ORIGINAL ARTICLE

A Study of Urinary Calcium/Creatinine Ratio and Microalbuminuria as a Predictor of Preeclampsia

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ABSTRACT

Objectives: To determine the predictive values of low urinary calcium/creatinine ratio and microalbuminuria for preeclampsia in a spot urine sample in asymptomatic pregnant women between 20 weeks and 32 weeks of gestation.

Materials and methods: One hundred fifty pregnant women who attended the obstetrics and gynecology (OBG) OPD, JSS Hospital, Mysuru for routine antenatal care between 20 weeks and 32 weeks of gestation were included in the study and was followed up till term for clinical pieces of evidence of preeclampsia.

Results: The incidence of preeclampsia was high among primigravidas (69.3%) compared to multigravidas (30.7%). Total 16 out of 150 pregnant women developed preeclampsia. Out of 16, 13 developed preeclampsia among cases and 3 in controls. The value of urinary calcium/creatinine ratio (UCCR) < 0.04 is taken as cut off value. 14 out of 16 patients have low urinary calcium/creatinine ratio out of which 11 (68.8%) patients developed preeclampsia subsequently. In the study group 11 (84.6%) patients, with urinary calcium/creatinine ratio < 0.04 developed preeclampsia and 2 (15.4%) patients with urinary calcium/ creatinine ratio > 0.04 developed preeclampsia. In the control group, one patient with significant urinary calcium/creatinine ratio did not develop preeclampsia.

Conclusion: The study shows that urinary calcium/creatinine ratio < 0.04 is an excellent screening tool for the prediction of preeclampsia with a specificity of 97%, sensitivity 68%, positive predictive value 78%, and negative predictive value 96% and microalbuminuria as a fair predictor of preeclampsia

Keywords: Preeclampsia, Urinary calciumcreatinine ratio, Urinary microalbuminuria.

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INTRODUCTION

Hypertension in pregnancy is the major cause of maternal mortality and fetal morbidity.[1] It complicates up to 7–10% of pregnancies of which preeclampsia/eclampsia constitute 70% and chronic hypertension 30%.[2] It is said that preeclampsia, eclampsia contributes to the death of women every 3 minutes worldwide.[3]

Hypertensive disorders complicating pregnancy represents one facet of a complex disease process. Gestational hypertension, preeclampsia, eclampsia majority of these conditions are preventable.[4] This has led to the interest in screening. Screening, the deliberate examination of substantial segments of the population in search for the disease at its earlier stages, is a logical extension of the role of preventive medicine.[5] Several methods have been proposed to identify the pregnant women who are at risk for preeclampsia. Renal function changes in preeclampsia which have been documented and several prospective studies indicate that at least some of the changes are present before the clinical diagnosis of preeclampsia. One such change is the association of hypocalciuria and microalbuminuria with pre-eclampsia as early as 24 weeks.[6]

This study aims to predict the development of preeclampsia in symptom-free pregnant women using UCCR and microalbuminuria. For a screening test to be of value, it should be selective, reliably cheap and easy to perform. It should increase the predictive value, and prophylactic measures must be effective.[7]

MATERIALS AND METHODS

One hundred and fifty pregnant women who attended the OBG OPD, JSS Hospital, Mysuru for routine antenatal care between 20 weeks and 32 weeks of gestation were included in the study and were followed-up until term for clinical eveidence of preeclampsia. This study was approved by the ethical committee of JSS Medical College and Hospital to use human subjects in the research study. Informed consent was taken from all the patients. The study was conducted for 2 years.

Inclusion Criteria

Normotensive pregnant women between 20 weeks and 32 weeks of gestation.

