ORIGINAL ARTICLE

Hypocalcaemia as A Predisposing Factor for Pregnancy Induced Hypertension

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ABSTRACT

Objective: To show correlation between serum calcium and development of pregnancy induced hypertension

Design: Case control comparative study.

Place & Duration of Study: This study was carried out in the Department of Obstetrics and Gynaecology unit II sir Ganga Ram Hospital, Lahore between January and December 2010.

Patients and Methods: In this study 200 pregnant women attending antenatal clinic of Sir Ganga Ram Hospital were included. They were divided in two groups each having 100 women. Selection of each group was done through convenience, non-probability sampling technique. All women had at least one antenatal visit at or just before 20 weeks of pregnancy and had normal blood pressure till that time. Women presenting with prolonged hyperemesis, repeated gastro-intestinal upsets and twin pregnancy were excluded from the study. These women were followed in antenatal clinic till 30 weeks of pregnancy. Then two groups were made. Group I included 100 pregnant women with normal blood pressure with gestational age between 30-40 wks. Group II included 100 pregnant women, inclusion criteria was patients having diastolic blood pressure ≥ 100mmHg, with or without proteinuria and patients with or without convulsions having same gestational age range as that of group I. Detailed history especially dietary history was taken through a specially designed performa. Serum calcium levels were estimated in both groups.

Results: Analysis of results showed that PIH developed in young patients who belonged to poor socioeconomic group & were not taking calcium regularly in diet and as calcium supplement and their total serum calcium level was significantly low. In group II 30% patient were taking regular dietary and supplementary calcium as compared to 60% patients in group I. Analysis of serum calcium level showed that average calcium level (7.36mg/dl) in group II (patients with PIH) was significantly lower as compared to group I controls (8.5mg/dl).

Conclusion: Study concluded that hypocalcaemia has a strong association with PIH and it is directly related to dietary and supplementary calcium intake.

INTRODUCTION

Pregnancy is a state which can induce hypertension in normotensive women. By definition pregnancy induced hypertension (PIH) is a condition occurring after 20th week of pregnancy in a previously normotensive patient. Generally PIH is defined by systolic blood pressure ≥ 140mmHg or diastolic blood pressure ≥90mmHg measured at two occasions four to six hours apart. (1). However a rise in systolic blood pressure of 20-30mmHg or 10-15mmHg of diastolic blood pressure or both from pre pregnant baseline value on two or more occasions 4-6 hours apart is also diagnostic (2). Once PIH is associated with proteinuria there is increased risk of developing eclampsia (3).

PIH is often referred as the disease of theories. Different theories have been made such as impaired trophoblastic invasion of spiral arterioles, uterine vascular changes, endothelial dysfunction, circulating oxidative radicles and cytokines disturbances.In addition to these theories certain predisposing factors are noted among them younger age, genetic predisposition, lower socioeconomic status and dietary deficiencies especially the calcium deficiency are the important ones. The hypothesis that calcium can be the predisposing factor was first put forward in 1980. The idea came from the observation that Mayan Indians in Guatemala, who traditionally soaked their corn in lime before cooking, had a low incidence of pre eclampsia (4)

Pregnancy imposes major changes in mothers' nutritional requirement and calcium metabolism. During last ten weeks of pregnancy fetus obtains approximately (1.8 grams) or 6.5millimol/day of calcium which is about eighty percent of the net

dietary absorption in a normal pregnant lady taking average 20millimole calcium in her diet per day. These demands are met by increasing absorption of calcium and not by reduction of urinary calcium from maternal skeleton. This increase in absorption is due to increase in circulating dehydroxylated metabolites of Vitamin D3 in maternal blood to twice the non-pregnant level (5). So increase in dietary calcium is mandatory otherwise low serum calcium level may lead to elevated levels of parathyroid hormones and calcitriol. These elevated levels of hormones stimulate increase in intracellular calcium level especially in vascular smooth muscles leading to vasoconstriction and hypertension (6). The effect of abnormal calcium and calcium regulating hormones levels may extend to blood pressure control centers of CNS. Low calcium levels can stimulate the release of norepinephrine and it increases its postsynaptic effect leading to hypertension(7).calcium causes natriuresis to lower the blood pressure(8).

