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CAN SERUM CALCIUM LEVEL BE USED AS MARKER IN PREECLAMPTICS WOMEN?

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ABSTRACT

This is a case controlled study to compare serum calcium ($Sr\ Ca^{2+}$) level in preeclampsia (PIH) and normal pregnant women (controlled group) and also to see the relation of body mass index (BMI), gestational age in PIH (n-50) and controlled group (n-50). A total of 100 pregnant women aged between 20-35 years from OPD & IPD of OBGY dept. who have satisfied inclusion and exclusion criteria and who have consented to participate in study were enrolled. Each enrolled subjects blood pressure (BP) was recorded and $Sr\ Ca^{2+}$ was estimated from venous blood by Autoanalyzer. PIH group exhibited significant decline in serum Ca^{2+} level and non significant change in BMI and gestational age was observed. In this study it has shown that decline serum Ca^{2+} level may have a role development of PIH and $Sr\ Ca^{2+}$ level can be used as marker of PIH and women at risk of developing PIH may be benefited by consuming additional dietary calcium.

Key Words: *Preeclampsia, Hypertension, Serum Calcium*

INTRODUCTION

PIH which occurs in 10% of pregnancies is major risk factors for maternal and prenatal morbidity and mortality (Appleton and Lange, 1989). PIH is characterized by abnormal increase in blood pressure, proteinuria, and edema, usually developing after the 20th weeks of pregnancy (ACOG Practice Bulletin, 2002).

Numerous studies are available linking preeclampsia with $Sr\ Ca^{2+}$ level (Marya *et al.*, 1987; Belizan *et al.*, 1988; Manjareeka *et al.*, 2011). Describing whether calcium supplementation during pregnancy would effectively lower blood pressure and whether such treatment would have an effect on the incidence of preeclampsia and low birth weight (Villar *et al.*, 1984; Bucher *et al.*, 1996; Levin *et al.*, 1997).

For foetal skeleton development at least 50-330mg Ca^{2+} is required. This high foetal demand for calcium is facilitated by profound physiological interactions between mother and fetus (Beinder, 2007).

Regulation of intracellular Ca^{2+} plays a key role in hypertension (Zemel, 2001). Ca^{2+} plays a critical role in function of the cardiac and vascular smooth muscle. Deficiency of Ca^{2+} may lead to irritable nervous. There is increase in parathyroid and renin hormone and intracellular calcium, leading to increase vascular smooth muscle contraction and increase blood pressure.

Calcium supplement has been hypothesized to reduce chances of pregnancy induced hypertension (Hofmeyr *et al.*, 2003; Kulier *et al.*, 2006). Pregnant women developing preeclampsia have significant lower dietary calcium intake as compared to normotensive women (Ramos *et al.*, 2006).

With this background and encouraged by facts, present study is undertaken to find out whether serum Ca^{2+} can be used as marker in PIH.

MATERIALS AND METHODS

Study Design

Present study is a hospital based case control study involving 100 subjects, normotensive pregnant women as controlled (n-50) group and PIH (n-50) group were enrolled.

Methods

Inclusion criteria included 1) Pregnant women age between 20-35 years 2) Primigravida 3) Normotensive and PIH women after completion of 20th weeks of gestational age. Exclusion criteria were women with 1) Multiparas 2) Family history and personal history of hypertension 3) Any other major diseases (cardiac,

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renal, diabetes, TB) 4) H/O smoking, addiction of tobacco and alcohol. Pregnant women of varied socioeconomic status were selected from OPD and IPD in OBGY Dept. of MGM Medical College, Aurangabad were enrolled. Informed and written consent was obtained from all enrolled subjects. Questionnaires included personal information's (age, no. of pregnancies, level of education, Ca²⁺ sources in diet) and Institutional ethical committee had cleared the project. PIH was diagnosed based on high blood pressure (two separate readings taken at least six hours apart of 140/90 mmHg or more), proteinurea and with or without edema (on face and hands). Blood pressure was measured using a sphygmomanometer and proteinurea analysis was done by using standard procedure. With all aseptic precautions 3ml of venous blood sample was collected in plain blue. Sr Ca²⁺ was estimated using Auto analyzer Dimension RXL Max Machine (Siemens).

Statistical Analysis

To analyze data students 't' test was used. 'p' value less than 0.005 was considered significant, 'p' value more than 0.05 was considered non significant and 'p' value less than 0.01 was considered highly significant.

RESULTS AND DISCUSSION

Results

100 women (PIH n=50) and (controlled n=50) that have satisfied the inclusion and exclusion criteria were selected.

