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Original Research Article

Comparison of High Dose and Low Dose Calcium Intake to Prevent Preeclampsia and Eclampsia

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ABSTRACT

Preeclampsia is a condition, which is the combination of raised blood pressure and proteinuria levels, occurs after 20 weeks of gestation, which leads to maternal complications (eclampsia) and fetal complications. According to worldwide epidemiology the incidence of preeclampsia is reported to be 8-10% among pregnant women. Current WHO recommendations are 1.5-2 g/day calcium supplementation for low-calcium intake pregnant women to prevent complications. The main aim of our study is to compare the high dose & low dose calcium intake to prevent preeclampsia & eclampsia. A prospective Interventional study was performed in south Indian tertiary care teaching hospital for about 6 months [August 2017-january 2018].We had recruited 60 pregnant women and were divided in to two groups: group A[low dose,500 mg, BID] and group B [high dose,500 mg, TID] based on simple randomization technique. After collection of patient data, both the groups were followed for 4 follow ups and Hb, proteinuria levels and Blood Pressure were monitored. Our study results shows that average mean Blood Pressure in low dose group was 109.33/72.66 and 110.33/76.33 and high dose was 125.00/84.33 and 104.333/69.667 before and after treatment respectively. By using SPSS Software results were analysed. By this comparison, we found extreme statistical significant difference between low dose Vs high dose calcium supplementation. Low dose calcium group has poor statistical significance [systole($p<0.586$) ,diastole(0.125)],where as high dose calcium group shows extreme statistical significance [systole($p<0.0001$),diastole($p<0.0002$)]. Finally, we may conclude that high dose calcium supplementation is preferable than that of the low dose calcium in preventing the Preeclampsia and Eclampsia.

Key Words: Preeclampsia, Eclampsia, Calcium, Blood Pressure, Proteinuria.

INTRODUCTION

Hypertension is a common disease that is simply defined as persistently elevated arterial blood pressure (BP). Normal Blood Pressure was. 130/90 mm Hg. Gestational hypertension and preeclampsia both are conditions occurring during pregnancy. Gestational hypertension is also called as pregnancy-induced hypertension (PIH). It is defined as high blood pressure measuring above 140/90mm Hg in pregnant females without the presence of proteinuria and which occurs beyond 20 weeks of gestation. This high blood pressure occurs as a fresh occurrence without any prior history of hypertension in individuals. [1]

Pre-eclampsia is a condition specific to pregnancy which typically occurs after 20 weeks of pregnancy. It is a combination of raised blood pressure (hypertension), protein in urine (proteinuria). BP has

reached greater than 140/90 mmHg on two different occasions at least 4 hours apart. Proteinuria of greater than or equal to 0.3g in a 24 hours urine specimen. Pre-eclampsia is a major cause of maternal mortality and morbidity, preterm birth, perinatal death, and intrauterine growth restriction. In India the incidence of preeclampsia is reported to be 8-10% among pregnant women, the prevalence of hypertensive disorders of pregnancy was 7.8% with preeclampsia. According to a study in India, 10%-15% of maternal deaths are directly associated with preeclampsia and eclampsia. [2]

The pathophysiology involves two stages: Stage:1 Poor placentation, Stage:2 Inflammation [3]

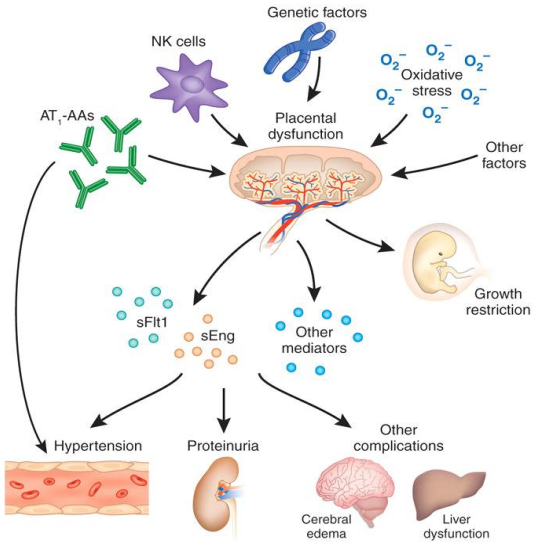

Fig-1 pathophysiology of preeclampsia [4]

Eclampsia is extremely severe form of PIH characterized by sudden onset of generalized tonic clonic convulsions. It is a severe complication of preeclampsia and is a rare but serious condition where high blood pressure results in seizures or coma during pregnancy or immediately after pregnancy. Pathophysiology of eclampsia includes, in mild HTN or normotension: abnormal autoregulatory response consisting of severe arterial vasospasm with rupture of endometrium & pericapillary haemorrhages with development of abnormal electric foci causing convulsion. In severe HTN, limit of auto regulation exceeded, vasodilatation occurs with hyper perfusion causing endothelial capillary damage and interstitial vasogenic edema. [5]

Current WHO recommendations are 1.5–2 g/day calcium supplementation for low-calcium intake pregnant women to prevent complications. [6] Low calcium intake may cause high blood pressure by stimulating either parathyroid hormone or renin release, thereby increasing intracellular calcium in vascular smooth muscle and leading to vasoconstriction.

