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An observational study to evaluate the potential of Serum Uric Acid as a predictive marker for diagnosing Gestational Diabetes Mellitus during the first trimester

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Abstract

Introduction: - The presence of elevated uric acid levels during pregnancy has been found to be associated with a higher risk of unfavourable outcomes, including gestational diabetes mellitus. This study seeks to investigate the hypothesis that an increase in uric acid levels during the first trimester of pregnancy is linked to the development of gestational diabetes in later stages.

Material and Methods: - In this study, all pregnant women under 12 weeks of gestation were enrolled after providing informed consent. Blood samples were obtained for serum uric acid analysis, and these individuals were subsequently monitored with an oral glucose tolerance test between twenty-four and twenty-eight weeks of pregnancy.

Results: - The average age of expectant mothers was 29.84 ± 4.94 years. The average height and weight were 151.52 ± 7.49 cm and 50.60 ± 6.88 kg respectively. The body mass index of the participants was 22.13 ± 3.31 kg/m2. The average gestational age of pregnant women was 11.14 ± 1.30 weeks. The average uric acid level was 3.81 ± 1.24 mg/dl. The chi-square test yielded a significant p value of 0.018 in this research study.

Conclusion: - Elevated uric acid levels during the initial trimester can serve as a dependable indicator for forecasting the development of gestational diabetes mellitus during subsequent stages of pregnancy.

Keywords:- Serum uric acid, Gestational diabetes mellitus, Maternal risk factor, BMI, Birth weight.

INTRODUCTION

Gestational diabetes is when a pregnant woman has trouble processing carbohydrates, and it can be mild or severe. It's usually detected during pregnancy, with a prevalence of 1 to 14%. African American and Asian women tend to have higher rates of GDM compared to Caucasian women.

Screening typically happens between 24 to 28 weeks to prevent issues for both the mother and baby. Women with GDM are more likely to have operative deliveries, C-sections, and complications like shoulder dystocia, large babies, and low blood sugar in newborns.

Women diagnosed with gestational diabetes mellitus (GDM) are also at a higher risk of developing diabetes later in life. According to the HAPO study, there is no specific threshold at which these negative events occur for both the mother and the foetus. The primary approach to treatment still revolves around medical nutrition therapy, glycaemic profile monitoring, and insulin therapy.

The normal range for serum uric acid levels is typically between 2 to 6.5 mg/dl. During early pregnancy, there is a decrease in serum uric acid due to an increase in glomerular filtration rate (GFR). Uric acid is a byproduct of purine metabolism and is produced by the enzyme xanthine oxidase. Hypoxia, placental ischemia, and cytokines like interferon stimulate the expression of xanthine oxidase, leading to an increase in uric acid production and

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reactive oxygen species. Serum uric acid levels are closely associated with hypertension, obesity, hyperinsulinemia, and dyslipidaemia, suggesting its potential involvement in the metabolic syndrome.

There is compelling evidence indicating a strong association between hyperuricemia and metabolic syndrome as well as type 2 DM within the general population. Uric acid plays a role in the development of insulin resistance by impairing endothelial function and reducing nitric oxide levels in epithelial cells. Additionally, it triggers inflammation and oxidative stress in adipocytes.

MATERIALS AND METHODS: -

This study is a prospective cohort study that spanned over a duration of 18 months. It focused on 210 antenatal women in their first trimester who were attending the outpatient department (OPD) in a tertiary care centre. Prior to conducting the study, ethical clearance was obtained from the Institutional Ethics Committee (IEC), and informed, written consent was obtained from all participants. Initially, the sample size was determined to be 210 based on previous studies. However, due to non-availability and non-responsiveness, the sample size had to be reduced to 106.

Inclusion criteria:

All antenatal women in their first trimester of pregnancy, who are not diagnosed with diabetes and are less than 12 weeks pregnant.

Exclusion criteria:

1. Women with hypertension.
2. Women with renal disease.
3. Women with liver disease.
4. Women with gout.
5. Women who smoke or consume alcohol.
6. Women taking medications known to increase serum uric acid levels, such as Aspirin, phenothiazines, and diuretics.

Methodology :-

- Venous blood samples were obtained from pregnant women in their first trimester, specifically those who were less than 12 weeks pregnant.
- The blood samples were processed through centrifugation, and the serum uric acid levels were determined using a colorimetric assay method with a detection range of 0.2-20mg/dl.
- These women will undergo a follow-up examination at 24-28 weeks of gestation to conduct an oral glucose tolerance test. This test involves collecting blood sugar levels after an overnight fast of 8-10 hours, followed by the administration of 75 grams of oral glucose dissolved in plain or lime water to enhance patient compliance.
- Venous blood samples are then collected after fasting, as well as one hour and two hours after glucose ingestion, and evaluated for gestational diabetes mellitus (GDM) based on the criteria set by the American Diabetes Association (ADA).

