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ROLE OF MATERNAL SERUM TRIGLYCERIDES IN PREDICTION OF EARLY ONSET PREECLAMPSIA AND ITS CORRELATION WITH UTERINE ARTERY DOPPLER

Dr Mahi Faiz*	Junior Resident, Department of Obstetrics and Gynaecology, Ganesh Shanker Vidyarthi Memorial, Medical College, Kanpur, Uttar Pradesh, India. *Corresponding Author
Prof. Shaily Agarwal	MS, Professor, Department of Obstetrics and Gynaecology, Ganesh Shanker Vidyarthi Memorial Medical College, Kanpur, Uttar Pradesh, India.
Prof. Neena Gupta	MS, Professor & Head, Department of Obstetrics and Gynaecology, Ganesh Shanker Vidyarthi Memorial Medical College, Kanpur, Uttar Pradesh, India.
Prof. Renu Gupta	Professor, Department of Obstetrics and Gynaecology, Ganesh Shanker Vidyarthi Memorial, Medical College, Kanpur, Uttar Pradesh, India.
Dr. Divya Tripathi	MS, Associate Professor, Department of Obstetrics and Gynaecology, Ganesh Shanker, Vidyarthi Memorial Medical College, Kanpur, Uttar Pradesh, India.

ABSTRACT According to the ICD-10, pre eclampsia is diagnosed when a previously normotensive woman develops hypertension (systolic BP >140 mmHg and diastolic BP >90 mmHg) after 20 weeks of gestation. S. triglycerides and Uterine artery Doppler have been identified as reliable predictors for early onset pregnancy. After analysis 52 were pre eclampsia out of 200 antenatal women. **Methods:** Total 230 Subjects were antenatal women with age 18-45 years attending OPD of G.S.V.M. Medical College, Kanpur. Inclusion criteria were an 18 – 45 years pregnant women**,** all antenatal women attending OPD in 11 to 28 weeks, women willing to follow up in the study. Exclusion criteria were women with preexisting renal disease**,** chronic hypertension, multiple gestation**,** diabetes mellitus, BMI >25**,** smoking habits. **Results:** The sensitivity, specificity, PPV and NPV of maternal serum triglycerides for early prediction of PE was found to be 75%,88%, 70% and 91% respectively in mid 2nd trimester(26 to 28week), whereas same parameters for MAP and Uterine artery doppler(Mean PI) are 92%, 70%, 52% and 96%, 99%, 98%,97% respectively. So, as a diagnostic marker, though serum triglyceride is inferior to MAP and uterine artery doppler(mean PI) but still it is having fairly good diagnostic accuracy(85%). Prediction of PE can be done using a cut off value of serum triglycerides> 172mg/dl with the sensitivity of 92% and specificity 99%. **Conclusion:** The study suggests that maternal serum triglycerides can serve as an early biomarker for predicting early-onset preeclampsia, enhancing the accuracy of early-onset preeclampsia prediction.

KEYWORDS : Pre eclampsia, Normotensive, Uterine artery doppler, MAP, Serum triglycerides, Predictors

INTRODUCTION

According to the ICD-10, preeclampsia (PE) is diagnosed when a previously normotensive woman develops hypertension (systolic BP ≥140 mmHg and diastolic BP≥90 mmHg) after 20 weeks of gestation, accompanied by proteinuria (30 mg/dl or 1+ on a dipstick test). In these Pre eclamptic women, the placenta may appear normal or show minimal abnormalities.[1]

Mean arterial pressure (MAP) is defined as the average arterial pressure over one cardiac cycle, influenced by cardiac output and systemic vascular resistance. MAP increases with maternal age and weight and decreases with maternal height. It is higher in women with a personal or family history of preeclampsia compared to parous women with no history of preeclampsia.[2]

Serum triglycerides have been identified as biomarkers for various metabolic disorders, including hypertension, and have been found to be reliable predictors of preeclampsia in several studies.[3] Hypertriglyceridemia, caused primarily by the increased entry of triglyceride-rich lipoproteins into the bloodstream, can be analyzed through a minimally invasive procedure. It directly contributes to endothelial dysfunction, leading to early-onset preeclampsia.[4]

The Doppler test uses sound waves to detect blood movement in vessels. Uterine artery Doppler is specifically used to monitor blood flow between the mother and the fetus, making it a crucial tool for managing high-risk pregnancies. Preeclampsia and eclampsia are responsible for nearly 10-15% of maternal deaths worldwide.[5]

Aim of this study examines the correlation between maternal serum triglyceride levels and early-onset preeclampsia (EOPE)development, uterine artery Doppler findings, and their predictive value in identifying high-risk pregnancies.