A possible mode of action for calcium supplementation is that it reduces parathyroid release and intracellular calcium and so reduces smooth muscle contractility. By a similar mechanism, calcium supplementation could also reduce uterine smooth muscle contractility and prevents preterm labour and delivery. This hypothesis was tested in several randomised trials commencing in the late 1980s, which suggested a promising beneficial effect for calcium supplementation. [7] The main aim of our study is to compare the high dose & low dose calcium intake to prevent preeclampsia & eclampsia.

MATERIALS AND METHODS

A prospective Interventional study was performed in OBG (IP&OP), RIMS, a south Indian tertiary care teaching hospital, Kadapa for about 6 months [August 2017-January 2018]. We had recruited 60 pregnant women. Study materials include Patient data collection proforma, Informed consent form.

Subjects included in the study were pregnant women (above 4th month), gestational hypertension, Patient who are willing to participate in the study, Patients with previous and family history of HTN, Obese pregnant population, Patient of age group between 20-35 years. Subjects excluded from the study are Patients who were not willing to participate in the study, HIV patients and other comorbid conditions, Patients with multiple diseases.

Subjects from the second trimester were recruited in the study based on inclusion and exclusion criteria. Patient related demographic details, past medical/ medication history, lab investigations were collected. After collection of data, B.P for each patient was monitored. The patients were divided into two groups randomly by using simple randomization technique i.e. Low dose calcium group 500 mg BID and High dose calcium group 500 mg TID. Both the groups were followed for 4 follow ups and Hb, protein in urine levels and B.P were monitored.

The results of both the groups were compared and the effect of calcium in preventing preeclampsia and eclampsia and also in reducing the incidence of pre term births and low birth weight were observed by measuring the parameters especially B.P.

RESULTS

Table 1. Patient distribution with respect to their age groups

S.NO	Age group	No.of patients	Percentage (%)
1.	20-25	33	55
2.	26-30	18	30
3.	31-35	9	15

Age Wise Distribution

We categorize the patient to their age groups ,out of 60 patients majority 33(55%) of them were found in between the age group 20-25 years, followed by 18(30%) in between the age group 26-30 years, followed by 9 (15%) in between the age group of 31-35.

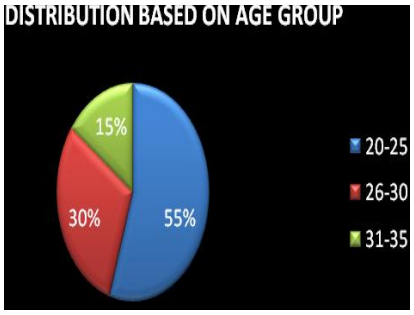

Fig.2.percentage of no. of patients according to their age

Treatment Outcome In Multigravida

We have categorize the patients based on their number of pregnancies. Table 2 shows patients with primi are 9, their average B.P before treatment was 116.94/77.96 and after treatment was 107.28/72.88;followed by patients with G2 were 21,and their average B.P was 117.01/78.07 and 107.54/72.98;patients with G3 were 22 and their average B.P was 117.57/78.61 and 107.33/73; Patients with G4 were 6 and their average B.P was 117.94/78.97 and 107.17/72.56;patients with G5 were 2 and their average B.P was 120.95/81.42 and 106.66/71.90 before treatment and after treatment respectively.

