Research Article

The Evaluation of Cord Blood Magnesium Level in Neonates of Magnesium Sulphate Treated Pre-eclamptic/eclamptic Mothers and its Clinical Correlation

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Abstract:

This case control study was carried out on 35 neonates born to pre-eclamptic/eclamptic mothers treated with magnesium sulphate and 35 neonates born to normal healthy mothers. Cases and controls were selected by inclusion-exclusion criteria irrespective of body weight and maturity of the babies. Magnesium sulphate administered to mother in study group was according to Pritchard's intramuscular regime (1984).

The cord blood samples were collected just after birth in both study and control group and magnesium level was estimated by calorimetric method. Magnesium level was found to be significantly higher in study group (6.0305±0.08047) than controls (1.916± 0.300; p = 0.0001). There was a significant difference in Apgar scores of study and control group. A negative weak linear correlation was found between cord blood magnesium level and different neonatal parameter like apgar score, birth weight and gestestional age. A weak positive linear correlation was found between magnesium level and neonatal mortality which was also not significant.

Key Words: Pre-eclampsia, Eclampsia, Magnesium sulphate.

Introduction:

Toxemia of pregnancy is a disease known from the time of Hippocrates. Pre-eclampsia is a multi-system disorder of unknown etiology characterized by hypertension of 140/90 mmHg or more with proteinuria after 20 weeks of gestation in a previously normotensive and nonproteinuric woman. Pre-eclampsia complicated by convulsion or coma is eclampsia.

Pre-eclampsia affects approximately 3% of all pregnancies worldwide. In India, the incidence of pre-eclampsia among hospital patients is about 7-10% of all antenatal admissions and that of eclampsia is about 0.94 to 1.8% the incidence in primigravidae is about 10% and in multigravidae is about 5% (Dutta & Konar, 2011).

Management of these cases has always been a controversial subject.Many drugs have been tried starting from chloroform, potassium bromide, morphine to diazepam (Duley et al, 2010), magnesium sulphate (Pritchard et al, 1984) and phenytoin (Slater et al, 1987).

When magnesium sulphate is administered parenterally to mother, it promptly crosses the placenta to achieve equilibrium with fetal serum. No untoward effect of magnesium sulphate has been noticed on babies after birth. Respiratory depression and hyporeflexia have been observed in newborns delivered by mothers undergoing intravenous magnesium sulphate therapy ,but intramuscular magnesium sulphate therapy has not been associated with any neonatal compromise. Recently a possible protective effect of magnesium has been demonstrated against cerebral palsy in very low birth weight infants (Nelson & Grether, 1995; Schendel et al, 1996, Crowther et al, 2003) .

This study was carried out to evaluate neonatal outcome in pre-eclamptic and eclamptic mothers, who received magnesium sulphate therapy intramuscularly.

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Materials and Methods:

This study was a case control study conducted in the Department of Pediatrics in active collaboration with the Department of Obstetrics & gyaenecology and Pathology, MLB Medical College, Jhansi. The period of study extended from January 2010 to September 2011.

The study was carried out on neonates born to pre-eclamptic/eclamptic mothers and normal mothers admitted in the labour room of the department of obstetrics & gyaenecology.

Neonates included in the study were divided into two groups : Group A-Study group

Group B-Control group.

Group A:

Inclusion Criteria for the study group:

Neonates born to mothers who had high blood pressure (>140/90mmHg) associated with proteinuria

and with or without convulsion or coma.

Exclusion criteria for the study group:

Babies born to mothers having following conditions were excluded from the study.

i. Eclamptic mothers with convulsions occurring after delivery or pre-eclamptic and eclamptic mothers with dead fetus *in utero*.
ii. Medical complications including heart disease, diabetes mellitus, chronic renal failure, thyrotoxicosis etc.
iii. Pre-pregnancy systemic hypertension, respiratory disease or history of epilepsy.

Selected mothers received magnesium sulphate therapy according to Pritchard's regime.

Group B:

Control group comprised of neonates born to healthy mothers who had normal BP throughout pregnancy with no proteinuria and no edema.

After selection of cases, detailed antenatal, natal and postnatal history with clinical examination was recorded in the proforma.

Following investigations were carried out:

In mother: Routine investigations including Hb, TLC, DLC, ESR, blood sugar, blood urea, urine routine / microscopy was done. Special investigations carried out in the study group were serum creatinine, serum electrolyte, liver function tests, total protein, serum albumin, serum globulin, AG ratio, urinary proteins.

In new born: Magnesium was estimated in cord blood collected at the time of delivery using magnesium kit (Calmagite method).

