Role of Urinary Calcium Creatinine Ratio in Prediction of Pregnancy Induced Hypertension

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Summary

Pre-eclampsia and gestational hypertension complicate approximately 10% of all pregnancies and are significant causes of both fetal and maternal morbidity and mortality. Many tests to predict pre-eclampsia are coming up on the horizon. The present study is intended to identify at risk patients and a selection criteria for primary prevention. The total of 100 patients having gestational age between 24-34 weeks have been taken and divided in two groups viz. Control (35 patients) and study group (65 patients). A morning urinary calcium creatinine ratio of all the patients in both groups was analysed. The urinary calcium level was analysed by OCPC method (Morin, 1974), while creatinine was estimated by Jaffes method (Bone & Taussky, 1945).

In subjects with urinary CCR ≤ 0.04, 64.3% developed pre-eclampsia and 35.71% did not. But 86 patients who had CCR > 0.04, 96.51% did not develop pre-eclampsia. On statistical analysis it was found that when CCR alone is taken as high risk factor for prediction of PIH it was highly significant P<.001, sensitivity 75%, specificity 94.38%, PPV 64.3% and NPV 96.51%. When high risk factor and CCR were combined then 70% chance of developing pre-eclampsia was found. So this test was satisfactory as an early predictor for the development of PIH.

Introduction

Hypertension, one of the commonest complication of pregnancy, is a leading cause of maternal and perinatal morbidity and mortality. To date various methods have been acclaimed for identifying pregnant women at risk of development of preeclampsia but none of these can predict PIH.

There is hypercalciuria during a normal pregnancy (Gertner et al, 1986) while pre-eclampsia is associated with hypocalciuria (Taufield et al 1987) and low urinary calcium creatinine ratio. This phenomenon occurs early enough and persists (Rodriguez et al 1988) throughout gestation, so it is useful for early identification of patients at risk.

The aim of our study was to investigate the significance of urinary calcium creatinine ratio in prediction of pregnancy induced hypertension.

Material and Method

The present study was conducted in the Department of Obstetrics and Gynaecology, Nehru Hospital, B.R.D. Medical College, Gorakhpur for a period of one year i.e. from August 1998 to July 1999.

One hundred normotensive patients with gestational age of 24 to 34 weeks from both indoor as well as outdoor were divided into two groups viz

I-Control Group and II- The Study Group

The control group included 35 normotensive patients who had no high risk factor for development of

pregnancy induced hypertension in the form of nulliparity, history of pregnancy induced hypertension in past pregnancy, history of twin pregnancy in present and past pregnancy or in the family, while the study group comprised of those 65 normotensive patients who had either one or more high risk factor.

History was taken regarding age, parity, socio-economic status, past family and personal history. General examination was done specially for blood pressure, oedema, weight gain. Women who have had history of chronic hypertension, diabetes, renal disorder or blood pressure ≥ 140/90 were not included in the study.

Study design: This is a prospective cohort study of patients in study and control groups. The fasting urine samples from all the patients were collected in calcium free vials and analysed for calcium creatinine ratio (CCR). The urinary creatinine was measured by Jaffes method (Bone 1945) while urinary calcium was estimated by orthocresolphpthalein complex (OCPC) method (Morin 1974).

No dietary alterations were recommended. After urine collection, patients were followed up at routine antenatal visits for signs of development of pregnancy induced hypertension and low urinary calcium creatinine ratio.

Observation

Observations made during our study were as follows:-

In Control group maximum patients (48.57%) were second gravidae while in study group maximum patients (89.23%) were primigravidae.

The maximum number of patients in the study group 88% and in control group 92% belonged to the age group of 20-29 years.

Table I shows distribution of patients with appearance of pregnancy induced hypertension in both study and control group with calcium creatinine ratio. We have taken ≤ 0.04 as a cut off level for development of pregnancy induced hypertension. In study group, among 9 patients with pregnancy induced hypertension, 7 had CCR ≤ 0.04 while 2 had ≥ 0.04.

Table-II shows distribution of patients according to urinary calcium creatinine ratio. In study group (n=65), 10 (15.38%) had CCR ≤ 0.04 while in control group (n=35), 4 (11.43%) had ≤ CCR 0.04.