Table 2. Treatment outcome in multigravida

S.NO	NO.OF PREGNANCIES	NO.OF PATIENTS	B.P	BEFORE TREATMENT	B.P	AFTER TREATMENT
			SYSTOLE	DIASTOLE	SYSTOLE	DIASTOLE
1.	1 pregnancy	9	116.94	77.96	107.28	72.88
2.	2 pregnancies	21	117.01	78.07	107.54	72.98
3.	3 pregnancies	22	117.57	78.61	107.33	73
4.	4 pregnancies	6	117.94	78.97	107.17	72.56
5.	5 pregnancies	2	120.95	81.42	106.66	71.90

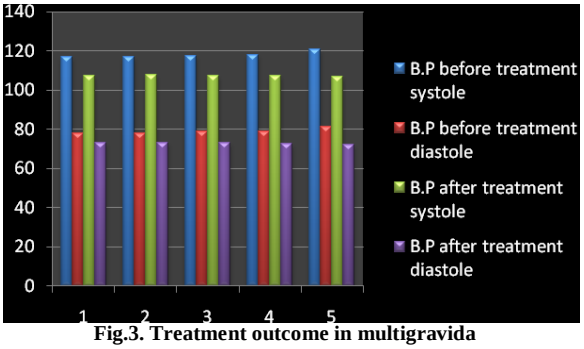

Fig.3. Treatment outcome in multigravida

Comparison of Average Blood Pressure between Low Dose Group and High Dose Group

Explains the average values and interpretation of comparative groups (i.e. low dose and high dose). The average mean of B.P in low dose group was 109.33/72.66 and 110.33/76.33 and high dose was 125.00/84.33 and 104.333/69.667 before and after treatment respectively.

Table 3. COMPARISON OF AVERAGE BLOOD PRESSURE BETWEEN LOW DOSE GROUP AND HIGH DOSE GROUP

S.NO	LOW DOSE CALCIUM				HIGH DOSE CALCIUM			
	PRE		POST		PRE		POST	
	SYSTOLE	DIASTOLE	SYSTOLE	DIASTOLE	SYSTOLE	DIASTOLE	SYSTOLE	DIASTOLE
MEAN	109.33	72.667	110.33	76.33	125.00	84.33	104.333	69.667

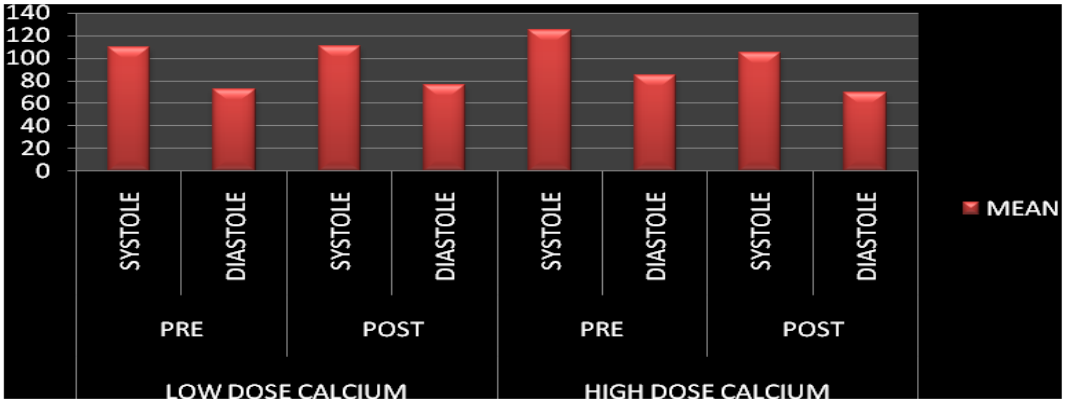

Fig.4. Comparison of Average Blood Pressure between Low Dose Group and High Dose Group

Table 4.Comparison of Average B.P In Both The Groups Before And After Treatment Along With P Value

VARIABLES	LOW DOSE CALCIUM				HIGH DOSE CALCIUM			
	BASELINE SYSTOLE	FINAL SYSTOLE	BASELINE DIASTOLE	FINAL DIASTOLE	BASELINE SYSTOLE	FINAL SYSTOLE	BASELINE DIASTOLE	FINAL DIASTOLE
MEAN	109.33	110.33	72.667	76.33	125.00	104.33	84.33	69.667
STD DEVIATION	10.1483	7.18395	10.8065	5.56053	13.83399	8.5836	9.35261	7.64890
P VALUE	0.586*		0.125*		0.0001***		0.0002***	

*****Extremely significant;**Very significant;*Poor significant ; ns-not significant**

Assessment of Proteinuria and Serum Calcium Levels

We have performed proteinuria levels at the day of recruitment and in each follow up. Among 60 patients we had found 11 patients with proteinuria levels at the time of recruitment and finally after the treatment we had found the normal protein levels among those patients. We assessed serum calcium levels at the last month of gestation for hypo or hypercalcemia levels and we came to know that no patient have fluctuations in their serum calcium levels.

Assessment of Post Labour Parameters [Pre-Term Births and Low Birth Weights]

Pre-Term Births:

Among 51 patients we had found that no patient had their labour before 36 weeks of gestation.