Observations:

In the present study, mean age of mother in the study and the control group was 24.09±4.39 and 26.62±4.80 years respectively. The difference was statistically significant ($p<0.05$). In the study group 65.7% and in control group 42.86% mothers were primigravida, the difference in parity was statistical significant.

Mean gestational age of neonates in the study group was 34.89 weeks, in contrast to 36.63 weeks in the control group. The difference was significant ($p<0.05$). The mean birth weight of newborn in the study group was 2165.7 gm against 2605.14 gm in the cotnrol group and the difference was significant ($p<0.05$). The mean apgar score in the study and in the control group was 6.45±1.83 and 8.05±1.12 respectively and the difference was highly significant ($p<0.0001$; Table I).

Mean dose of magnesium sulfate administered to mothers in the study group was 33.50±14.30 gm and mean duration of administration was 18.33±10.489 hours. Mean cord blood level of magnesium was higher in the study group as compared to the control group and the difference was highly significant ($p<0.0001$).

Neonatal mortality was higher in the study group as compared to the control group but the difference was not statistically significant ($\chi^2=2.25$, d.f=2, p=0.32). However, neonatal morbidity in terms of prematurity ($\chi^2=4.632$, d.f=1, p=0.03), low birth weight ($\chi^2=5.733$, d.f=1, p=0.01), asphyxia ($\chi^2=4.590$, d.f=1, p=0.032), IUGR ($\chi^2=4.928$, d.f.=1, p=0.02) was significantly higher in the study group as compared to the control group (Table II).

In the present study, it was observed that there was insignificant weak negative correlation between cord blood magnesium and neonatal parameters like apgar score, birth weight and gestational age ($p>0.05$). There was a weak positive linear correlation between magnesium level and neonatal mortality which was also not significant ($p>0.05$).

Table I: Comparison of different parameters between the study and control groups.

Parameter	Study Group Mean ±SD (n=35)	Control Group Mean ±SD (n=35)	*z*-value	*p*-value
Age of mother (in years)	24.09 ± 4.39	26.62 ± 4.80	2.298	0.0215*
Gestational age (in weeks)	34.89 ± 2.84	36.63 ± 2.45	2.740	0.006 *
Birth weight (in grams)	2165.7 ± 642.97	2605.14 ± 538.32	-3.103	0.0019*
Apgar score	6.45 ±1.83	8.05 ± 1.12	18.161	0.0001**
Cord blood magnesium level (in mg)	6.0305± 0.08	1.916±0.30	28.3273	0.0001**

*Significant ($p<0.05$), ** Highly Significant ($p<0.0001$)

Table II: Bivariate correlation analysis with their significance (2 tailed) between cord blood magnesium level and different neonatal parameters in study group.

		Apgar Score	Birth Weight	Gestational Age	Neonatal Mortality
Cord blood	Correlation *(r)*	-0.228	-0.234	-0.174	+0.051
Magnesium level	Significance *(p)*	0.1869	0.1747	0.2353	0.7748

Discussion:

Toxemia of pregnancy is one of the leading cause of maternal and perinatal mortality and morbidity not only in developing countries but also in most developed nations (Lopez-Liera et al, 1976).

Newton (1964) found the incidence of toxemia in primigravida to be 70%; Pritchard et al (1984) found this incidence to be 85%, as against 65.7% in the study group of the present study.

In the present study, 65.7% neonates of the study group were, below 37 weeks of gestation, similarly Mohanty et al (1990) found 66% cases to be below 37 weeks of gastation. In the present study significant difference was observed in birth weight in both the groups. Twenty four out of 35 babies of the study group and 13 out of 35 babies of the control group were of low birth weight in the present study.

At 1 minute, 91.2 % babies had apgar score of <7 and 39.9% babies had apgar score of <7 at the end of 5 minutes in the study group while in the control group, 48.55% babies had apgar score of <7 at the end of 1minute and only 8.5% babies had apgar of <7 at the end of 5minutes.

Crowther et al (2003) reported 44% babies to have apgar score of <7 at 1 minute and in 22% apgar score of <7 at 5 minutes in a group of toxemic mothers treated with magnesium sulphate.

Study conducted by eclampsia collaborative group (1995) observed that 48.9% neonates had apgar score of <7 at 1 minute while apgar score at the end of 5 minutes was of <7 in 22.3% neonates.

Eighty percent babies in study group survived beyond 72 hours, whereas 91.4% newborns survived beyond 72 hours in the control group. Although neonatal mortality in study group was higher, but the difference between the two groups was not statistically significant.

In the present study, the perinatal mortality in study group was 17.05%, however, Crowther et al (2003) reported the perinatal mortality to be 7.4%; Mohanty et al (1990) reported perinatal mortality to be 31%, and in a randomized control trial by Magpie trial collaborative group (Altman et al, 2002) found it to be 12.7%.

