



Contents lists available at BioMedSciDirect Publications

## International Journal of Biological & Medical Research

Journal homepage: [www.biomedscidirect.com](http://www.biomedscidirect.com)



### Original article

## Study of Biochemical changes in Preeclamptic Women

T. Sunitha<sup>a\*</sup>, K. Sameera<sup>a</sup>, G. Umaramani<sup>a</sup>.

<sup>a</sup>Department of Biochemistry, Katuri Medical College & Hospital, Guntur, INDIA

#### ARTICLE INFO

##### Keywords:

Preeclampsia,  
Proteinuria,  
Serum sodium,  
Total proteins,  
Uric acid,  
Urinary proteins.

#### ABSTRACT

Preeclampsia can be defined as a pregnancy specific condition of increased blood pressure accompanied by proteinuria, edema or both. It is a multisystem disorder characterized by endothelial cell injury which plays an important role in the pathogenesis of preeclampsia. This injury leads to various biochemical alterations. In the present study serum sodium, Uric acid, total proteins and spot urinary proteins, SBP/DBP of preeclamptic age-matched women (devoid of diabetes, UTI, renal and liver disorders) in their third trimester, as compared to their normotensive counterparts, have been measured, analyzed and compared with results of earlier studies. The preeclamptic women group exhibited highly significant change in all the parameters that were studied. Such changes in biochemical findings will lead to cardiovascular, hematological, endocrine and metabolic changes in preeclamptic patients which finally lead to end organ derangements. We suggest that preeclamptic women should be advised to have their blood pressures checked regularly to prevent future complications.

©Copyright 2010 BioMedSciDirect Publications IJBMR -ISSN: 0976:6685. All rights reserved.

### 1. Introduction:

Hypertension is reported to complicate 1 in 10 pregnancies hence it is the most common medical disorder of pregnancy [1]. Hypertensive disorders remain one of the major causes of maternal and perinatal mortality in developing as well as developed countries [2]. Hypertension during pregnancy is defined as a diastolic blood pressure of  $\geq 90$  mmHg on two occasions more than 4 hours apart or a single reading of diastolic blood pressure  $> 110$  mmHg [3]. Hypertensive disorders during pregnancy occur in women with pre-existing primary or secondary chronic hypertension, and in others who develop new-onset hypertension in the second half of pregnancy. If this hypertension is associated with proteinuria and edema it is known as preeclampsia. Family history of essential hypertension is a risk factor in development of preeclampsia and there may also be a relationship between risk of preeclampsia and the metabolic syndrome [4, 5]. The worldwide prevalence of preeclampsia is 9% and in India it is 8-10%. Preeclampsia is mainly a disease of primigravidas. The incidence is 14.1% in primigravidas versus 5.7% in multigravidas [6].

In normal human pregnancy there is decreased blood pressure

response to pressor materials but in preeclampsia there is marked increase in response to vasopressin, norepinephrine, and to angiotensin. It is the increased responsiveness of the arterial system to pressor substances which probably causes the generalized vasoconstriction and hypertension in preeclampsia. The generalized vasoconstriction is responsible for reduction in renal blood flow and GFR. This causes alterations in various biochemical parameters. These alterations secondarily lead to many pathophysiological changes which adversely affect maternal and fetal wellbeing. Preeclampsia is multisystem disorder and multi-organ dysfunction is due to increase in blood pressure [7]. Liver function abnormalities and renal function impairment are most important causes in causing complications [8]. Preeclampsia is associated with risks for the fetus which include intrauterine growth restriction, prematurity and death and the preeclamptic mother is at risk of renal failure, pulmonary edema, stroke, and death. Even after considerable research, the causes for preeclampsia remains unclear and there are no clinically useful screening tests in early diagnosis of Preeclampsia [9].

A thorough research on all the biochemical changes is thus necessary in correctly understanding the pathophysiology and to identify biochemical markers that help in early diagnosis of the disorder. This helps the at risk women in preventing hypertension in subsequent pregnancies and later in their life. In the present study we studied the changes in biochemical parameters like serum.

