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# Role and estimation of serum calcium, serum uric acid and C-RP in preeclamptic and normal pregnant women in Dhiraj General Hospital of Sumandeep Vidyapeeth Vadodara: A case control study

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***Abstract*---**Preeclampsia is one of the major conditions causing maternal morbidity and mortality throughout the world. Hyperuricemia due to oxidative stress is known to be associated with deleterious effects on endothelial function, oxidative metabolism, platelet adhesiveness and aggregation. C-reactive protein (CRP) is an acute phase reactant protein, plays a role in eliciting the inflammatory response characteristic of preeclampsia. Patients with Preeclampsia showed the low levels of serum calcium. To estimate serum uric acid, CRP and serum calcium in cases and controls and to study the association of the levels of serum uric acid, CRP and calcium with preeclampsia. A case control study conducted on 100 patients with clinically diagnosed preeclampsia and 100 normotensive singleton pregnant women as controls from the general population from Dhiraj General Hospital, Piparia, Vadodara, Gujarat. 6 ml of each venous blood was collected to estimate the Serum Uric Acid, CRP and Serum Calcium levels in subject. The data was analyzed and expressed in terms of mean ± SD. There was statistically significant increase in the levels of serum uric acid, CRP ($P < 0.001$) and statistically decreased levels of serum calcium ($P < 0.001$) in cases as compared to the normal controls. It can be concluded that serum uric acid, CRP and serum calcium could be considered as a supportive diagnostic tool in preeclampsia.


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***Keywords***---preeclampsia, serum uric acid, CRP, serum calcium, oxidative stress, endothelial injury.

## Introduction

Preeclampsia is best described as a pregnancy- specific syndrome of reduced organ perfusion secondary to vasospasm and endothelial activation. The definition of pre-eclampsia was revised in 2014 and is defined as hypertension developing after 20 weeks' gestation with one or more of the following: proteinuria, maternal organ dysfunction (including renal, hepatic, hematological, or neurological complications), or fetal growth restriction.[1,2] Preeclampsia is a major complication of pregnancy and occurs in about 7-10% of all pregnant women and it is still an important cause of both maternal and fetal morbidity and mortality.[3] In India, the incidence of preeclampsia is reported to be 8-10% among the pregnant women. According to a study, the prevalence of hypertensive disorders of pregnancy was 7.8% with preeclampsia in 5.4% of the study population in India. 4 Clinically pre- eclampsia is characterized by a persistently elevated blood pressure of greater than 140/90 mm Hg. If preeclampsia is left untreated, eclampsiacan develop. Several medical conditions, such as chronic hypertension, diabetes mellitus, renal disease, and hypercoagulable states are associated with increased preeclampsia risk.[5,6]. Eclampsia is a very serious condition in which the woman experiences seizures due to hypertension. Eclampsia puts the mother and baby. In our study we correlate preeclampsia and biochmeical parameter like protein, Ca, Uric acid, CRP. Hyperuricemia due to oxidative stress is known to be associated with deleterious effects on endothelial function, oxidative metabolism, platelet adhesiveness and aggregation. C-reactive protein (CRP) is an acute phase reactant protein, plays a role in eliciting the inflammatory response characteristic of preeclampsia. Low level of serum Ca in Patients with Preeclampsia also observed.

## Material and Materials

Case sectional study was conducted in Department of Biochemistry, SBKS MIRC Department of Gynaec & obstetric Dhiraj General Hospital (DGH) Piparia, Vadodara, Gujarat after Ethical clearance (SVIEC/ON/MED/BNP417/018015). Total 200 Pregnant women(100, (Pre-Eclamptic Women) and Control Groups-100 (Normal single tone Pregnant Women) ,who volunteered and gave consent, were recruited. Study was conducted for consecutive one years May- 2018 to April 2019 aged between 18 to 45. All the women were explained the ojectives of present study in detail.

All subjects enrolled gave written consent to participate in this study. Present and past history of the patients were collected with the help of pre-test Proforma, The Proforma sheet included, name, age, sex with clinical history. Informed consent was taken from all the subjects. All questionnaires and investigation were done at Dhiraj General Hospital (DGH) piparia, Vadodara, Gujarat. Pregnant women in third trimester of gestation (28 – 40 weeks), who were diagnosed as having preeclampsia on the basis of Clinical history, examination, systolic blood pressure >140mmHg and diastolic blood pressure >90mmHg. Controls: Apparently healthy

singleton pregnant women in the third trimester (28 – 40 weeks). Following subjects were excluded from this study. Patients with multiple gestation,Patients in active labor , Patients with essential hypertension ,Patients with history of acute or chronic liver diseases, Patients on drugs affecting coagulation ,Patients taking corticosteroids ,Patients with DM, Gout ,Patients having chronic inflammatory disorders like Rheumatoid Arthritis, Tuberculosis, Osteoarthritis, Inflammatory Bowel Disease etc. More over Hypothyroidism or hyperthyroidism, Patients on drugs like Diuretics, Salicylates, Ethambutol, Pyrizinamide, Patients on magnesium or other metal containing medications, Chronic Alcoholics, Chronic Kidney Diseases, Patients with cardiovascular diseases, Fetal infections or fetal congenital abnormalities , Women with chorioamnionitis, Women with premature rupture of membranes, Women with active sexually transmitted diseases, Women with severe anemia (Hb< 6g/dL)

Sample Collection: - About 6.0 ml of blood sample was collected from each subject by venipuncture with standard blood collection technique. Out of which 2ml were added in EDTA vial for hemoglobin (Hb) and simultaneously analyzed. Remaining 4ml of blood were added in Plane vial, which allowed to clot for 30 minutes and then centrifuged at 3000 rpm for 10 minutes in order to get serum & plasma and was kept at $-20^0$ C till further analysis.

