ORIGINAL RESEARCH PAPER

Obstetrics & Gynaecology

A STUDY OF ASSOCIATION OF FIRST TRIMESTER SERUM URIC ACID LEVELS WITH DEVELOPMENT OF GESTATIONAL DIABETES MELLITUS

KEY WORDS: Gestational diabetes mellitus, OGTT, First trimester, Serum uric acid levels.

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ABSTRACT

Objectives: GDM is a major pregnancy complication that can cause maternal and foetal morbidity and mortality . A substantial amount of research suggests that uric acid may be a major risk factor for the development of diabetes in women. The purpose of this research was to determine whether early pregnancy maternal blood uric acid levels and the onset of gestational diabetes mellitus are interrelated. **Methods:** The prospective observational study was conducted in Government general hospital, Kurnool from November 2023 to May 2024. Pregnant women of gestational age up to 13 weeks who visited the OBG outpatient department for regular antenatal check-ups during this time period were enrolled in the study with prior consent. **Result:** In our study, among the 360 pregnant women, 43 (12%) developed GDM. Of these Women with GDM 34 (79.07%) had uric acid levels above 3.5 mg/dl and 9 women (20.93%) with GDM had uric acid levels below 3.5 mg/dl. In present study, the serum Uric acid levels with the criteria of >3.5mg/dl , demonstrated that sensitivity of 80.95% and specificity of 97.16%. **Conclusion:** There is a strong association between the onset of GDM and an elevated serum uric acid level during the first trimester. A 3.5 mg/dl cut-off level appears to have good sensitivity and specificity.

INTRODUCTION

Gestational diabetes mellitus (GDM) is defined as carbohydrate intolerance of variable severity, with an onset or first recognition during pregnancy, whether insulin or only diet modification is used for treatment and whether or not the condition persists after pregnancy.(1)

Despite significant advancements in medical science, medical practitioners still encounter adverse pregnancy outcomes (APO) such as pre-eclampsia, perinatal growth disorders, gestational diabetes mellitus, and hypertension. Of these, gestational diabetes mellitus (GDM) has raised the most concerns due to its high prevalence, accounting for 7–25% in the world.(2-4)The prevalence of GDM in India is ranging from 3 to 35% (5-9).The Prevalence of GDM in Andhra Pradesh was (17.20–21.81%) (10)

GDM is a major pregnancy complication that can cause maternal and foetal morbidity and mortality (11) The xanthine oxidase enzyme produces uric acid, which is the final byproduct of purine metabolism. A substantial amount of research suggests that uric acid may be a major risk factor for the development of diabetes in women.(12)

The purpose of this research was to determine whether early pregnancy maternal blood uric acid levels and the onset of gestational diabetes mellitus are interrelated. Early detection and precise diagnosis of gestational diabetes mellitus are critical for prompt intervention and the best possible outcome for both mother and baby.

So that women can be counselled regarding increased risk for development of GDM. This study provides evidence that a simple new marker such as uric acid can be used to predict the development of GDM.

MATERIALS AND METHODS

The prospective observational study was conducted in Government general hospital, Kurnool from November 2023 to May 2024. Pregnant women of gestational age up to 13 weeks who visited the OBG outpatient department for regular antenatal check-ups during this time period were enrolled in the study with prior consent.

We collected data on demographic information, obstetrical and family history. Measurements of height, weight, and BMI were made. The LMP was used to calculate the gestational age, which was then confirmed by ultrasound. Along with other standard serological investigation, blood samples were obtained for the purpose of estimating serum uric acid. RBS testing done to exclude pre gestational diabetes mellitus.

Using an enzymatic uricase technique and a Beckman Coulter AU 480, the level of serum uric acid was measured. Regardless of the patient's most recent meal, a one-step test (DIPSI) utilizing a 75g oral glucose load was performed to detect GDM at 24 to 28 weeks of gestation. A blood sample was also taken to estimate the patient's S. uric acid levels.