\* Corresponding Author : Dr. T. Sunitha

Department of Biochemistry, Katuri Medical College & Hospital,  
Katuri Nagar, Chinakondrupadu, Guntur - 522 019, Andhra Pradesh, INDIA.  
Email: [sunithathatty@gmail.com](mailto:sunithathatty@gmail.com)

total proteins, uric acid, sodium and spot urinary protein in preeclamptic women and compared it with normotensive pregnant women

## 2. Materials and Methods:

### 2.1. Subjects

The study was carried out on 100 subjects in the age group of 19-26 years who were primis with gestational age between 28 weeks and 36 weeks of which 50 were cases who had hypertension with proteinuria and edema and 50 were controls who were normotensive. We have excluded diabetes, UTI, renal and liver disorders in the subjects. This study was approved by institutional review board and informed consent was obtained from all subjects involved in the study.

Blood pressure of all the subjects in supine position was measured by mercury sphygmomanometer. Under aseptic conditions blood samples (5 ml) were drawn into clot activator tubes from ante-cubital veins of cases and controls. Urine sample was collected from the subjects. The collected blood was allowed to clot for 30 minutes, and then centrifuged at 2000 g for 15 minutes for clear separation of serum.

### 2.2. Measurement of serum uric acid, total proteins

Serum uric acid, total proteins levels were estimated immediately after serum was separated using ERBA kits on semi auto analyzer.

### 2.3. Measurement of serum sodium

Serum sodium was analyzed by ion selective electrode method on Roche analyzer.

### 2.4. Measurement of spot quantitative urinary protein

Spot quantitative urinary protein levels were measured by ERBA kits on semi auto analyzer.

### 2.5. Statistical analysis

The results were expressed as mean  $\pm$  SD. p value  $<0.05$  was considered statistically significant. P value  $<0.01$  was considered highly significant. Statistical analysis was performed using SPSS software. Results were expressed as mean  $\pm$  Standard deviation (SD). Serum sodium, Uric acid, total proteins and spot urinary proteins of cases were compared with controls by student's t test. Comparison of parameters in cases was done using One-Way ANOVA followed by post-hoc test.

## 3. Results:

**Table 1: shows mean and SD of SBP and DBP in controls and cases**

PARAMETER	CONTROLS MEAN $\pm$ SD	CASES MEAN $\pm$ SD	p value
SBP	109.92 $\pm$ 1.7173	139.68 $\pm$ 3.9855	<0.001
DBP	69.52 $\pm$ 2.226	89.12 $\pm$ 3.5864	<0.001

## 3. Results:

**Table 1: shows mean and SD of SBP and DBP in controls and cases**

PARAMETER	CONTROLS MEAN $\pm$ SD	CASES MEAN $\pm$ SD	p value
SBP	109.92 $\pm$ 1.7173	139.68 $\pm$ 3.9855	<0.001
DBP	69.52 $\pm$ 2.226	89.12 $\pm$ 3.5864	<0.001

p value  $<0.001$  is considered highly significant

**Table 2: Table showing MEAN  $\pm$  SD and p values of spot urinary protein in cases and controls**

PARAMETER	CONTROLS MEAN $\pm$ SD	CASES MEAN $\pm$ SD	p value
Spot urinary protein	30.08 $\pm$ 3.390	61.60 $\pm$ 12.02	<0.001

**Table 3: Table showing MEAN  $\pm$  SD and p values of Serum sodium, uric acid, And total proteins in cases and controls**

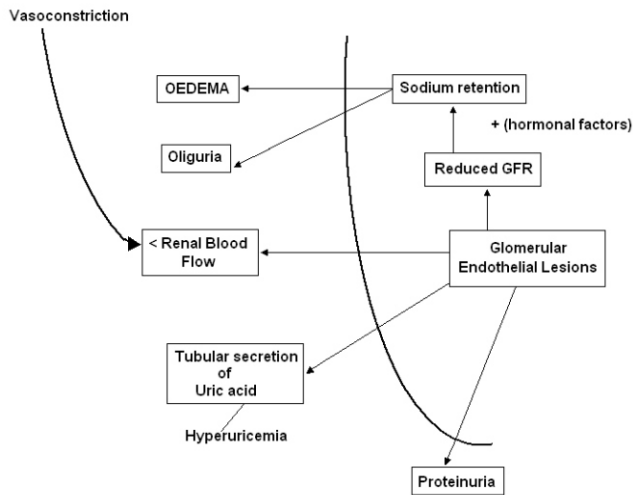
PARAMETER	CONTROLS	CASES	p value
Serum sodium	136 $\pm$ 4.312	143 $\pm$ 3.259	<0.01
Serum uric acid	3.224 $\pm$ 0.659	4.184 $\pm$ 0.9321	<0.01
Total proteins	7.224 $\pm$ 0.252	5.896 $\pm$ 0.6143	<0.001

p value  $<0.001$  is considered highly significant and p value  $<0.01$  is considered significant.