Exclusion Criteria

- Patients with chronic hypertension/use of any anti-hypertensive drugs.
- Patients with diabetes
- Patients with renal diseases or on any diuretics
- Patients with a chronic medical illness like chronic liver disease, autoimmune disorders

Collection of Urine Samples

Spot urine samples were collected from all the patients in clean plastic containers and the sample was tested immediately. The following parameters were calculated:
- Urinary calcium
- Urinary creatinine
- Urinary calcium/creatinine ratio
- Urinary microalbumin

Urinary calcium was estimated by Arsenazo III method, creatinine by enzymatic method and micro-albuminuria by the immunoturbidometric method

STATISTICAL ANALYSIS

- Paired sample t-test will be used for comparing the different biochemical parameters between study and control group
- Repeated measure analysis of variance (ANOVA)
- Descriptive statistics
- Contingency table analysis using SPSS for windows (V–16)

RESULTS

Women of different age groups were included in the study. The most common age group of patients included in the study was between 23 years and 28 years (49.3%). The most common BMI of patients included in the study was between 23 kg/m^2 and 27.9 kg/m^2.

The incidence of pre-eclampsia was high among primigravidas, which was around 69.3% when compared to multigravidas which were around 30.7% (Graph 1). Women between 20 weeks and 32 weeks of gestation were included in the study. Fifty (33.3%) patients in both cases and controls were affected between 23 weeks and 25 weeks of gestation.

Sixteen out of 150 pregnant women developed pre-eclampsia. Out of the 16 patients who developed pre-eclampsia, 13 patients developed preeclampsia among the case group and 3 patients among the control group. Hence, the incidence of preeclampsia was 10.7% in our study (Graph 2).

Eight out of 16 patients belonging to the age group of 17–22 years developed preeclampsia. Thirteen patients out of 16 were primigravidas. The incidence of pre-eclampsia was high in primigravidas (81.2%) as compared to multigravida (18.8%)

The value of urinary calcium/creatinine ratio < 0.04 is taken as cut off value for the prediction of preeclampsia. Analysis of results shows 14 out of 16 patients have low urinary calcium/creatinine ratio out of which 11 (68.8%) patients developed preeclampsia subsequently. Only, 5 (31.2%) of patients with UCCR > 0.04 developed pre-eclampsia (Graph 3).

In the study group 11 (84.6%) patients, with low urinary calcium/creatinine ratio < 0.04 developed preeclampsia and 2 (15.4%) patients with urinary calcium/creatinine ratio > 0.04 developed preeclampsia. In the control group, one patient with significant urinary calcium/creatinine ratio did not develop preeclampsia (Graph 4).
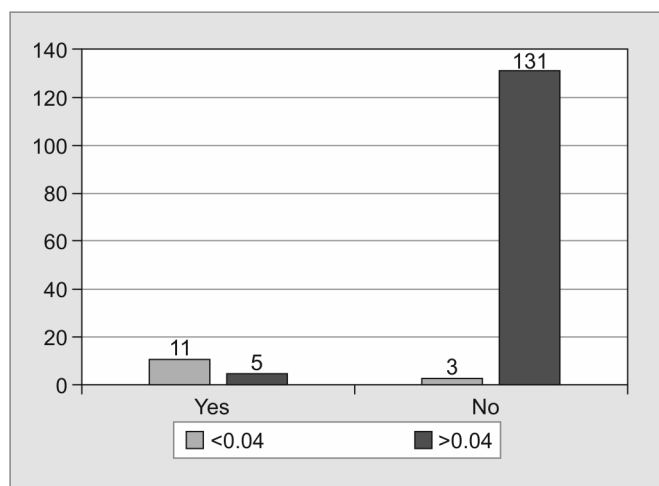
DISCUSSION