METHODS

This prospective study to analyze the experiences of antenatal women attending OPD Obstetric and Gynecological Department at G.S.V.M. Medical College, Kanpur, over a period of one year. Inclusion criteria were an 18 – 45 years pregnant women**,** all antenatal women attending OPD in 11 to 28 weeks, women willing to follow up in the study. Women with preexisting renal disease, chronic hypertension, multiple gestation, diabetes mellitus, BMI >25, smoking habits, or unwilling participants were excluded.

The study employed a simple random sampling technique to select antenatal women attending Obstetrics and Gynecology (OPD) from June 2022 to June 2024. Participants were divided into cases and control groups after diagnosing preeclampsia up to 34 weeks. All participants provided informed consent, were informed of the study's objectives, methods, and advantages, and were guaranteed their personal and medical data would remain confidential.

A predesigned questionnaire was used to collect relevant data, with informed consent obtained from every patient. Demographic details such as age, BMI, parity, residence, education, and socioeconomic status were collected. The study also recorded parameters such as body weight and height, blood pressure, serum triglycerides, and uterine artery Doppler.

The study plan involved measuring all variables at enrolment, reassessing them four weekly, following routine antenatal care until delivery, and determining the end point of preeclampsia before 34 weeks. Females developing preeclampsia were considered cases, while those not developing preeclampsia were considered control.

Results were calculated using appropriate statistical tools, including descriptive statistics for categorical variables, continuous variables, and ROC analysis. Descriptive statistics were reported as frequency and percentage, while continuous variables were presented as mean, median, standard deviation, and quartiles. Graphical representations were employed for data visualization, and appropriate tests of significance were applied to determine associations between variables. A p-value of less than 0.05 was considered significant.

RESULT:

Figure 1 Shows Distribution of Participants among comparison groups. Participants were enrolled in 1:3 ratio. 52(26%) were in pre eclampsia group and 148(74%) were in Normotensive group.

Table 1- Sociodemographic profile distribution and association between comparison groups

Variable		Preeclampsia (N=52)	Normotensive (N=148)	X^2	P value
		N(%)	N(%)		
Age	20-25 Years	22 (42.3%)	54 (36.5%)		
	26-30 Years	20 (38.5%)	72 (48.6%)		
	31-35 Years	10 (19.2%)	18 (12.2%)	3.990	0.298
	>35 Years	0 (0.0%)	4 (2.7%)		
	20-25 Years	52 (100.0%)	148 (100.0%)		
BMI	<18.5 Kg/m2	0 (0.0%)	1 (0.7%)		
	18.5-22.9 Kg/m2	30 (57.7%)	76 (51.4%)		
	23.0-24.9 Kg/m2	14 (26.9%)	43 (29.1%)	1.236	0.902
	25.0-29.9 Kg/m2	8 (15.4%)	27 (18.2%)		
	30.0-34.9 Kg/m2	0 (0.0%)	1 (0.7%)		
Parity	Primigravida	22 (42.3%)	78 (52.7%)	1.663	0.197
	Multigravida	30 (57.7%)	70 (47.3%)		
Family history of hypertension	Yes	1 (1.9%)	2 (1.4%)	0.085	1.000
	No	51 (98.1%)	146 (98.6%)		
Mode of Delivery	NVD	18 (34.6%)	96 (64.86%)	14.4	<0.001
	LSCS	34 (65.4%)	52 (35.13%)		

Table 1 shows sociodemographic profile distribution and association between comparison groups. In pre eclampsia group: 42.3% were in 20-25years, 38.5% were in 26-30 years, 19.2% were in 31-35 years and in normotensive group: 36.5% were in 20-25 years, 48.6% were in 26-30 Years, 12.2% were in 31-35 years, 2.7% were >35 years. The participants in the group pre eclampsia 26.9% had BMI: 18.5-22.9 Kg/m2, 15.4% of 23.0-24.9 Kg/m2,0.7% of 30.0-34.9 Kg/m2 and 51.4% of the participants in the group normotensive had BMI: 18.5-22.9 Kg/m2, 29.1% of 23.0-24.9 Kg/m2, 18.2% of 25.0-29.9 Kg/m2, 0.7% of 30.0-34.9 Kg/m2. In pre eclampsia group 42.3% were Primigravida and 57.7% were Multigravida but in normotensive 52.7% were Primigravida and 47.3% were Multigravida. 1.9% pre eclamptic and 1.4% of normotensive participants had family history of hypertension respectively. in pre eclamptic group 34.6% had NVD and 65.4% had LSCS, while in normotensive group 64.86% had NVD and 35.13% had LSCS.