Table-III shows relationship of calcium creatinine ratio and development of pregnancy induced hypertension. Out of total 100 patients, 14% had CCR ≤ 0.04 and of these 9 patients (64.2%) had developed pregnancy induced hypertension later on. On the contrary, out of 86 patients with CCR ≥ 0.04, only 3 (3.49%) had pregnancy induced hypertension and remaining 83 (96.51%) did not have. When it was calculated statistically, it was found that when CCR alone was taken as high risk factor for prediction of PIH

Table I
Distribution of patients with Apperance of Pregnancy Induced Hypertensions (PIH) later on in study and control group with calcium creatinine ratio

Group	With PIH No.	CCR ≤ 0.04 %	With PIH No.	CCR > 0.04 %
Study Group (n=9)	7	77.77	2	22.22
Control Group (n=3)	2	66.67	1	33.33
Total=12	9		3	

Table II
Distribution of Patients According to Urinary Calcium Creatinine Ratio

Group	With PIH No.	CCR ≤ 0.04 %	With PIH No.	CCR > 0.04 %
Study Group (n=65)	10	15.38	55	84.61
Control Group (n=35)	4	11.43	31	88.57
Total 100	14		86	

Table-III
Relationship of CCR and development of Pregnancy Induced Hypertension

Group	PIH present		PIH not present	
	No.	%	No.	%
CCR ≤ 0.04 (n=14)	9	64.2	5	35.71
CCR > 0.04 (n=86)	3	3.49	83	96.51
Total=100	12		88	

it was highly significant P≤0.001, sensitivity 75%, specificity 94.38%, positive predictive value 64.23% and negative predictive value 96.51%.

Table-IV shows relationship of urinary CCR and development of pregnancy induced hypertension later on in control and study groups. It was found that out of 10 patients with CCR < 0.04, 7 (70%) developed PIH.

Discussion

There is definite relationship between low urinary calcium creatinine ratio and development of pregnancy induced hypertension.

In the study of Rodriguez et al (1988), 83% patients with low CCR developed PIH. In the study of Suzuki et al (1992), 58% with low CCR developed PIH. In study of Kamra et al (1997) 71.4% with low CCR developed pre-eclampsia.

Out of total 100 normotensive, 12 patients developed pre-eclampsia later on (Table-III). Mudliar and Menon (1973) report the incidence of 10% Sanchez Ramos et al (1991) 14% Kamra et al (1997) 13.6% and Rodriguez et al (1988) of around 10%.

Table-IV shows relationship of urinary CCR and development of pregnancy induced hypertension later on in the Control and Study group. When urinary CCR was taken as high risk factor for development of pregnancy induced hypertension, 64.3% patients developed pregnancy induced hypertension, but if alongwith this other high risk factors were also taken into consideration i.e. in study group, 70% of them developed pre-eclampsia. This is comparable to the study of Kamra et al (1997) in which 80% of the patients developed pregnancy induced hypertension. There are four studies that have investigated the predictive value of low CCR in pre-eclampsia as shown in Table V.

Conclusion

Therefore, we finally conclude that a pregnant woman with a high risk factor as nulliparity alongwith low urinary CCR is at high risk for development of pregnancy induced hypertension (70%). Therefore, a single urinary CCR may be an effective screening method for impending pre-eclampsia and may identify population at greatest risk to be included in primary prevention programmes.

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Table IV
Relationship of CCR and development of PIH in Study and Control group

Appearance PIH	Calcium ratio		Creatinine ≤ 0.04		Calcium ratio		Creatinine ≤ 0.04	
	Control group		Study group		Control group		Study group	
	No.	%	No.	%	No.	%	No.	%
PIH (n=12) present	2	50	7	70	1	3.23	2	3.64
PIH (n=88) absent	2	50	3	30	30	96.77	53	96.36
Total (n=100)	4		10		31		55	

Table V
Comparison of Predictive value of Calcium Creatinine ratio in Present Study with Other Studies

Author	Year	No. of Patients	Parity	HDP	Sensitivity %	Specificity %	PPV %	NPV %
Rodriguez et al	1988	88	>0	11	70	95	64	96
Sanchez - Ramos et al	1991	99	0	8	88	84	32	99
Ozcan et al	1995	56	0	14.3	63	96	71	93
Ritu Kamra et al	1997	104	>0	13.46	71.4	95.5	71.4	95.5
Present study	1999	100	>0	12	75	94.38	64.23	96.51

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