Though by definition, preeclampsia can occur at any time after 20 weeks of gestation, it usually develops
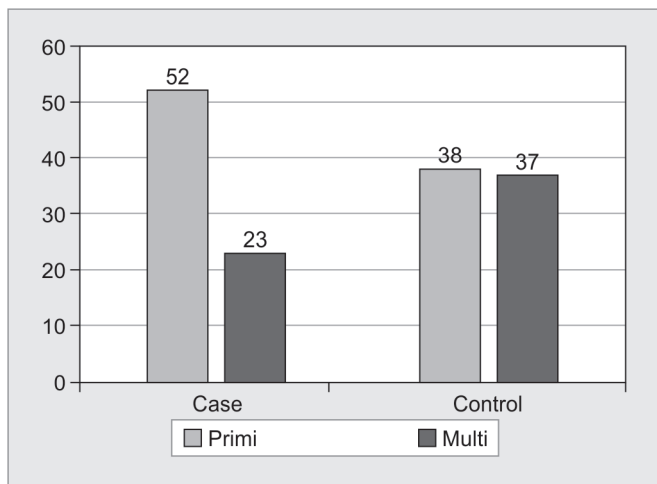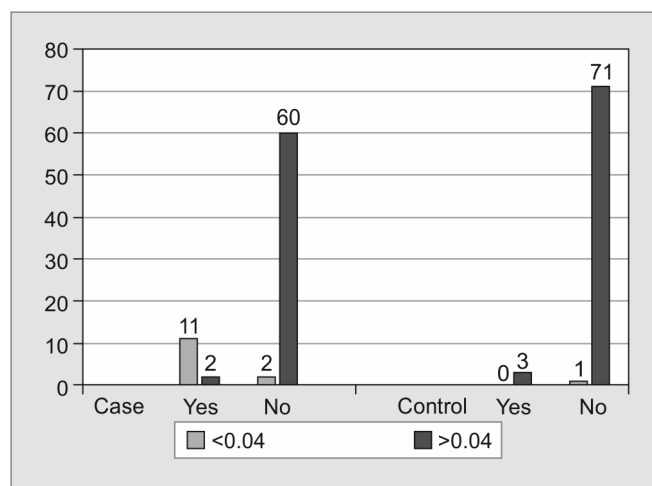

Graph 1: Distribution of cases and controls according parity
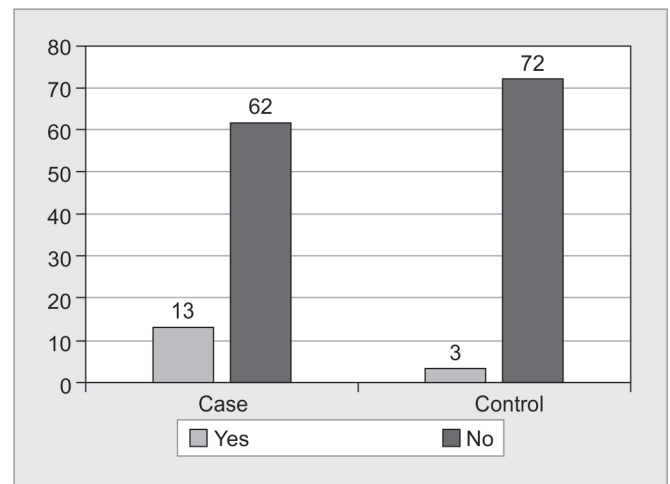
Graph 2: Incidence of preeclampsia among cases and controls

Graph 3: Relationship of UCCR with preeclampsia

Graph 4: Distribution of cases of preeclampsia and its correlation with UCCR in case and control groups

at the end of pregnancy, during labor or immediate postpartum period. The predominant pathology, the endothelial dysfunction sets in as early as 8–18 weeks of gestation; however, the signs and symptoms appear in late mid-trimester. To arrest the disease process in the initial stages or to prevent complications especially in women predisposed to preeclampsia, various predictors have been proposed.[8]

The parameters like urinary calcium, urinary creatinine, microalbuminuria, urinary calcium/creatinine ratio were used as predictors of preeclampsia. But their validity was not studied. This study was undertaken to find out their validity. The main aim of this study was to determine whether urinary calcium/creatinine ratio and microalbuminuria can be used as a predictor of preeclampsia.

Among study group 14 patients had UCCR < 0.04 out of which 11 patients developed preeclampsia with an incidence of 78.5% and 3 out of 14 who had UCCR < 0.04 did not develop preeclampsia with an incidence of 21.4%. 136 (90%) pregnant women showed UCCR > 0.04 out of which five patients developed preeclampsia (3.1%) and 97.9% did not develop preeclampsia. Sensitivity being 68%, specificity 97% positive predictive value 78% and negative predictive value of 96% $p < 0.001$ (Chi-square chart).

