



GLOBAL JOURNAL OF MEDICAL RESEARCH: K
INTERDISCIPLINARY

Volume 14 Issue 4 Version 1.0 Year 2014

Type: Double Blind Peer Reviewed International Research Journal

Publisher: Global Journals Inc. (USA)

Online ISSN: 2249-4618 & Print ISSN: 0975-5888

Study of Serum and Urinary Calcium Levels in Pregnancy Induced Hypertension Cases in and Around Chitradurga

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Abstract- Pregnancy Induced Hypertension (PIH) is defined as multisystem disorder of unknown aetiology causing vasospasm and anoxia and there is a raised blood pressure recorded at least on two occasions at 6 hours apart. It is thought that preeclampsia develop when the pregnancy induced systemic response causes one or more maternal system to decompensate. The high foetal demand for calcium is facilitated by profound physiological interactions between mother and foetus. Biochemical changes in PIH are increased plasma Creatinine, urea and uric acid concentration with proteinuria due to renal glomerular endotheliosis leading to impaired glomerular perfusion and filtration.

A case control comparative study was done with PIH and normal pregnant women both from outpatient and inpatient of Basaveshwara Medical College Hospital and Research Centre, Chitradurga, according to the criteria.

Study group will be followed up every four weeks from 28th week of gestation and 24hour/random urine sample will be collected for Biochemical evaluation of urinary Calcium, Creatinine and protein.

Keywords: PIH, Urinary calcium, Creatinine, Protein and Protein/Creatinine ratio, serum uric acid.

GJMR-K Classification: NLMC Code: WJ 190



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Study of Serum and Urinary Calcium Levels in Pregnancy Induced Hypertension Cases in and Around Chitradurga

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Abstract- Pregnancy Induced Hypertension (PIH) is defined as multisystem disorder of unknown aetiology causing vasospasm and anoxia and there is a raised blood pressure recorded at least on two occasions at 6 hours apart. It is thought that preeclampsia develop when the pregnancy induced systemic response causes one or more maternal system to decompensate. The high foetal demand for calcium is facilitated by profound physiological interactions between mother and foetus. Biochemical changes in PIH are increased plasma Creatinine, urea and uric acid concentration with proteinuria due to renal glomerular endotheliosis leading to impaired glomerular perfusion and filtration.

A case control comparative study was done with PIH and normal pregnant women both from outpatient and inpatient of Basaveshwara Medical College Hospital and Research Centre, Chitradurga, according to the criteria.

Study group will be followed up every four weeks from 28th week of gestation and 24hour/random urine sample will be collected for Biochemical evaluation of urinary Calcium, Creatinine and protein.

In this study, it was found that there was significant hypocalcaemia ($p < 0.001$), moderately significant elevations of creatinine in urine ($p < 0.01$) and significant increases in urinary protein ($p < 0.001$) was associated with preeclampsia compared to normal pregnant women, further in our study, it was also found that there was moderately significant hypocalcaemia ($p < 0.01$) and significant hyperuricemia ($p < 0.001$) and normal Creatinine levels in blood compared to normal pregnant women. Suggesting that, measurement of calcium in urine along with estimation of protein in urine may be used as screening tests along with estimation of blood levels of calcium and uric acid for confirming PIH cases.

Keywords: PIH, Urinary calcium, Creatinine, Protein and Protein/Creatinine ratio, serum uric acid.

I. INTRODUCTION

Hypertension is one of the common complications met with pregnancy and contributes significantly to maternal and perinatal morbidity and mortality. There is generalised vasospasm leading to systemic disorders involving all the vital organs of the body. Severity of Hypertensive disease in pregnancy is controllable with proper management in most of the

cases and mortality is avoidable. PIH is a term used to describe new hypertensions which appear after midterm pregnancy (20 weeks) and resolves after delivery. PIH is defined as raised blood pressure recorded at least on two occasions at 6 hours apart (2). It may be either diastolic > 90 mm of Hg or systolic > 140 mm of Hg. Preeclampsia is also associated with significant proteinuria > 300 mg/ 24 hours (3).

Gestational hypertension shows an exaggerated B.P. reference detected first time after mid pregnancy without proteinuria. It is thought that preeclampsia develop when the pregnancy induced systemic response causes one or more maternal system to decompensate. In its clinical phase preeclampsia is a hypocalcaemic state and it has been reported that hypocalcaemia predicts preeclampsia (9). The pregnant women's body provides daily doses of 50-330 mg calcium to supports development of foetal skeleton (7). This high foetal demand for calcium is facilitated by profound physiological interactions between mother and foetus. Studies of blood calcium level during pregnancy found significantly decreases in total serum as pregnancy progressed (6). Regulation of intracellular calcium plays a key role in hypertension half of the pregnant women with hypertension have preeclampsia. Pregnant women who develop severe preeclampsia have significant low dietary calcium intake compared to normotensive women. A calcium supplement has been hypothesized to reduced chances of PIH and preeclampsia (16). Biochemical changes in PIH are increased plasma Creatinine, urea and uric acid concentration with proteinuria due to renal glomerular endotheliosis leading to impaired glomerular perfusion and filtration. Many studies have been conducted to rule out the etiology, early screening and diagnostic tests, like lipid profile, oxidant and antioxidant status but among these serum and urine calcium levels and calcium metabolism have been studied extensively in PIH and preeclampsia and various conflicting results are given. Study is conducted to know alterations in serum and urinary calcium levels in all PIH cases of hypertension induced in pregnant women in and around Chitradurga.