In the present study, cord blood magnesium level was higher in neonates in the study group (6.03±0.80 mg/dl) as compared to neonates in the control group (1.91±0.30 mg/dl).

The above observations were in accordance with the study of Cruikshank et al (1979), who suggested that at the time of delivery, the offsprings of the $MgSO_4$ exposed women were hypermagnesemic, although less so than their mothers. Mason et al (1996) found that total magnesium and ionized magnesium were significantly ($p<0.001$) elevated in the cord blood samples of the treated group. Perveen et al (2002) suggested that magnesium may reach the fetus and appear in the cord blood at a higher than normal concentrations.

Bibliography:

1. Altman D, Carroli G, Duley L, Farrell B, Moodley J, Neilson J, Smith D (Magpie Trial Collaboration Group): Do women with pre-eclampsia, and their babies, benefit from magnesium sulphate? The Magpie Trial: A randomized placebo-controlled trial. *Lancet*, 2002;359(9321):1877-1890.
2. Crowther CA, Hiller JE, Doyle LW, Haslam RR (Australasian Collaborative Trial of Magnesium Sulphate Collaborative Group): Effect of magnesium sulfate given for neuroprotection before preterm birth: A randomized controlled trial. *The Journal of the American Medical Association*, 2003;290(20):2669-2676.
3. Cruikshank DP, Pitkin RM, Reynolds WA, Williams GA, Hargis GK: Effects of magnesium sulfate treatment on perinatal calcium metabolism. I. Maternal and fetal responses. *American Journal of Obstetric and Gynecology*, 1979;134(3):243-249.
4. Duley L, Henderson-Smart DJ, Walker GJA, Chou D: Magnesium sulphate versus diazepam for eclampsia (Review). Cochrane Database of Systematic Reviews, John Wiley and Sons, 2010;12. Art. No.: CD000127. DOI: 10.1002/14651858.CD000127.pub2.
5. Dutta DC, Konar H: Hypertensive disorders in pregnancy. In: Dutta's Textbook of obstetrics including perinatology and contraception. 7th Edn.; New Central book agency, Kolkata, 2011;pp.219-240.
6. Mason BA ,Standley CA, Whitty JE, Cotton DB : Fetal ionized magnesium levels parallel maternal level during magnesium sulphate therapy for preeclampsia. *American Journal of Obstetric and Gynecoloy*, 1996;175(1):213-217

7. Mohanty S, Kanungo S, Nayak S: Evaluation of anticonvulsant regimes in eclampsia. *Journal of Obstetrics and Gynecology of India*, 1990;40(1):386-391.
8. Nelson KB, Grether JK: Can magnesium sulfate reduce the risk of cerebral palsy in very low birth weight infants? *Pediatric*, 1995;95(2):263-269.
9. Newton M: The continuing problem of eclampsia. *Surgery, Gynecology & Obstetrics*, 1964;118(6):1055-1058.
10. Perveen S, Altaf W, Vohra N, Bautista ML, Harper RG, Wapnir RA: Effect of gestational age on cord blood plasma copper, zinc, magnesium and albumin. *Early Human Development*, 2002;69(1-2):15-23.
11. Pritchard JA, Cunningham FG, Pritchard SA: The Parkland Memorial Hospital protocol for treatment of eclarnpsia: Evaluation of 245 cases. *American Journal of Obstetric and Gynecology*, 1984;148(7):951-963.
12. Lopez-Llera M, Rubio-Linareo G, Hernandez-Horta JL: Maternal mortality rates in eclampsia. *American Journal of Obstetric & Gynecology*, 1976;l24(2):145-149.
13. Slater RM, Wilcox FL, Smith WD, Donnai P, Patrick J, Richardson T, Mawer GE, D'Souza SW, Anderton JM: Phenytoin infusion in severe pre-eclampsia .*The Lancet*, 1987; 329 (8547):1417-1421.
14. Schendel DE, Berg CJ, Yeargin-Allsopp M, Boyle CA, Decoufle P: Prenatal magnesium sulfate exposure and the risk for cerebral palsy or mental retardation among very low-birth-weight children aged 3 to 5 years. *Journal of American Medical Association*, 1996; 276(22): 1805-1810.
15. Which anticonvulsant for women with eclampsia? Evidence from the Collaborative Eclampsia Trial. *Lancet*, 1995;345:1455-1463.
16. WHO: Make every mother and child count. In: world Health Report 2005. Leo vita- Finzi, Barbara companini Eds.; WHO, Geneva, 2005,p.63.

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