As depicted from tables 1, 2 and 3, when preeclamptic women were compared with normotensive pregnant women Systolic blood pressure, diastolic blood pressure were highly significant. Serum total protein level showed highly significant decrease in preeclamptic women. Serum sodium and uric acid showed significant rise compared to controls. Urinary spot protein level also showed highly significant increase in their levels in cases.

## 4. Discussion

Preeclampsia is defined as development of hypertension with proteinuria, edema or both induced by pregnancy after 20th week of gestation according to American college of Obstetrics and Gynecology [10-12]. It is a multifactorial process with no individual factor strictly essential or sufficient for causing it [13]. Several studies indicate that genetic abnormalities, immunological intolerance between fetoplacental and maternal tissues, abnormal trophoblast invasion of uterine blood vessels, mal-adaptations to the cardiovascular changes and dietary deficiencies are some of the probable factors [14]. Endothelial cell dysfunction and inflammation are considered to have a crucial role in the

**Fig 1: Consequences of renal lesions in preeclampsia**

Glomerular endotheliosis leads to spasm in glomerular arterioles which finally causes tubular damage leading to the net effects of diminished renal blood flow and glomerular filtration rate and also impaired tubular re-absorption. Uric acid is secreted by distal tubules. High level of serum uric acid is found to correlate with reduced renal blood flow and decreased glomerular filtration rate [15-20]. In our study also we found significantly increased serum uric acid levels in preeclamptic women. The precise mechanism of sodium retention in preeclampsia is not clear. The retention is likely due to vasoconstriction leading to reduction of GFR and increased sensitivity to angiotensin II. The net effect is decreased intracellular fluid and increased extra-cellular fluid [20-26]. This study also supported the above findings. Due to the decreased tubular re-absorption caused by spasm of the glomerular arterioles there is increase in capillary permeability which causes leakage of proteins in the urine. This is responsible for the hypoproteinemia and significant proteinuria in preeclamptic women. Our study also documented highly significant hypoproteinemia and proteinuria.

## 5. Conclusion

In summary our present study showed significant changes in various biochemical parameters like serum sodium, uric acid, total proteins, and spot urinary protein levels in pregnant women with significant increase in systolic and diastolic blood pressures.

This association may be noteworthy in understanding the pathological process of Preeclampsia and may help in developing strategies for prevention and early diagnosis of maternal and fetal complications.

## Acknowledgments

The authors are grateful to the Management, Katuri Medical College, Guntur, India, for providing the facilities to work in the Department of Biochemistry and the Superintendent, Katuri Hospital, Guntur, India, for permitting to collect samples.

