



# Estimation of Urinary Calcium as a Predictor of Pregnancy Induced Hypertension

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## **Author's contribution**

*This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.*

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## **ABSTRACT**

Hypertensive diseases are still a leading cause of death among mothers all over the world. It's complicated aetiology, which begins with aberrant placentation and ends with endothelial dysfunction, is yet unknown. The goal of this study is to learn about changes in serum and urine calcium levels in women who have Gestational Hypertension. 200 normotensive pregnant women between 24-28 weeks were included in the study based on inclusion and exclusion criteria. Urine calcium and creatinine and serum uric acid, total protein, albumin and serum sodium were estimated in corresponding samples collected from patients. The study showed a sensitivity of 80%, specificity of 71%, positive predictive value was 77%, negative predictive value 74%, and diagnostic accuracy as 74%. A single estimation of calcium to creatinine ratio in asymptomatic pregnant women between 24-28 week of gestation is a simple and cost-effective test.

**Keywords:** Gestational hypertension; Pregnancy; complications.

## **1. INTRODUCTION**

Pregnancy is a physiological stress associated with many complex and interrelated biochemical,

physiological and anatomical alterations occurring in the body. More emphasis is laid in the biochemical changes seen in the blood during the

normal pregnancy and are exaggerated in various complications of pregnancy [1].

Establishing the right diagnosis of preeclampsia and proceeding with an early intervention when it is diagnosed is one strategy to limit the impact of arterial hypertension on maternal mortality. The symptoms are thought to be a late symptom of an illness that has been present from the first trimester of pregnancy. Because of this "diagnostic delay," various tests have been developed to diagnose preeclampsia as soon as feasible, frequently even before the patient manifests arterial hypertension [2,3].

Studies on estimation of urinary calcium for prediction of pregnancy induced hypertension are not consistent. Also, there is a constant need to conduct studies to explore a screening tool for the prediction of preeclampsia which is easy to carry out, non-invasive and not much expensive in Indian setup [4,5]. To this purpose, the present study was carried out" To investigate the significance of urinary calcium for prediction of pregnancy induced hypertension and thus may identify population at greater risk to be included in primary prevention programme.

## 2. MATERIALS AND METHODS

This study was conducted in compliance with the protocol. The present comparative study involved a group of 200 normotensive pregnant women between 24 to 28 weeks who attend the antenatal clinic in the Department of Obstetrics and Gynaecology of Sree Balaji Medical College and hospital.

### 2.1 Inclusion Criteria

- Normotensive pregnant women
- Between 24 to 28 weeks of gestation
- Both primi and multigravida
- Both singleton and multiple pregnancies

### 2.2 Exclusion Criteria

- Patient with history of chronic hypertension or use of any antihypertensive drugs.
- Patient with diabetes mellitus.
- Patient with renal disease or on any diuretics.
- Patients with vasospastic or immunological disorder

## 2.3 Statistical Analysis

The statistical analysis will be carried out with IBM SPSS Version-20. Categorical data will be presented as actual numbers and percentages. Categorical variables will be analysed with Chi square test. Continuous variables are presented as Mean (SD). For normally distributed data (e.g., Age, BMI, and BP) between groups' analyses was done by unpaired t test. For statistical significance, a two tailed probability value of less than 0.05 will be considered.

## 3. RESULTS

86% of pregnant women in no risk group had no complications, and remaining 14 % developed Pregnancy Induced Hypertension (PIH). 45% of pregnant women in at risk group had no complications throughout pregnancy and remaining 55 % developed PIH (Table 1).

In No risk, 79 pregnant women with urinary calcium >196 mg/24 hrs had normal pregnancy without PIH, 7 pregnant women with urinary calcium <195 mg/24 hrs developed PIH, 9 pregnant women with urinary calcium >196 mg/24 hrs had developed PIH, and also, 5 pregnant women with urinary calcium <195 mg/24 hrs developed PIH (Table 2).

In at risk group, 32 pregnant women with urinary calcium >196 mg/24 hrs had normal pregnancy without PIH, 13 pregnant women with urinary calcium <195 mg/24 hrs developed PIH, 11 pregnant women with urinary calcium >196 mg/24 hrs had developed PIH, and also, 44 pregnant women with urinary calcium <195 mg/24 hrs developed PIH (Table 3).

Mean urinary calcium in pregnant women without PIH was 247.9(43.3) mg/24 hrs. Mean urinary calcium in pregnant women with PIH was 166.7(42.4) mg/24 hrs and was statistically significant on comparison with pregnant women without PIH ( $p < 0.0001$ ) (Table 4).

In No risk group, 85 had nil urinary albumin, in that 79 women had urinary calcium >196 and out of that 1 women developed PIH, 9 had <195 and 2 developed PIH .12 had urine albumin positive and one women had urinary calcium >196 and developed PIH and the rest 9 women had urinary calcium <195 and all 9 developed PIH. In High risk group, 53 women had nil urine albumin, out of that 21 had urine calcium >196 and 5 developed PIH, 8 women

had urinary calcium <195 and 19 developed PIH. 47 women had urine albumin positive, in that 11 had urine calcium >196 and 6 developed PIH, 5 women had urine calcium <195 and 25 developed PIH (Table 5).

The study showed a sensitivity of 80%, specificity of 71%, positive predictive value was 77%, negative predictive value 74%, and diagnostic accuracy as 74% (Table 6).