**Methodology**

- All the cases and controls in the study was subjected to detailed history regarding age, height, pre-pregnancy weight, and weight at the time of blood collection was recorded.
- Maternal occupation, literacy, husband's occupation along with literacy, religion, race, socioeconomic status, family history of preeclampsia, past obstetric history, past medical history, smoking, medical disorders like hypertension and diabetes of first degree relatives, physical activity during pregnancy was recorded.
- Systemic examination was done with the special reference to edema, blood pressure and gestational age and routine antenatal investigations were also recorded in the proforma, specially designed for this study.
- The biochemical parameter such as serum uric acid, calcium and C-reactive protein (CRP) were analyzed on Biochemistry Autoanalyser EM-200 in Central clinical laboratory DGH.
- 24 Hours urine sample examination by Dipstick method: - Urine protein was recorded. Single Plus (+) - Normal patients Two plus (++) /Three plus (+++) - Mild preeclampsia.
- Serum Ca ,Uric acid,and CRP were also estimated by enzymatic and agglutiation method.

**Result & Observation**

Table-1: Comparison of Blood pressure between Case and Control Groups

| *Blood Pressure (BP) mmHg* | *Case Group (Mean± SD)* | *Control Group (Mean± SD)* | *P- value* |
|---|---|---|---|

| | | | |
|---|---|---|---|
| *Systolic* | *127.55±8.89* | *116.64 ± 14.7* | *0.001*** |
| *Diastolic* | *93.0±8.20* | *80.25±10.73* | *0.001*** |

** Highly Significant * Significant # non-significant

Above table shows that systoic and diastolic BP is slightly higher in preeclamptic pregnant women compare to normal pregnant woment

Table-2: Comparison of Serum calcium between Case and Control Groups.

| *Variables* | *Case Group (Mean± SD)* | *Control Group (Mean± SD)* | *P- value* |
|---|---|---|---|
| *serum calcium (mg/dl)* | *8.4±0.64* | *10±0.85* | *0.001*** |
| *Uric acid (mg/dl)* | *6.87±2.61* | *4.54±2.20* | *0.001*** |
| *CRP (IU/ml)* | *12.38±2.32* | *3.88±7.21* | *0.001*** |

**Discussion**

Developing countries like India and in western country hypertensive disorders of pregnancy frequently manifest as Preeclampsia. Despite progress in its prevention, detection and treatment, it continues to be the leading cause of maternal death. Research over last decade has been proved the role of oxidative stress and inflammation in pathophysiology of preeclampsia. Some of the biochemical markers like Oxidative stress, xanthine oxidase activity and inflammation are important contributors. Various traditional and newer biomarkers were suggested for diagnosis and prognosis of preeclampsia.

In view of the present study was taken to assess clinical utility of the promising biochemical markers like serum uric acid, CRP and serum calcium which are inexpensive and can be of some diagnostic and prognostic significance. In the present comparative, case-control study was conducted in the department of biochemistry and Dhiraj general Hospital, SBKSMI & RC. The study include total 200 subject with comprising of 100 case (Preeclamptic women) and 100 normal pregnant women as a control. Here we have compared the biochemical parameters between cases and controls having healthy gestational age matched normal singleton pregnant women. A serum calcium level is assessed in pregnant women to find out the abnormality in pregnancy as several study suggested that it is decreases in any abnormality. In our result shows comparison between cases and control groups where we found the level of calcium in the control groups were increases and decreases in the case groups and it statistically significant (>0.001**) Similarly imdad et al (2009) found a significant decrease in serum calcium in pregnant women with preeclampsia.[7,8] Serum calcium plays an important role in the uteroplacental blood flow as it lowers the resistance index in uterine and umbilical arteries and its deficiency is capable of producing smooth muscle constriction and increased vascular resistance according to some studies. The explanation for the vasoconstriction due to calcium deficiency was reduced vasoactive substances. NO, a vasoactive substance produced by vascular endothelium from the amino acid L-arginine by the action of the enzyme endothelial NO synthase, was responsible for these hemodynamic changes. Serum calcium ion level plays a crucial role in the production of endothelial NO. Importance of the calcium supplementation and the dosage in every pregnant

women has been used on the basis requirement of each subject. Calcium supplementation appears to approximately decreases the risk of pre-eclampsia, to reduce the risk of preterm birth and to reduce the occurrence stilldeath or serious morbidity.