## 6. References:

- [1] Podymow T, August P, Update on the use of antihypertensive drugs in pregnancy. *Hypertension*. 2008; 51:960-969.
- [2] Magee LA, Von Dadelzen P. Treatment of hypertension in pregnancy. *J Clin Pharmacol*. 2004; 11(2):e199-e201.
- [3] Davey DA, MacGillivray I, The classification and definition of the hypertensive disorders of pregnancy. *Am J Obstet Gynecol*. 1988; 158(4):892-898.
- [4] Packer CS. Biochemical markers and physiological parameters as indices for identifying patients at risk of developing preeclampsia. *J Hypertens*. 2005; 23(1):45-6.
- [5] NAF Islam, MAR Chowdhury, GM Kibria, S Akhter Study Of Serum Lipid Profile In Pre-Eclampsia And Eclampsia *Faridpur Med. Coll. J.* 2010; 5(2) :56-59.
- [6] Mordechai Hallak, David K James, Philip J Steer, Carl P Weiner, Bernad Ganik- High risk pregnancy: Management options 2nd ed. 639 onwards, (2000).
- [7] Friedman SA, Taylor RN, *Clinical perinatology*. 1991; 18: 661-682.
- [8] Lindheimer M B and Katz A, *Renal physiology and disease in pregnancy, The Kidney: physiology and Pathophysiology*, 2nd Ed, 1992; 3371-3431.
- [9] Caren G, Solomon, Seely EW. Preeclampsia searching for cause. *New Eng J Med*. 2004; 350(7):641-2.
- [10] American college of Obstetricians and Gynecologists (ACOG) – Revised classification and definition with sign and symptoms, (2002).
- [11] ACOG practice bulletin. Diagnosis and management of preeclampsia and eclampsia. Number 33, January 2002. *Obstet Gynecol* 2002; 99: 159-167.
- [12] Aruna Patel , Brijesh Singh , Arun Patel , Manoj Sharma Serum calcium level in pregnancy induced hypertension *Int J Biol Med Res*. 2012; 3(3): 1914-1918
- [13] Chesley LC. Hypertension in pregnancy: Definitions, familial factor, and remote prognosis. *Kidney Int*. 1980; 18:234-240.
- [14] Saibai BM, diagnosis and management of gestational hypertension and Preeclampsia: *Obstet and gynecology*. 2003; 102 (1).
- [15] Hiralal konar, Ed. *Text book of Obstetrics*, D.C. Dutta, 6th edition; 223-225, (2004).
- [16] Lam C, Lim KH, Kang DH, Karumanchi SA. Uric acid and preeclampsia. *Semin Nephrol*. 2005 Jan; 25(1):56-60.
- [17] Annabel C. Martin & Mark A. Brown. Could uric acid have a pathogenic role in pre-eclampsia? *Nature Reviews Nephrology*. December 2010; 6: 744-748 .] doi:10.1038/nrneph.2010.125
- [18] Bainbridge SA, Roberts JM. Uric Acid as a Pathogenic Factor in Preeclampsia. *Placenta*. 2008 March; Volume 29, Supplement, Pages 67-72.
- [19] Koopmans CM, Van Pampus MG, Groen H, Aarnoudse JG, van den Berg PP, Mol BW. Accuracy of serum uric acid as a predictive test for maternal complications in pre-eclampsia: bivariate meta-analysis and decision analysis. *Eur J Obstet Gynecol Reprod Biol*. 2009 Sep; 146(1):8-14. Epub 2009 Jun 21.
- [20] LANA K. WAGNER, M.D., First Choice Community Healthcare, Albuquerque, New Mexico. Diagnosis and Management of Preeclampsia. *Am Fam Physician*. 2004 Dec 15; 70(12):2317-2324.
- [21] Kashyap MK, Saxena SV, Khullar M, Sawhney H, Vasishta K. Role of anion gap and different electrolytes in hypertension during pregnancy (preeclampsia). *Mol Cell Biochem*. 2006 Jan; 282(1-2):157-67.

## 6.References:

- [22] Lopatin DA, Ailamazian EK, Dmitrieva RI, Shpen VM, Fedorova OV, Doris PA, Bagrov AY. Circulating bufodienolide and cardenolide sodium pump inhibitors in preeclampsia. *J Hypertens*. 1999 Aug; 17(8):1179-87.
- [23] Maxwell CV, Tao QF, Seely EW, Repke JT, Graves SW. Regulation of the sodium pump in pregnancy-related tissues in preeclampsia. *Am J Obstet Gynecol*. 1998 Jul; 179(1):28-34.
- [24] Unger C, Biedermann K, Szloboda J, Wyss P, Huch A. Sodium concentration and pre-eclampsia: is salt restriction of value? *Z Geburtshilfe Neonatol*. 1998 May-Jun; 202(3):97-100.
- [25] James M. Roberts, Judith L. Balk, Lisa M. Bodnar, José M. Belizán, Eduardo Bergel, and Anibal Martinez. Nutrient Involvement in Preeclampsia. *J. Nutr*. May 1, 2003; vol. 133(no. 5):1684S-1692S
- [26] Chesley LC(1978). *Hypertensive disorders of pregnancy*. Appleton-Century-Crofts, New York.

© Copyright 2010 BioMedSciDirect Publications IJBMR -ISSN: 0976:6685.  
All rights reserved.