Inclusion Criteria

1. Antenatal women in first trimester of pregnancy attending the OPD (13 weeks)

Exclusion Criteria

1. Women with pregestational diabetes
2. Chronic hypertension
3. Chronic renal disease
4. Chronic liver disease
5. Autoimmune disorders
6. GOUT
7. Women on drugs causing hyperuricemia

Ethical and scientific committee approval was obtained for the study.

Table 1: Age Distribution

Age in years	Number of patients	Percentage
19-24	147	40.8
25-29	127	35.2
30-34	66	18.4
35-39	20	5.6
TOTAL	360	100

Table 2: Parity Distribution

Parity	Number of patients	Percentage
Primi	194	53.9
Multi	166	46.1

TOTAL	360	100

Table 3: BMI Distribution

BMI	Number of patients	Percentage
<18.5 Underweight	54	15
18.5-24.9 Normal	201	55.8
25-29.9 Overweight	84	23.4
>30 Obese	21	5.8
TOTAL	360	100

Table 4: High Risk Factor Distribution

High Risk Factors	Number of Patients	Percentage
Present	33	9.2
Absent	327	90.8
TOTAL	360	100

Table 5 : Serum Uric Acid Levels

Serum uric acid level (mg/dl)	Number of Patients	Percentage
<3.5	318	88.3
>3.5	42	11.7
TOTAL	360	100

RESULTS:

In our study, 385 pregnant women in total were included; of them, 4 (1.04%) had an abortion and 21 (5.45%) were lost to follow-up. After follow-up, 43 (12%) of the 360 prenatal women who were still available for study developed GDM.

The majority of the women (40.8%) belonged to the 19–24 years of age group. With a BMI of 18.5-24.9 in 201 (55.8%), the majority of the women were Primi gravidas (53.9%). Of the 43 individuals (12%) with a higher serum uric acid level, 34 had GDM.

Table 6: OGTT Results

OGTT	Number of Patients	Percentage
Normal	317	88
Abnormal	43	12
TOTAL	360	100

Table 7: Comparison Of Baseline Demographics Between Patients With And Without GDM

Baseline demographic	GDM No	GDM Yes	Total
Age(years)			
19-24	131 (41%)	16 (37.21%)	147 (40.8%)
25-29	117 (36%)	10 (23.26%)	127 (35.2%)
30-34	57 (19%)	9 (20.93%)	66 (18.4%)
35-39	12 (4%)	8 (18.60%)	20 5.6%)
Gravida			
Primi	176 (55.52%)	18 (41.86%)	194 (53.9%)
Multi	141 (44.48%)	25 (58.14%)	166 (46.1%)
BMI (kg/m2)			
<18.5	48 (15.14%)	6 (13.96%)	54 (15%)
18.5-24.9	174 (54.89%)	27 (62.79%)	201 (55.8%)
25-29.9	76 (23.98%)	8 (18.60%)	84 (23.4%)
>30	19 (5.99%)	2 (4.65%)	21 (5.8%)
High Risk factors			
Present	14 (4.42%)	19 (44.19%)	33 (9.2%)
Absent	303 (95.58%)	24 (55.81%)	327 (90.8%)
Serum Uric Acid levels (mg/dl)			
<3.5	309 (97.48%)	9 (20.93%)	318 (88.3%)
>3.5	8 (2.52%)	34 (79.07%)	42 (11.7%)

DISCUSSION:

One of the most prevalent metabolic illnesses during pregnancy is gestational diabetes mellitus, which has a variable prevalence in India and around the world. Because GDM affects both the mother and the foetus, it is important to identify it early and implement appropriate treatment. It is linked to a number of maternal complications, including macrosomia, stillbirth, birth injuries, hypoglycemic episodes after delivery, hyperbilirubinemia, RDS, preterm deliveries, polyhydramnios, stillbirths, and higher rates of LSCS and in fetus CNS, cardiac, and genitourinary anomalies and NTD. The xanthine oxidase is the enzyme that produces uric acid, which is the final byproduct of purine metabolism Due to the increased GFR or reduced proximal tubular reabsorption , there is a decrease in the serum uric acid levels in the first trimester in normal Pregnant women(13)