RESULT :

Table 1: Age category of the patient

Age Category	Frequency	Percent
20-25	20	18.9
26-30	49	46.2
31-35	22	20.8
36-40	13	1.9
41-45	2	1.9
Total	106	100.0

Table 2: Parity

Obstetric Code Category	Frequency	Percent
Multi	49	46.2
Primi	57	53.8
Total	106	100.0

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Table 3: Serum uric acid category

Serum uric acid category	Frequency	Percent
Elevated (>4.2)	42	39.6
Normal (<4.2)	64	60.4
Total	106	100.0

Table 4: GTT results

GTTresults	Frequency	Percent
Normal	95	89.6
Positive	11	10.4
Total	106	100.0

Table 5: Cross tabulation of serum uric acid category with GTT results

			GTT Results		
			Normal	Positive	Total
Serum Uric Acid Category	Elevated	Count	34	8	42
		%within Serum Uric Acid Category	81.0%	19.0%	100.0%
	Normal	Count	61	3	64
		%within Serum Uric Acid Category	95.3%	4.7%	100.0%
Total		Count	95	11	106
		%within Serum Uric Acid Category	89.6%	10.4%	100.0%
Chi-Square– 5.62, P-value– 0.018 (Significant)					

Discussion:

The central focus of this study is to examine the usefulness of assessing uric acid concentrations during the first trimester of pregnancy as a means to predict the prevalence of diabetes that may arise during pregnancy.

Successfully treating pregnant mothers can reduce complications for both the mother and the baby. Our research found that the average age of pregnant mothers in our study was 29.8 years, which is similar to a study conducted by Laughon SK et al.8, where the average age was 25.1 years. It is also comparable to a research study by Wolak T et al.9, which reported an average age of 29.5 years.

In terms of gestational age, our study found that the mean gestational age was 11.14 ± 1.3 weeks, which is almost similar to Laughon SK et al.'s study, where the mean gestational age was 8.9 ± 2.5 weeks. Another study by Baliga P et al.10 reported a mean gestational age of 12 weeks plus 3 days, which is close to our findings.

Regarding primiparity, our study found that 53.8% of the participants were primi, which is identical to a research study conducted by Rasika C et al.11, where primi represented 51.4%. This finding is also similar to the study by Ganta SJ et al.12, where primi represented 55.8%. However, a research study by El-Gharib et al.13 reported that 24.8% of the participants were primi.

In terms of mean uric acid levels, our study found that the mean uric acid level was 3.81. This is similar to a research study conducted by Aker SS et al.14, where the mean uric acid level was 3.72 ± 1.14 mg/dl. Laughon SK et al.'s study reported a mean uric acid level of 3.08 ± 0.85 mg/dl, which is also similar. Baliga et al.'s research study reported a mean uric acid level of 2.83 mg/dl, which is almost similar to our findings.

In our study, we used the IADPSG-ADA criteria to interpret the values of the oral glucose tolerance test (OGTT). According to these criteria, any two of the values with fasting ≥ 95mg%, one hour ≥ 180 mg%, and two hours ≥ 155mg% were considered positive for gestational diabetes mellitus (GDM). In our study, 10.4% of the participants tested positive for GDM. This prevalence is almost similar to the study.

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The prevalence of gestational diabetes mellitus (GDM) was found to be higher in individuals with a serum uric acid (UA) cut-off of 5.5, as indicated in the study conducted by Wolak et al. This finding aligns with the observations made by Rao et al., who reported that an elevated level of UA in the first trimester of pregnancy increased the risk of developing diabetes during pregnancy in South Indian mothers. Additionally, Rao et al. determined that a cut-off point of 3.2 mg/dl for serum uric acid level demonstrated good specificity and sensitivity in predicting GDM ($p<0.05$). These results are consistent with the findings of El-Gharib et al., who also identified a cut-off point of 4 mg/dl for UA.

In our study, among individuals with elevated serum UA levels, 19% tested positive for glucose tolerance test (GTT), while only 4.7% of those with normal serum uric acid levels had a positive GTT result. This contrasts with the study conducted by Baliga et al., where only 2.28% of individuals in the elevated UA category developed GDM. Furthermore, Ganta et al. investigated 312 participants and found that 84% of those with diabetes during pregnancy had UA levels exceeding 3.5 mg%, while 15.9% had UA levels below 3.5 mg%. The lower occurrence of GDM in our study may be attributed to the smaller study population.

CONCLUSION :

The findings and research approach utilized have led us to determine that there is a heightened risk of gestational diabetes mellitus (GDM) with elevated serum uric acid levels during the initial trimester of pregnancy. Particularly, uric acid levels during the first 12 weeks of gestation show a more pronounced association with the risk of developing GDM.

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Conflict of interest:- None

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