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Relationship between serum liver enzymes, albumin, uric acid, creatinine and gestational diabetes mellitus

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Aim: To assess the relationship between biochemical parameters of serum liver enzymes, albumin, uric acid, creatinine in women with GDM and pregnant women with normal glucose tolerance.

Methods: a total of 134 women with pregnancy were evaluated, 54 of whom had GDM and 80 women without history of any complication of pregnancy were taken as control. All the women had estimation of serum liver enzymes (AST, ALT), albumin, uric acid and creatinine between 24 and 28 weeks of gestation.

Results: Creatinine levels were slightly increased in GDM group than in the control group (0 .62±.11 vs 0.59±.09 mg/dL) but they were not statistically significant (p>0.05).Serum Uric acid levels in GDM were higher than the control group but elevation was not statistically significant(5.73± 1.35 vs 4.70± .93 mg/dL) (p>0.05).Serum albumin levels in GDM group was mildly decreased when compared with normal glucose tolerance group(3.30± .33 vs 3.36±.29 g/dL) but there was no statistical significance p>0.05.The liver enzymes ALT and AST in GDM group were 39.92± 33.02 vs 37.57± 38.86 IU/L and 46.40± 40.04 vs 41.81± 42.47 IU/L respectively when compared with normal pregnant women. The serum creatinine levels correlated significantly and positively with those of serum uric acid p<0.05, while the serum creatinine and serum uric acid levels correlated negatively with those of serum albumin but it was not statistically significant p>0.05.

Conclusion: In this cross-sectional study patients with GDM had higher levels of creatinine and uric acid but they did not reach statistically significant levels when compared with women with normal glucose tolerance. The liver enzymes levels of ALT and AST in GDM group were higher than non GDM group but they were not statistically significant.

Introduction

GDM is defined as a hyperglycaemia of variable severity with onset or first recognition during pregnancy because of glucose intolerance (1). It is a common antepartum condition affecting about 9–25% of pregnancies worldwide (2,3), differences in rates are due to differing populations studied and the diagnostic criteria applied. Pregnancy is characterized by a number of metabolic changes that leads to lipid deposition in early pregnancy and eventually leads to insulin resistance and lipolysis in late pregnancy. The ability of Insulin to suppress

lipolysis in GDM is reduced more compared to women with normal glucose tolerance (4) that results in greater postprandial increases in free fatty acids, increased hepatic glucose production, and severe insulin resistance (5).

In normal pregnancy GFR increases that leads to decreased levels of serum creatinine levels and serum uric acid levels.

Increased levels of creatinine during pregnancy is associated with rates of maternal mortality and fetal loss that range from 30 to 60%, making it a life-threatening event (6) and may also signify impending renal disease in GDM patients. The raised Uric acid level are considered a part of metabolic syndrome due to insulin resistance (7) that features in GDM.

The reduced albumin levels in GDM and altered liver function measured by the enzyme activity of AST and ALT may be seen because of its effect on liver, as liver plays an important role in regulating the metabolism of carbohydrates.

The objective of this study was to find out if there are significant changes in various liver and kidney biomarkers in GDM patients that may help to recognize and prevent complications related to it.

Material and methods

After obtaining the written consent from all the subjects, pregnant women with gestational age of more than 24 weeks, who attended the Department of Obstetrics and Gynecology of our institute (GMC Srinagar) were subjected to a 50g oral glucose challenge test (OGCT). Among them those who met the criteria of ≥140mg/dl of venous plasma glucose after 1 hour were subjected to a 75g oral glucose tolerance test (OGTT) to confirm GDM by using the IADPSG criteria.

A total of 134 women with pregnancy were enrolled, 54 of whom had GDM and 80 women without history of any complication of pregnancy were taken as control respectively.

Venous blood samples were collected aseptically from both the groups of patients for estimating serum creatinine, uric acid, AST, AST, ALT and albumin after obtaining proper obstetric history from all the patients.

Table 1: IADPSG Criteria for a positive 75 gm OGTT in pregnancy (24-28 weeks gestation).

	Fasting plasma glucose	*1hour plasma glucose*	*2-hours plasma glucose*
IADPSG and American Diabetes Association	≥92 mg/dl	≥180 mg/dl	≥153mg/dl

*Fasting glucose> 126mg/dl: Overt diabetes; *One or more values > threshold: GDM; *All 3 values < threshold: Normal

Statistics

The data was expressed as mean ± standard deviation (SD). SPSS version 26 was used for all the statistical calculations by applying the independent samples t-test and the Pearson's correlation test

A p-value of <0.05 was considered as statistically significant.