Table 2- Predictors distribution and association between comparison groups

Predictors	Pre eclampsia (N=52)	Normotensive (N=148)	P value
	Mean ±SD	Mean ±SD	
MAP	111.83±6.73	98.27±8.79	<0.001
Serum Triglycerides	162.58 (13.03)	138.88 (15.95)	<0.001
Uterine Artery Doppler	1.74 (0.15)	1.94 (10.77)	<0.001

Table 2 illustrates predictors distribution and association between comparison groups MAP in preclampsia group had mean(SD) 111.83±6.73 and in normotensive was 98.27±8.79. Serum Triglycerides (mg/dl) was in preclampsia group had mean(SD) 162.58 (13.03) and in normotensive was 138.88 (15.95). The mean (SD) of Uterine Artery Doppler (Mean PI) in pre eclampsia group was 1.74 (0.15). The mean (SD) of Uterine Artery Doppler (Mean PI) in the normotensive group was 1.94 (10.77). All three predictors were statistically significant.

Table 3: Comparison of the Diagnostic Performance of Various Predictors

Predictor	AUROC	95% CI	P	Sn	Sp	PPV	NPV	DA
S.Triglycerides (mg/dl)	0.870	0.811-0.928	<0.001	75%	88%	70%	91%	85%
MAP	0.881	0.833-0.928	<0.001	92%	70%	52%	96%	76%
Uterine Artery Doppler (Mean PI)	0.975	0.944-1	<0.001	92%	99%	98%	97%	98%
S.Triglycerides (mg/dl) +MAP+Uterine Artery Doppler (Mean PI)	0.943	0.908-0.979	<0.001	94%	88%	73%	98%	90%

AUROC: Area under ROC curve; CI: Confidence interval; P: P value; Sn: Sensitivity; Sp: Specificity; PPV: Positive predictive value; NPV: Negative predictive value; DA: Diagnostic Accuracy.

Table 3 illustrates **Comparison of the Diagnostic Performance of Various Predictors** the area under the ROC curve (AUROC) for Serum Triglycerides (mg/dl) (2nd Visit) predicting early onset preeclampsia among comparison groups was 0.870 (95% CI: 0.811-0.928), it was statistically significant (p = <0.001) with sensitivity 75% and specificity 88%.The area under the ROC curve (AUROC) for MAP (2nd Visit) predicting early onset preeclampsia among comparison groups was 0.881 (95% CI: 0.833-0.928), it was statistically significant (p = <0.001) with sensitivity 92% and specificity 70%. The area under the ROC curve (AUROC) for Uterine Artery Doppler (Mean PI) predicting Early Onset Pre-Eclampsia among comparison groups was 0.975 (95% CI: 0.944 - 1),it was statistically significant (p = <0.001) with a sensitivity of 92%, and a specificity of 99%. The area under the ROC curve (AUROC) for S.Triglycerides (mg/dl) +MAP +Uterine Artery Doppler (Mean PI) predicting Group: Case vs Group: Control was 0.943 (95% CI: 0.908 - 0.979), thus demonstrating excellent diagnostic performance. It was statistically significant (p = <0.001). At a cutoff of S.Triglycerides (mg/dl) (2nd Visit)+MAP (2nd Visit)+Uterine Artery Doppler (Mean PI) ≥0.269, it predicts Group: Case with a sensitivity of 94%, and a specificity of 88%.

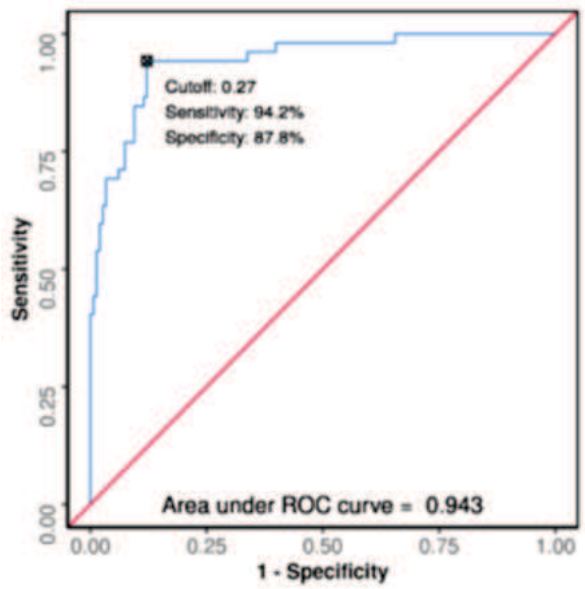

Table 4 demonstrates Foetal outcome association between comparison groups . The fetal outcome in reference to fetal heart pattern was reassuring in 65.38% of pre eclamptic and 97.7% of normotensive

participants while non reassuring fetal pattern was in 30.7% of pre eclamptic and 2.02% of normotensive participants. Term deliveries occurred in 75.6% pre eclamptic and 94.59% of normotensive participants while pre term deliveries occurred in 25% pre eclamptic and 5.4% normotensive participants. 59.6% and 93.9% had normal fetal growth while 40.38% in pre eclamptic and 6.08% normotensive participants had fetal growth restriction. the fetal outcome observed was that 96.15% pre eclamptic and 100% normotensive participants had alive baby while 3.8% pre eclamptic had IUD while none of the normotensive participants had IUD.