At physiological concentrations, uric acid has a beneficial impact on blood–brain barrier stability, free radical scavenging, and antioxidation(14) Higher levels of blood uric acid in the first and middle trimesters of pregnancy lead to pre-existing metabolic disturbances, which make it difficult for mothers to adapt in the later months of pregnancy and predispose them to gestational diabetes mellitus. It has also been shown that hyperuricemia increases the risk of type 2 diabetes and cardiovascular disorders (15,16)

In addition, with the potential function of antioxidant, Additionally, it has been reported that Uric Acid levels has been linked with degenerative conditions including osteoporosis (17).

According to Nakagawa et al, (2007) Uric acid causes endothelial dysfunction and inhibits the production of nitric oxide. For "insulin-mediated glucose uptake into cells in skeletal muscles and adipose tissue," nitric oxide is beneficial (18). Insulin resistance develops as a result of decreased nitric oxide, which also lowers glucose uptake into the cells (19).

An alternative hypothesis suggests that elevated uric acid can cause adipocytes to experience "insulin resistance, inflammation, and oxidative stress," all of which are factors in the development of metabolic syndrome(20) The age at which the risk of GDM considerably increases is a topic of debate.

The American Diabetes Association recommends a 25-year cut-off, which is the lowest cut-off in the literature; nevertheless, there is not much data to support this recommendation (21).

Hyperuricemia has also been linked to metabolic syndrome markers like obesity and dyslipidemia. (22-25) Several factors influence uric acid levels, including ethnicity, obesity, age, metabolic syndrome, and a purine-rich diet, all of which are associated with the risk of GDM (26,27).

According to Li et al. (2013), there was a positive and independent correlation between the UA level at 16–18 weeks of gestation and an elevated risk of GDM; the risk increased by 55.7% for the highest UA quartile(28) Monitoring UA after 13–18 weeks of gestation is crucial, as evidenced by a cohort research involving 85,609 pregnant women that revealed an increased risk of GDM due to elevated first-trimester UA levels. (29) The detection of UA in saliva from pregnant women can be used to predict risk of GDM in pregnancy and it is a noninvasive, convenient, and affordable method (30)

Other studies, such as Ganta et al, found that patients with a BMI of 25-29.9 (overweight) had a higher risk of developing GDM. In our study, patients with BMIs ranging from 18.5-24.9 had a significant rate of GDM. (31)

In Aparna et al, among 22 patients with serum uric acid levels >3.4mg/dl, 10 patients were diagnosed with GDM. (32) In Neeraj et al study, among 54 patients with serum uric acid levels >3.4mg/dl, 24 patients were diagnosed with GDM. (33) Similarly in our study, we found that 42 patients are with serum uric acid level >3.4mg/dl and among those 34 patients are diagnosed as GDM which is significantly associated. In Neeraj et al, 40 patients who had high risk factors ,14 patients (48.15%) developed GDM, whereas in our study among 33 patients who presented with high risk factors 19 patients (44.19%) are diagnosed with GDM. Neeraj et al reported that

Serum Uric acid levels with criteria of >3.5mg/dl was found that sensitivity of 88.9% and specificity of 90.3%. In present study, the serum Uric acid levels with the criteria of >3.5mg/dl , demonstrated that sensitivity of 80.95% and specificity of 97.16%.

CONCLUSION

There is a strong association between the onset of GDM and an elevated serum uric acid level during the first trimester. A 3.5 mg/dl cut-off level appears to have good sensitivity and specificity. We recommend routine testing for serum uric acid levels during the first antenatal visit as a reliable predictor for diagnosis of GDM.

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