Table 1: Comparative statistics: of BMI, gestational age, systolic BP, diastolic BP, proteinurea in controlled and PIH groups (SD- Standard deviation)

| Characteristics | Groups | Mean \pm SD | 't' value | 'p' value |
|--------------------------|------------|--------------------|-----------|-----------|
| Age(25-35yrs) | Controlled | 28.62 \pm 2.29 | 2.08 | 0.05 |
| | PIH | 29.58 \pm 2.32 | | |
| BMI (Kg/m ²) | Controlled | 23.08 \pm 1.80 | 0.87 | 0.65 |
| | PIH | 23.04 \pm 1.80 | | |
| Gestational age(weeks) | Controlled | 31.50 \pm 2.12 | 0.87 | 0.65 |
| | PIH | 30.98 \pm 3.67 | | |
| Systolic BP(mm of Hg) | Controlled | 129.28 \pm 8.01 | 11.35 | 0.0005 |
| | PIH | 170.68 \pm 13.34 | | |
| Diastolic BP (mm of Hg) | Controlled | 79.84 \pm 4.48 | 24.24 | 0.0001 |
| | PIH | 103.36 \pm 5.2 | | |
| Proteinurea | Controlled | 0 | 0.1 | 0.96 |
| | PIH | 2.20 \pm 0.78 | | |

Table 1 shows comparative statistics of controlled and PIH groups as follows-

1. Mean age in years showed significant positive correlation. Mean gestational period in weeks and BMI were not statistically different in controlled and PIH groups.
2. Systolic and diastolic blood pressures were highly significant higher in PIH group than controlled group.
3. Proteinurea in controlled (0) and PIH (2.20 \pm 0.78) were positively significant.

Table 2 shows serum Ca²⁺ in PIH group was significantly lower than controlled group. There was negative significant correlation between blood pressure changes serum Ca²⁺

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Table 2: Comparative statistics: using serum Ca²⁺ level in controlled and PIH groups

| | Controlled (n-50) Mean ± SD | PIH (n-50) Mean ± SD | ‘t’ value | ‘p’ value |
|--|--|---------------------------------|------------------|------------------|
| Serum Ca²⁺ level(mg %) | 8.98 ± 0.37 | 8.07±0.43 | 1.35 | 0.005 |

Table 3, PIH group in later part of third trimester (>32 wks) showed significant decline in serum Ca²⁺ levels as 8.96 ± 0.36 as compared to early part of third trimester (< 32 wks) as 9.00 + 0.38, whereas controlled group did not show much changes with increase in gestational age. Serum Ca²⁺ level comparison in PIH and controlled group in relation to gestational age was statistically not significant.

Table 3: Comparative statistics: using serum Ca²⁺ level in controlled and PIH groups in relation to gestation age

| Serum Ca²⁺ level (mg%) | Controlled (n-50) Mean ± SD | PIH (n-50) Mean ± SD |
|--|--|---------------------------------|
| Gestational age | | |
| <32 wks | 8.05 + 0.35 | 9.00 + 0.38 |
| >32 wks | 8.08 + 0.49 | 8.96 + 0.36 |
| ‘t’ value | 0.198 | 0.46 |
| ‘p’ value | 0.406 | 0.42 |

Discussion

Our study has shown that the mean Sr Ca²⁺ of the PIH group was (8.07±0.43), while the SrCa²⁺ of the control group was (8.98±0.3). There was statistically significant difference in both groups p=0.005. This result matches previous data which suggest that an inverse relationship between calcium and incidence of PIH. BMI and gestational age did not show much statistical significant difference in both groups.

On the basis of experimental findings, no precise mechanism has been established relating serum calcium levels with preeclampsia. However, several theories have been put forward. One of the possibility is that preeclampsia have a significantly lower 1, 25 – dihydroxyvitamin D, This lower level may contribute to the suboptimal intestinal absorption of calcium during the time of increased calcium demand (Aamer Imdad et al., 2011). Further, low calcium intake results in high parathyroid hormone levels and increased membrane permeability, resulting in increased intracellular calcium levels and decreased serum calcium levels. The former triggers vascular smooth muscle contraction and contributes to increased blood pressure (Seely et al., 1992).

Conclusion

Our study showed large variation in the values of proteinuria (2.20± 0.78) among the PIH and controlled group. All other parameters showed moderate to low variation among the normal as well as PIH subjects. Statistically significant increase in systolic and diastolic BP was observed in PIH than normal group. This was associated with significant decrease in Sr Ca²⁺ level in PIH than normal group. Suggesting that the low level of maternal Sr Ca²⁺ may have a role in development of PIH.

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