Table 4 -foetal Outcome Association Between Comparison Groups

Fetal Outcome	Preeclampsia (N=52)	Normotensive (N=148)	X^2	P value
	N(%)	N(%)		
Reassuring fetal heart pattern	34 (65.38%)	145 (97.7%)	43.7	<0.001
Non- Reassuring fetal heart pattern	16 (30.7%)	3 (2.02%)		
Term	39 (75.6%)	140 (94.59%)	15.7	<0.001
Preterm	13 (25.0%)	8 (5.40%)		
Normal Growth	31 (59.6%)	139 (93.9%)	35.5	<0.001
FGR	21 (40.38%)	9 (6.08%)		
Alive	50 (96.15%)	148 (100.0%)	5.75	0.016
IUD	2 (3.8%)	0 (0.0%)		

DISCUSSION:

Pregnancy-induced hypertension is a major contributor to maternal and perinatal illnesses and deaths worldwide. It's early prediction allows for preventive measures to avoid complications. Over the past 15-20 years, extensive research has focused on identifying early biophysical and biochemical markers for predicting preeclampsia. This study indicates that early changes in serum triglyceride levels are significant in the development of hypertensive disorders during pregnancy.

The prevalence of pre-eclampsia in this study was 26%.The three predictors i.e. S.Triglycerides (mg/dl), MAP and Uterine Artery Doppler (Mean PI) predicts early onset preeclampsia with a sensitivity of 94%, and a specificity of 88%. Chopra et al (2020) The mean (SD) of Uterine Artery Doppler (Mean PI) of cases was 211.05 (87.99) and controls was 146.93 (47.49) with sensitivity of 57.14%.[6] Narang et al (2016) mean (SD) 1.94 (0.55) controls and 1.42 (0.44) cases with 75.9% sensitivity.[7] Das et al (2022) shows sensitivity of 68% Uterine Artery Doppler (Mean PI).[5]

The fetal outcome observed was that 96.15% pre eclamptic and 100% normotensive participants had alive baby while 3.8% pre eclamptic had IUD while none of the normotensive participants had IUD. There was a significant difference between the comparison groups in terms of distribution of Fetal Outcome ($p = 0.016$), in comparison to other studies like in Chopra et al(2020) Out of 26 preeclamptic participants - 12 (46.15%) subjects had mild preeclampsia, 1(3.85%) developed severe preeclampsia, 2 (7.69%) had eclampsia with IUD, 8 had IUGR and remaining 3 subjects had only IUD.[6] In Narang et al(2016) out of 78, 32.05% developed IUGR and 11.54% preeclampsia. [7]

Studies have shown a link between lipid profiles and preeclampsia, suggesting that serum lipids could play a role in predicting and understanding this pregnancy complication. Kumar Sharma et al. (2013)[8] highlighted the importance of monitoring lipid profiles in early pregnancy as a screening tool for preeclampsia, with elevated triglyceride levels potentially contributing to endothelial dysfunction. Dey et al. (2013) found that changes in lipid levels, particularly cholesterol, could be an early marker for predicting preeclampsia development, offering potential for preventive intervention.[9] Mansoor et al. (2012) confirmed that lipid abnormalities, particularly elevated triglycerides and cholesterol, are associated with preeclampsia, which can be linked to increased oxidative stress, endothelial dysfunction, and impaired placental perfusion.[10]

The study explores the role of maternal serum triglycerides in early-onset preeclampsia prediction and their correlation with uterine artery Doppler. It suggests that elevated triglyceride levels contribute to preeclampsia development by promoting endothelial dysfunction, affecting uteroplacental blood flow. The study suggests a non-invasive, cost-effective method to identify high-risk pregnancies, complementing existing screening methods and guiding preventive measures. The findings could also stimulate further research into lipid-based biomarkers.

CONCLUSION:

A study found that 26% of participants developed preeclampsia, while 74% remained normotensive. The study found that serum triglycerides levels increase with gestational age, and women with preeclampsia had higher levels. Serum triglycerides had a sensitivity, specificity, PPV, and NPV of 75%, 88%, 70%, and 91% for early PE prediction in the mid 2nd trimester. Despite being inferior to MAP and uterine artery doppler, serum triglycerides still have 85% diagnostic accuracy. Predicting pre-eclampsia can be done using a cutoff value of S. triglycerides >172 mg/dl with a sensitivity of 92% and specificity of 99%.

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Conflict Of Interest: Nil

Ethical Approval: The study was approved by the Institutional Ethics Committee of GSVM Medical College, Kanpur (India)

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