Results

The maternal age ranged between 22–36 years in GDM group with slightly higher mean of 29.36 years while in non GDM group it ranged from 21-38 years with mean age of 28.76 years with p value of 0.03 Most of the women in GDM group were of >25 years of age. This

finding is in agreement with other studies done previously.

In GDM group 29% of women had their first pregnancy while as 71% were multiparous.

Creatinine levels were slightly increased in GDM group than in the control group (0.62±.11 vs 0.59± .09 mg/dL) but they were not statistically significant p>0.05.Serum Uric acid levels in GDM group were higher than the control group but elevation was not statistically significant (5.73± 1.35 vs 4.70± .93 mg/dL) p>0.05.

Serum albumin levels in GDM group were mildly decreased when compared normal glucose tolerance group (3.30± .33 vs 3.36±.29 g/dL) but there was no statistical significance p>0.05.

The liver enzymes ALT and AST in GDM group were 39.92± 33.02 vs 37.57± 38.86 IU/L and 46.40± 40.04 vs 41.81± 42.47 IU/L respectively when compared with normal pregnant women.

On performing correlation analysis, we found that the serum creatinine levels correlated significantly and positively with those of serum uric acid p<0.05,while the serum creatinine and serum uric acid levels correlated negatively with those of serum albumin but it was not statistically significant p>0.05(Table2).

	GDM (n=54) (Max-Min)	Non GDM (n=80) (Max-Min)	p value
Age(years)	29.39±3.42 (22-36)	28.76± 3.30 (21-38)	.031*
Parity	P=16,M=38	P=22,M58	-
ALT (IU/L)	39.92 ±33.02 (6.00 -126.00)	37.57±38.86 (6.00-215.00)	.522
AST(IU/L)	46.40±40.04 (10.00-196.00)	41.81±42.47 (8.0-229.0)	.651
Uric acid (mg/dL)	5.73±1.35 (3.00-10.90)	4.70± 0.93 (2.50-7.90)	.717
Albumin(g/dL)	3.30±0.33 (2.60-4.10)	3.36±0.29 (2.70-4.40)	.679
Creatinine(mg/dL)	0.62±0.11 (0.50-1.00)	0.59±0.09 (0.50-1.00)	.055
Hba1c(%)	6.12±0.99 (4.50-9.10)	4.72±0.23 (4.20-6.50)	.327

Table 2: The distribution of clinical and biochemical parameters between GDM and normal glucose tolerance groups.

		Albumin GDM	Creat GDM	UA GDM
Albumin GDM	Pearson Correlation	1	-.134	-.227
	P value		.334	.099
Creat GDM	Pearson Correlation	-.134	1	.427**
	P value	.334		.001
UA GDM	Pearson Correlation	-.227	.427**	1
	P value	.099	.001	

Table 3: Correlation between various parameters in GDM patients.(Creat=creatinine,UA=Uric Acid)

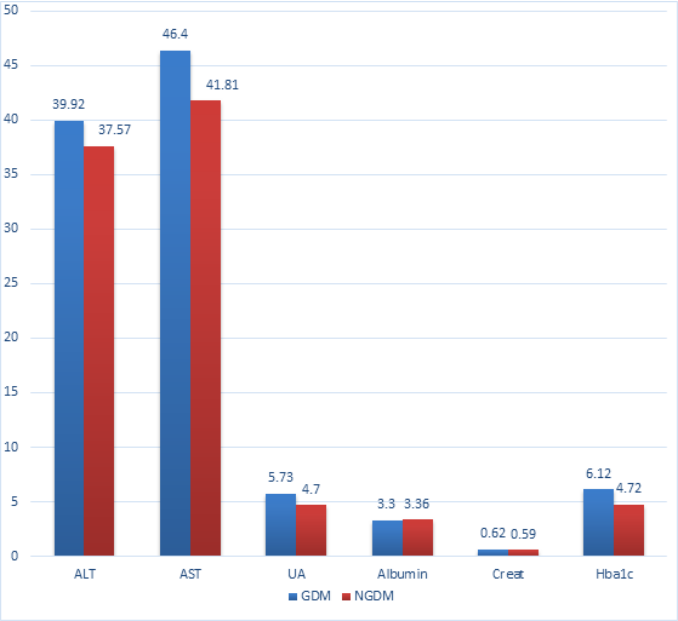

Figure 1: Comparison of key parameters between GDM and NGDM (mean value)
(GDM-gestational diabetes; NGDM-non gestational diabetes)