Low Birth Weights:

All most all the 51 patients had their healthy babies with normal weight. The mean average weight of 51 babies was found to be 2.697.

Table 5. Average mean of birth weight among both groups

FREQUENCY	BIRTH WEIGHT
BID	2.689
TID	2.701

DISCUSSION

Out of 60 patients 33(55%) were in the age group of 20-25,18 (30%) were in the age group of 26-30,9(15%) were in the age group of 31-35.From this study we have concluded that patients in the age group of 30-35 were more prone to PIH disorders.

In our study, we had recruited gestational HTN patients and they were prescribed with calcium supplementation which results in decreased progression to preeclampsia, which is supported by Shakuntala Chhabra et al. [8] and Lawrie TA et al. [9]

In our study, we have performed proteinuria levels at the day of recruitment

and in each follow up. Among 60 patients we had found 11 patients with proteinuria levels at the time of recruitment and finally after the treatment we had found the normal protein levels among those patients.

In our study, we had found the decreased risk of preeclampsia among women who are at increased risks of eclampsia, which is supported by Leonelo E. Bautista et al. [10]

In our study, among 60 patients, 51 had their labour in term and no preterm deliveries were observed (i.e. before 36 weeks of gestation), here we can conclude, by prescribing enough calcium supplementation (according to WHO-2 gm/day requirement) for pregnant women will dramatically decrease the risk of preeclampsia and preterm births, which is supported by Hacker AN et al., [11] Azar Aghamohemmad et al., [12] Sarah Bruyn Jones et al. [13] and Sammya Bezerra Maia E Holanda Mouria et al. [14]

In our study, by the use of high dose calcium supplementation during pregnancy reduces the risk of preeclampsia and preterm birth when compared to low dose calcium supplementation. Calcium also have a role in reducing placental abruption, incidence of preeclampsia, LSCS and low birth weight (<2500 gms), which is supported by Lucy Mackillop et al. [15]

In our study, after prescribing calcium supplementation, no maternal deaths were observed, which is supported by Erika Barbosa Camargo et al. [16]

In our study, as per our follow ups, we found that all the mothers and babies were very healthy after their delivery, as per our aim, we can conclude that supplementation of calcium helps in improving the health of mother and baby during pregnancy, also helps in preventing the risk of preeclampsia and premature births, which is supported by Brain P.Randall et al. [17]

In our study period, out of 51 deliveries, 30(58.82%) were NVD, by this we conclude that calcium supplementation during gestational period may reduce the incidence of LSCS, perinatal deaths. Calcium also directly effects on smooth muscles to reduce contractility and prevent preterm labour, which is supported by Richard J.Levine et al. [18]

We have measured B.P at each follow up .For low dose calcium group, the mean average B.P at baseline was found to be 109.33/72.66 and mean average B.P at final follow up was found to be 110.33/76.33.For high dose calcium group, the mean average B.P at baseline was found to be 125.00/84.33 and at final follow up 104.33/69.667.

By this comparison, we found the extreme statistical significance difference between low dose Vs high dose calcium supplementation. Low dose calcium group has poor statistical significant [systole ($p<0.586$), diastole (0.125)], where as high dose calcium group shows extreme statistical significant [systole ($p<0.0001$), diastole ($p<0.0002$)].

In our study, as we are prescribing calcium supplementation for pregnant women included in the study, we assessed their calcium levels for hypo or hypercalcemia, as we are prescribing more dose than normal. After assessment we found no fluctuations in serum calcium levels and more over their babies may have good bone strength.

Our study results were also supported by Win Khaing et al., [19] Moshood O Omotayo et al., [20] Dr.Lisa Watson et al., [21] Jason Waugh et al., [22] Tito Silvio Patrelli et al., [23] Aamer Imdad et al., [24] G Justus Hofmeyr et al., [25] L.Duley et al. [26]

CONCLUSION

With this study we concluded that the high dose calcium supplementation to the pregnant women will have more beneficial effects when compared to that of the low dose calcium supplementation.

Most of the supporting literature is review articles; this study may be the first research work which concludes the benefits of high dose calcium supplementation. After

the treatment with the calcium, there is the decrease in B.P in the patients with the high risk of attaining pre eclampsia. In case of high dose calcium the difference in decreasing B.P is more and extremely significant when compared to low dose calcium. Hence here we can prove that by giving the high dose calcium supplementation may be very helpful in preventing the preeclampsia which in turn prevents eclampsia.

Finally, we concludes the high dose calcium supplementation is preferable than that of the low dose calcium in preventing the preeclampsia and eclampsia.

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