**Table 1. Distribution of patients among two groups according to outcome of pregnancy**

Groups	Outcome		Total
	Without PIH	PIH	
No risk group	86	14	100
At risk group	45	55	100
TOTAL	131	69	200

**Table 2. Distribution of patients with appearance of pregnancy induced hypertension later on in study groups based on urine calcium in no risk group**

Group		Outcome	
		Without PIH	PIH
No riskgroup	96 mg/24 hrs	79	9
	195 mg/24 hrs	7	5
Total		86	14

**Table 3. Distribution of patients with appearance of pregnancy induced hypertension later on in study groups based on urine calcium in at risk group**

Group		Outcome	
		Without PIH	PIH
At risk group	196 mg/24 hrs	32	11
	>195 mg/24 hrs	13	44
Total		45	55

**Table 4. Mean urinary calcium excretion according to outcome**

	Outcome	N	Mean	Std. Deviation	p
Urinarycalcium	Without PIH	131	247.9	43.3	<0.0001
	PIH	69	166.7	42.4	

**Table 5. Distribution of no risk and at risk cases based on urine albumin and urine calcium**

	URINE Albumin	URINE Calcium (mg/24 hrs)	Outcome	
			Normal Count	PIH Count
No risk group	Nil	>196	78	1
		<195	7	2
	Positive	>196	1	8
		<195	0	3
At risk group	Nil	>196	21	5
		<195	8	19
	Positive	>196	11	6
		<195	5	25

**Table 6. Diagnostic validity of urine calcium (24 hrs) in the prediction of pre- eclampsia**

At riskgroup	Urinarycalcium (mg/24 hrs)	PIH	Normal	Total
	95	44 (a)	13(b)	57
	96	11(c)	32(d)	43
	Total	55	45	100
	Sensitivity = 80%			
	Specificity= 71%			
	PPV=77%			
	NPV==74%			
	Diagnostic accuracy =74%			

#### 4. DISCUSSION

Hypertension affects 5 to 10% of pregnant patients, making it the leading cause of maternal death in and around the world. Preeclampsia is diagnosed when a pregnant woman has high blood pressure (>140/90 mmHg) after the 20<sup>th</sup> week of pregnancy (without a previous history of arterial hypertension) together with other symptoms [6,7]. These symptoms are now thought to be a late symptom of an illness that has been present since the first trimester of pregnancy. Because of this "diagnostic delay," various tests have been developed to diagnose preeclampsia as soon as feasible, frequently even before the patient manifests arterial hypertension [8].

Hypocalciuria in gestational hypertension is caused by a complicated shift in calcium homeostasis at the cellular level that is independent of renal function. Many studies have shown that urine calcium levels in women who are predisposed to developing prenatal hypertension gradually decrease until they reach term.

The current study included 200 pregnant women aged 16 to 35 who were separated into two groups depending on their risk factors: no risk and high risk. In our study, 34.5 % of people had PIH. Urinary calcium was estimated from a 24-hour urine sample taken between 24-28 weeks of pregnancy, and cases were then followed up on for evidence of PU development. This test had an 80 % sensitivity, a 71 % specificity, a 77 % positive predictive value, a 74 % negative predictive value, and a 74 % diagnostic accuracy.

Calcium excretion by the kidneys increases during normal pregnancy, and hypercalciuria is a result of a higher glomerular filtration rate. Calcium excretion in the urine was 300 mg in a normal 24-hour period. Taufield et al [9] found a link between hypertension and hypocalciuria in

pregnant women. Preeclampsia patients' calcium excretion was lowered in the third trimester, and total urine calcium excretion (129.7 mg/24 h) was considerably lower than that of normotensive individuals (293.9 mg/24 h), according to Sanchez- Ramos et al [10].

In a longitudinal research, Pedersen et al [11] and his colleagues found that urine calcium excretion in preeclamptic pregnant women was much lower in the third trimester than in both normotensive pregnant patients and non-pregnant controls. They speculated that these changes could be linked to preeclampsia's decreased glomerular filtration.

It's a straightforward test to calculate the calcium creatinine ratio in a random urine sample. Furthermore, the test is simple to execute, ensuring patient compliance. It has a high predictive value, so the expense is justified. As a result, it can be recommended as a screening tool for pre-eclampsia in pregnant women after 20 weeks of pregnancy during their antenatal appointment. Both foetal and maternal morbidity and mortality are caused by pre-eclampsia and gestational hypertension.

#### 5. CONCLUSION

Screening, or the systematic examination of large groups of people in order to detect disease in its early stages, is a logical extension of preventive medicine's role and one that is gaining popularity. Preeclampsia is a multisystem condition with a complex aetiology, and there is now no way to prevent it. As a result, early detection of preeclampsia and adequate care may prevent maternal and foetal problems. A number of predictors have been suggested. One such prediction is hypocalciuria. Hypocalciuria is a predictor of pregnancy-induced hypertension in the at-risk group, but its predictive value is modest in the no-risk group, according to this study. Pregnancy-induced hypertension is not a

preventable condition, but it can be avoided if detected early. Consequently, even if we need to monitor women in no-risk categories on a regular basis by taking their blood pressure and performing a physical checkup. We can deduce from this research that a pregnant lady with low urine calcium is more likely to develop pregnancy-induced hypertension. As a result, single urinary calcium may be a useful PIH screening technique.

### CONSENT AND ETHICAL APPROVAL

The Institutional Ethics Committee (IEC) clearance was taken. Informed consent was obtained from all study participants and ICH/GCP guidelines were followed.

### COMPETING INTERESTS

Author has declared that no competing interests exist.

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