It was also found Calcium interact with sodium potassium and magnesium, different studies found that calcium is crucial for synthesis of nitric oxide and prostacyclin which act as vasodilator, So decrease in the serum calcium can lead to more predisposition to development of PIH(9).

Maternal mortality is extremely high in Pakistan where one in eighty-nine women dies of maternal causes, with pre-eclampsia and eclampsia as one of the major causes (25). This study was conducted to determine the factors associated with PIH and pre-eclampsia in healthy women with single pregnancy presenting to the antenatal clinic of Sir Ganga Ram Hospital. Moreover, the study investigated the association between serum calcium level and PIH.

PATIENTS AND METHODS

In this study 200 pregnant women attending antenatal clinic of Sir Ganga Ram Hospital were included. They were divided in two groups each having 100 women. Selection of each group was done through convenience, non-probability sampling technique. All women had at least one antenatal visit at or just before 20 weeks of pregnancy and had normal blood pressure till that time. Women presenting with prolonged hyperemesis, repeated gastro-intestinal upsets and twin pregnancy were excluded from the study. These women were followed in antenatal clinic till 30 weeks of pregnancy. Then two groups were made. Group I included 100 pregnant women with normal blood pressure with gestational age between 30-40 wks.Group II included 100 pregnant women, inclusion criteria was patients having diastolic blood pressure ≥ 100mmHg, with or without proteinuria and patients with or without convulsions having same gestational age range as that of group I.

All patients were subjected to a questionnaire including age, parity. gestational age, family history, monthly income dietary and supplementary calcium intake. Clinical examination included general physical examination and obstetric examination. During general examination, blood pressure was taken by mercury sphygmomanometer in sitting position in outpatient. The patient who had diastolic blood pressure >90mmHg were admitted as day case for monitoring and identifying patient with PIH. Selected patients were admitted in antenatal ward for monitoring and management of blood pressure. Estimation of total serum calcium was done by photometric calorimetric test by cresolphthalein method in both groups. Normal range of total serum calcium was 8.1-10.4 mg/dl (2.02-2.06m mole/litre).

Data was analyzed by using SPSS version 10.Descriptive statistics were computed for data presentation. To compare qualitative response variables Pearson's chi square test was applied, student's t-test was used to compare average serum calcium level in two groups. Statistical significance was taken at $p<0.05$.

RESULTS

The socio-demographic features of study population are shown in figure.

This table showed that most of group II [with PIH] were primigravida[62% with poor socioeconomic status [75%] and were not taking regular dietary [70%] and supplementary calcium[90%].

Table II is showing relationship of serum calcium and blood pressure in two groups. Serum calcium level progressively fell as the blood pressure increased.

Lower serum calcium levels were observed in eclamptic patients.50 %(6) of eclamptic patients had serum calcium level between 7.1_7.4. The relationship is shown in table 3.

Table 1: Demographic characters of patients

Parameter	**Group I (normotensive)**	**Group II(PIH) p value**
Age <25 yrs. >25 yrs.	 45% 55%	 56% 34% P<0.01
Parity Primigravida Multigravida	 48% 52%	 62% 38% p<0.01
Weight >100kg	10%	20% p<0.01
Socioeconomic status Poor Middleclass High class	 28% 60% 12%	 75% 25% p<0.001 0%
Dietry calcium intake Regular Irregular	 60% 40%	 30% 70% p<0.001
Supplementary calcium intake Regular Irregular	 60% 40%	 10% 90% p<0.0001
Past history of PIH Family history of PIH/ Hypertension	3% 6%	10% 20%