Our study shows the comparison of serum uric acid in case and control groups. Case group's mean was which is highly significant. . (>0.001**) This is in accordance with the study done by Saleh F et al (2016), Roberts J M et al (2010), and Repke J, who were also found significant increase in the serum uric acid levels in patients with preeclampsia and stated that it was a good predictor of maternal disease progression and fetal outcome. Concluded that measurement of serum uric acid seems to be a useful test to predict maternal complications in the management of women with pre-eclampsia. Serum uric acid levels reflect the xanthine oxidase activity [9,10,11] Hyperuricemia due to oxidative stress is known to be associated with deleterious effects on endothelial dysfunction, oxidative metabolism, platelet adhesiveness, hemorrheology and aggregation.[12] Hence elevated serum uric acid is highly predictive of increased risk of adverse maternal and fetal outcome.[13]

Our study shows CRP level in the case and control groups. In case group (12.38 IU/ml) it was significantly higher than control group (>0.001**). Stefenovic M et al. (2010) and his co-researchers provided The evidence for a maternal inflammatory response with raised CRP levels in case. The study also demonstrated the use of serum CRP levels in early pregnancy to clarify the temporal relationship between elevated maternal CRP and subsequent risk of preterm delivery.[14] In the study urine protein was also estimated as it is important bio-marker for the preeclampsia. Case group have high values of urine protein than in the control groups which was highly significant.

**Conclusion**

This was a comparative case control study done on 100 patients with Preeclampsia attending Dhiraj General Hospital, SBKSMI& RC piparia Vadodara. The levels of serum uric acid, CRP and serum calcium were estimated and we found the highly statistically significant role in PE patients as compare to our controls.Serum uric acid levels reflect the xanthine oxidase activity and oxidative stress production, the immune activation related to endothelial dysfunction, the inflammatory mechanisms that lead to vasospasm, and the inflammatory response associated with the presence of necrotic placental cells in the uterine and placental bed. There were statistically decreased levels of serum calcium in cases ($P < 0.001$). Serum calcium plays an important role in the synthesis of nitric oxide and its deficiency is capable of producing vasoconstriction Thus, it can be concluded that serum uric acid, CRP and serum calcium could be considered as a supportive diagnostic tool in preeclampsia along with other conventional markers. Furthermore studies are needed to draw the utility of these parameters for the diagnostic assessment of Preeclampsia.

**References**

1. Cunningham FG, Leveno KG, Bloom SL, Hauth JC, Gilstrap III LC, Wenstrom

KD. Hypertensive disorders in pregnancy. Williams Obstetrics. 22nd edition. Mc Graw Hill 2005;761-785.
2. Dane, S., Welcome, M.O.A case study: Effects of wet cupping therapy in a male with primary infertility (2019) Journal of Complementary Medicine Research, 10, pp. 155-161.
3. Duckitt K, Harrington D. Risk factors for pre- eclampsia at antenatal booking: systematic review of controlled studies. British Medical Journal 2005; 330(7491): 565–567.
4. Hawkins TL A, Roberts JM, Mangos GJ et al. Plasma Uric Acid remains a marker of poor outcome in hypertensive pregnancy: A Retrospective cohort study. BJOG 2012; 119:484 – 492.
5. Imdad A, Jabeen A, Bhutta ZA. Role of calcium supplementation during pregnancy in reducing risk of developing gestational hypertensive disorders: meta- analysis from studies from developing countries. BMC Public Health 2011;11(3):s18.
6. JM Robert, RN Taylor, TJ Musci, GM Rodgers- American journal of Obstetrics and Gynecology.
7. Kumru S, Godekmerdan A, Kutlu S, et al: Correlation of maternal serum high-sensitive C-reactiveprotein levels with biochemical and clinical parameters in preeclampsia. Eur J Obstet Gynecol Reprod Biol 2006; 124(2): 164-167.
8. Nadkar MY, Jain VI. Serum Uric Acid in Acute Myocardial Infarction. JAPI. 2008;56(10):759-762.
9. Repke J, Villar J, Bergel E, Belizan JM. The effect of ion absorption in patients receiving calcium supplementation. 9th Annual Meeting of the Society of Perinatal Obstetricians; 1989 February 1-4; New Orleans, Louisiana, USA. 1989:512.96
10. Shamshiraj AA, Paidas M, Krikun G. Preeclampsia, hypoxia, thrombosis and inflammation. J Pregnancy 2012; 2012:374047.
11. Sibai B, Dekker G, Kupferminc M. Pre-eclampsia. Lancet 2005; 365(9461), 785–799.
12. Stefenovic M, Vukomanovic P, Milosavljevic M et al. Insulin resistance and C-reactive protein in preeclampsia. Bosnian Journal of Basic Medical Sciences 2009; 9 (3): 235-238.
13. Walker JJ. Pre-eclampsia. Lancet 2000; 356 (9237):1260–1265
14. Zipes, Brounwald E, Gibby. Recommendation about magnesium therapy Ed 5th 2001:1172-1173.