In the control group, no patients had UCCR < 0.04 and one patient had UCCR > 0.04, who developed Preeclampsia. Forty-eight pregnant women (96%) had UCCR > 0.04 out of which one patient developed preeclampsia (2.08%) and whereas 97.92% with UCCR > 0.04 did not develop preeclampsia.

The mean urinary calcium in those who developed preeclampsia was 6.50 mg/dL. When it compared to 16.1 mg/dL who did not develop preeclampsia. The difference was statistically significant (< 0.001).

This is in accordance with the hypocalciuria observed in preeclampsia by various workers Taufield.[9]

CONCLUSION

Preeclampsia is a complex multisystem disorder characterized by hypertension and proteinuria which has the highest maternal mortality and fetal morbidity. It can cause changes in almost all systems, most notably in renal systems.[10]

The study shows that spot urinary calcium-creatinine ratio with the cut off value of <0.04 done between 20 weeks and 32 weeks of gestation is an excellent screening tool for the prediction of preeclampsia among numerous screening test with specificity of 97% and sensitivity of 68%, and positive predictive value 78%, and negative predictive value 96%.

This test is ideal because:
- Simple and easy to perform
- Inexpensive
- Noninvasive and convenient for the patient

Low UCCR value helps in to identify the population who is at greatest risk to be included in a primary prevention program. It is also emphasized from the study that a regular evaluation after 20 weeks of gestation with urinary calcium/creatinine ratio may be an effective predictor and urinary microalbumin as a fair predictor of preeclampsia.[11]

REFERENCES

1. Prakash J, Pandey LK, Singh AK, Kar B. Hypertension in Pregnancy-Hospital Based Study. Journal-Association of Physicians of India. 2006 Apr;54(R):273-277.
2. Dennis A, Daney, Vray M. The classification and definition of the hypertensive disease of pregnancy. Am J Obstet Gynecol. 1988;158:892-898.

3. Ales KL, Norton ME, Druzin ML. Early prediction of ante-partum hypertension. Obstetrics and Gynecology. 1989 Jun;73(6):928-933.

4. Anai T, Hirota Y, Yoshimatsu J, Oga M, Miyakawa I. Hypocalciuria in women with preeclampsia. Nihon Sanka Fujinka Gakkai Zasshi. 1992 Jan;44(1):28-32.

5. Attallah A, Hotmeyr GJ, Duley L. Calcium supplementation during pregnancy for preventing hypertension disorder Cochrane data base systematic review 2000;(3) CD0010500.

6. Chesley LC, Williams LO. Renal glomerular and tubular function in relation to the preeclampsia. E American J Obstet and Gynecol 1945;50:367-375.

7. Anumba DOC, Ford GA, Boys RJ, Robson SC. Stimulated nitric oxide release and nitric oxide sensitivity in forearm arterial vasculature during normotensive and preeclamptic pregnancy. American Journal of Obstetrics and Gynecology . Elsevier BV; 1999 Dec;181(6):1479-1485.

8. Cunningham FG, Norman FG, Kenneth JL, Larry CG, John CH, Katharine DW. Williams Obstetrics. 22nd editon. New York: Williams and Wilkins. 2005.

9. Taufield PA, Ales KL, Resnick LM, Druzin ML, Gertner JM, Laragh JH. Hypocalciuria in preeclampsia. New England Journal of Medicine. 1987 Mar 19;316(12):715-718.

10. Redman CWG. Hypertension in pregnancy. In : Chamberlain G. Jurthulls Obstetrics. 2nd edn. Edin Bergh: Churchill Living Stone Publications. 1995:441-449.

11. Sheela CN, Beena SR, Mhaskar A. Calcium-creatinine ratio and microalbuminuria in prediction of preeclampsia. The Journal of Obstetrics and Gynecology of India. Springer Nature; 2011 Feb;61(1):72–76.