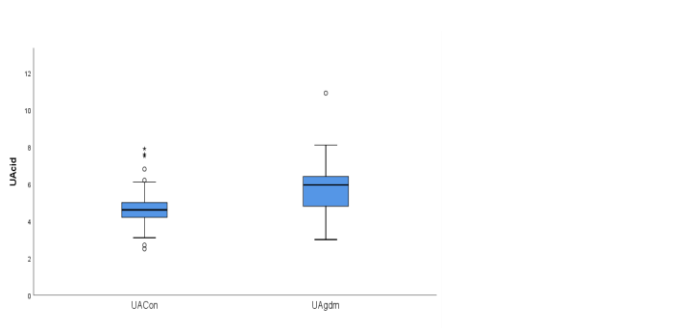

Figure 2: box and whisker plot for serum Uric Acid of GDM group and non GDM group

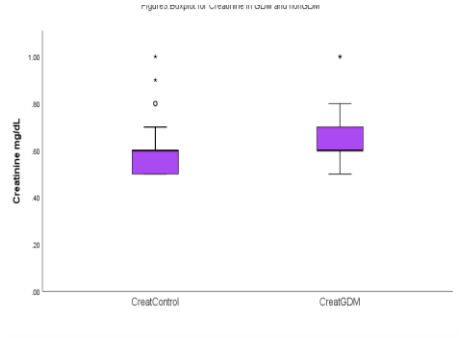

Figure 3: box and whisker plot for creatinine in GDM and non- GDM group(control group).

Discussion

GDM like type 2 diabetes is characterized by insulin resistance and relative insulin deficiency as a result of reduction in β-cell function and mass (8, 9). Women with GDM have tendency to develop type 2 diabetes later in life with a 50% greater risk (10). This study was done so as to compare the important renal and liver parameters that are affected by GDM and are easily available tests. This may help to identify the complications arising out of the derangements of these biochemical parameters accompanying this disorder and the insulin resistance persisting beyond pregnancy that may lead to type 2 diabetes.

In our study we found that increasing maternal age >25 years (mean of 29 years) was associated with GDM, this is in conformity with several studies done previously (11). As seen in HAPO and other studies, women with GDM also have an increased possibility of gestational hypertension and preeclampsia (1). The mechanism responsible for this relates to insulin resistance seen in GDM that affects trophoblast invasion leading to impaired placentation (12).

The liver plays an important role in maintaining glucose homeostasis. Also, liver fat is considered a key feature of insulin resistance and NAFLD, higher ALT/AST may

imply relatively worse metabolic status and previous studies in Asian populations suggested ALT/AST was a good predictor of insulin resistance (13) a feature GDM shares with type 2 diabetes. In our study AST and ALT were higher than the control group but they did not reach statistically significant levels. The albumin levels in the blood signify the synthetic function of the liver, in our study there was not much difference between the GDM and non GDM group although in GDM group it was slightly on lower side (3.30 vs 3.36 in GDM and non GDM).

The higher uric acid level in our study can be explained to be a component of metabolic syndrome (7) that is as a result of insulin resistance. Uric acid levels in our study were higher in the diabetic patients, but this elevation was not statistically significant similar to the result of study by Gungor ES et al (7). In our study it has shown positive correlation with creatinine in GDM group and correlation was statistically significant $p>0.05$. High uric acid level in pregnancy has been shown to increase the risk of preterm birth, low Apgar index, IUGR, and neonatal death (14).

In our study creatinine level in GDM group was higher than non GDM group. Higher serum creatinine level can be a marker of a future renal disease in GDM, so it's important to follow this in post pregnancy period to prevent progression to chronic kidney disease. In study by Gungor ES et al creatinine levels were higher in the GDM group than in the control group. But a study by Tarim et al reported higher levels of creatinine but not statistically significant. (15,16)

The limitation of our study was relatively small sample size. Further studies involving larger population into this can be beneficial and economical.

Conclusion

In this cross-sectional study patients with GDM had higher levels of creatinine and uric acid but they did not reach statistically significant levels when compared with women with normal glucose tolerance. The liver enzymes levels of ALT and AST in GDM group were higher than non GDM group but they were not statistically significant. The higher uric acid level in our study can be explained to be a component of metabolic syndrome that is as a result of insulin resistance that characterizes GDM while the higher creatinine values in GDM can be followed up to prevent development of chronic renal disease later on.

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