. Am J Med. 1967 Dec;43(6):868-75
11. Dehghan A, van Hoek M, Sijbrands EJ, Hofman A, Witteman JC. High serum uric acid as a novel risk factor for type 2 diabetes. Diabetes Care. 2008;31(2):361-2
12. Cook D, Shaper A, Thelle D, Whitehead T. Serum uric acid, serum glucose and diabetes: relationships in a population study. Postgraduate Medical Journal. 1986;62(733):1001-1006
13. Kodama S, Saito K, Yachi Y. Association between serum uric acid and development of type 2 diabetes. Diabetes Care. 2009;32(9):1737-1742