Table 2: Relationship between serum calcium level and blood pressure

Serum calcium level in mg/dl	No & %age of patient with different diastolic blood pressures in two groups				
	Group 1 <100mmHg	Group II 100mmHg	Group II >100-110mmHg	Group II >110-120mmHg	Group II >120mmHg
8.1-10	87(87%)	7(7%)	3(3%)	1(1%)	1(1%)
7.5-8	12(12%)	25(25%)	6(6%)	2(2%)	2(2%)
7-7.4	1(1%)	18(18%)	12(12%)	2(2%)	1(1%)
6.5-7	0	2(2%)	4(4%)	9(9%)	2(2%)
Below6.5	0	0(0%)	0(0%)	2(2%)	1(1%)

Table 3: Serum calcium level of twelve eclamptic patients in group II

Serum calcium level	No. &%age of eclamptic patients
7.1-7.4	6(50%)
6.5-7.0mg/dl	4(33.3%)
5.5-7.0 mg/dl	2(16.6%)

Table 4: Statistical analysis of serum calcium level in two groups &calculation of P value descriptive statististics

Group	Total patients	Minimum serum calcium	Maximum serum calcium	mean	Standard deviation
I	100	7.00	11.0	8.59	.7632
II	100	5.60	9.00	7.6	.5472

T-TEST
One sample test
Test value=0.005

Group	Sig(2tailed)	Mean difference	95% confidence interval of the difference	
I	0.000	8.5860	8.4346	8.7374
II	0.000	7.3620	7.2534	7.4706

Descriptive analysis of serum calcium in two groups showed that group II minimum level was 5.6 mg/ dl while it was 7 mg/dl in group I.

DISCUSSION

Results of our study revealed that most of the pregnant ladies developing PIH were younger age primigravida. Similar results were observed by Indomati V. In that study, majority (51.3%) was in age group of 21-25 years and 68% of them were primigravida. (16) while other studies showed no correlation most probably their sample size was below 40 so this relationship could not be so obvious (12, 21)

Our study also showed that 20% of PIH group ladies had more than 100 kg weight which is a risk factor for development of hypertension as mentioned by other workers(12,21)

A strong correlation between PIH and family history of PIH and hypertension was observed. These results are consistent with other studies (22, 23, and 24). These results suggest that family history of hypertension deflects genetic and behavioral factors.

In our study, most of the ladies developing PIH were belonging to low socio-economic group and they were not taking regular dietary or supplementary calcium. Much attention has been paid to the relationship between serum calcium and blood pressure by various workers. (10,11)A causal relationship between serum calcium deficit &gestational hypertension as well as beneficial effect of calcium supplementation has been reported in pregnant women (12-14).An analysis of 14 trials enrolling2500women has shown that the ladies who took (1500-2000) mg calcium per day were less likely to develop PIH. Canadian researchers have also reported in Journal of American Medical Association that the ladies who took calcium supplements were 62% less likely to develop PIH (15). It is the limitation of our study that we only asked about calcium intake through a questionnaire and we could not actually assess the amount of calcium taken per day.

Mean serum calcium in group II patients was 7.6 mg/dl (1.8 mmol/l) & only 12% had values in normal range these results are consistent with those reported from other developed and developing countries studying low socioeconomic groups and Asian mothers. Due to our limitation we measured total serum calcium,while in other studies it was seen that only ionized calcium is crucial for blood pressure regulation. (17-18,21)

It was also noted in this study that group II eclamptic patients had markedly reduced serum calcium level thus supporting the fact that low serum calcium level has a direct relationship with PIH & its complications similar results were observed by Idogun Es et al in Africa.(18).

CONCLUSION

From our study, though calcium deficiency during pregnancy cannot be pin pointed as sole factor for the development of PIH and its complications, its relationship with PIH cannot be denied. Therefore calcium intake during pregnancy should be encouraged. Calcium supplements should be recommended for women who skip milk and milk products due to personal preferences and food faddism. This target can be achieved by improving health education of ladies during antenatal period through individualized counseling sessions and group discussions at hospital setup .Media can also play a very important role for mass awareness and health education of young girls and expectant mothers. Special school health classes should be

arranged for young girls to stress upon the usefulness of milk intake for their healthy bones as well as for becoming a healthy expectant mother in future.

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