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II. MATERIALS AND METHODS

a) Inclusion Criteria

50 pregnant women at period (18-20 weeks) of gestation both from out patients and inpatient of BMC Hospital who were following up with their with regular antenatal checkups, followed with regular routine blood and Urine investigations –i.e. Hb, RBS, VDRL, urine routine examination for protein, sugar, pus cells, epithelial cells are examined.

b) Exclusion criteria

Pregnant women who are previously known diabetic, hypertensive and suffering from any illness (mainly renal and hepatic) are excluded from the study.

i. Methods

Study group will be followed up every four weeks from 28th week of gestation and 24hour/random urine sample will be collected for Biochemical evaluation

of urinary Calcium (12), Creatinine (13) and protein by multiple strips (dipsticks) by Roche's Urine Analyser.

3 ml venous blood sample was collected from both PIH cases and normal pregnant women as per the criteria into plane vaccutainers. Blood samples are used for serum Calcium (12), serum Uric acid (14) and serum Creatinine (13). The results were statistically analysed with Students "test".

A case control comparative study was done with PIH and normal pregnant women accordingly to the criteria.

III. RESULTS

The present study included a total number of 100 subjects consists of 50 PIH cases and 50 normal pregnant women. Table-1 narrates the urinary Calcium, Creatinine, Protein and protein-Creatinine ratio in PIH cases and Normal pregnant women.

Table 1 : Table showing the Urinary Protein, Urinary Creatinine, Urinary Calcium and Protein/ Creatinine Ratio in PIH and Normal pregnant women

Parameter	Urinary Calcium (mg/dl)	Urinary Protein (gm/day)	Urinary Creatinine (gm/day)	Protein/Creatinine ratio
Normal pregnant women (n=50)	390.42 ± 34.36	0.080 ± 0.026	1.29 ± 0.33	0.05 ± 0.03
PIH Cases (n=50)	342.92*** ± 52.1	0.333*** ± 0.13	0.76** ± 0.11	0.43* ± 0.17

Note: 1. The number in parenthesis shows the number of samples.
2. Values are expressed as their Mean ± SD.
3. p- value * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

Table - 2 shows, the serum levels of Uric acid, Calcium and Creatinine in PIH cases and compared with normal pregnant women.

Table 2 : Table showing the serum Uric acid, serum Creatinine and serum Calcium levels in PIH and Normal pregnant women

Parameter	Serum Uric acid (Mg/dl)	Serum Calcium (Mg/dl)	Serum Creatinine (Mg/dl)
Normal pregnant women (n=50)	5.62 ± 1.01	8.95 ± 0.88	0.80 ± 0.13
PIH Cases (n=50)	7.64*** ± 1.39	8.29** ± 0.47	0.898 ± 0.16

Note: 1. The number in parenthesis shows the number of samples.
2. Values are expressed as their Mean ± SD.
3. p- value * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

IV. DISCUSSION

Table-1 shows a comparative study between PIH and normal pregnant women on parameter Creatinine, calcium, protein and protein/ Creatinine ratio.

It is seen that the urinary calcium in PIH cases is significantly decreased ($p < 0.001$) as compared to normal pregnant women.

Studies have shown marked hypocalciuria in PIH cases Taufield et. al. (11). Sanchez Ramos et. al.

(10) has reported decreased calcium in third trimester of PIH cases. Bilgin et.al. (1) have reported hypocalciuria in cases of PIH compared to normal pregnant women .Ramos et.al. (8) reported that 24 hour Calcium <100mg may confirm suspected case of preeclampsia.

The Urinary protein levels in PIH cases is significant increase ($p < 0.001$) as compared to normal pregnant women. The proteinuria in PIH cases as compared to normal pregnant women is probably due to renal glomerular endotheliosis leading to impaired glomerular perfusion and filtration.

Total protein excretion in urine is considered as abnormal in pregnant women when it exceeds 300mg/24 hours.

The urinary creatinine levels in PIH cases decreased as compared to ($p < 0.001$) normal pregnant women. GFR and renal blood flow raised markedly during pregnancy results in physiological fall in the serum Creatinine concentration. Urine protein excretion increases substantially due to combination of increased GFR, increased permeability of glomerular basement membrane. The protein/Creatinine ratio in PIH cases is marginally increased as compared to normal pregnant women. Thus the pathogenesis of hypocalciuria in PIH is controversial and theoretically may be due to decreased calcium uptake by the foetus and/or increased renal tubular absorption of calcium (5).

The serum uric acid levels are significantly increased ($p < 0.001$) in PIH cases compared to normal pregnant women (Table-2) and this supports the theory of uric acid role in vascular damage and in oxidative stress, the renal lesion of glomerular endotheliosis is mostlikly caused by circulating anti endothelial factors such as soluble fms- like tyrosinekinase-1, it is conceivable that uric acid may synergise with soluble fms- like tyrosinekinase-1, to induce endothelial dysfunction also the afferent arteriolar disease is seen in individuals with PIH, which explains development of hypertension in PIH (4).

In this study, it was found that significant hypocalciuria was associated with preeclampsia, suggests that, calcium measurement may be useful in screening for the PIH cases.

In a conclusion, hypocalciuria and hyperproteinuria is important feature of severe preeclampsia and probably indirectly related to the altered renal function seen in toxemia of pregnancy (15).

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