Original Article

Efficacy of Low Dose Magnesium Sulphate in Control of Convulsion in Eclampsia in a Tertiary Care Hospital of Bangladesh

Naher A[1], Naher K[2], Begum A[3]

Abstract

Background: *Eclampsia is the third major cause of maternal mortality in our country. Global studies have demonstrated that using magnesium sulphate ($MgSO_4$) to manage hypertensive disease in pregnancy reduces morbidity and mortality due to severe pre-eclampsia and eclampsia. Magnesium sulphate is therefore the anticonvulsant of choice for both prevention and treatment of eclampsia. The aim of the study is to evaluate the use and efficacy of a low dose (6 gm) of magnesium sulphate in controlling convulsion amongst women with pre-eclampsia and eclampsia in a tertiary care hospital of Bangladesh.* ***Material and Methods:*** *This comparative interventional study was conducted in Sylhet MAG Osmani Medical College and Hospital with ethical clearance from respective IERB. Hundreds (100) eclampsia patients have been selected by consecutive sampling from the eclampsia ward and divided into 2 groups by random selection. Group A contains 50 patients who received a low dose and group B also contains 50 patients who received a loading plus a maintenance dose of $MgSO_4$. Patient's demographic data and follow up signs were recorded in a data collection sheet. Data was coded and entered SPSS for analysis.* ***Results:*** *Among 100 patients, the mean age of the participants for group A and group B was 23.98 ±5.26 and 23.92±3.85 years, respectively. The mean gestational age was 37.38±2.88 weeks for Group A and 36.94±3.13 weeks for Group B. Occurrence of eclampsia was found to be significantly high (Group A 58% and Group B 78%) among primigravida of both groups, belonged to low (Group A 60% and Group B 50%) and middle (Group A 36% and Group B 46%) socioeconomic backgrounds. Received antenatal care irregularly (only one visit) (Group A 52% and Group B 48%). Antepartum eclampsia was 90% in Group A and 86% in Group B, intrapartum was 2% in Group B and postpartum was 10% in Group A and 12% in Group B. Recurrence of convulsion was only observed in 8% of women from Group A and 10 % from Group B. Maternal complications were seen in only 2% woman from each group.* ***Conclusion:*** *This study revealed that a low dose regimen can control convulsions much more effectively than a conventional full dose regimen. The recurrence rate of convulsion was not significant with this low dose and has the advantage of lower magnesium toxicities. It is also cost-effective.*

Keywords: Magnesium Sulphate, Convulsion, Eclampsia.
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Introduction

Globally, there are approximately 600,000 estimated maternal deaths occurring each year. Out of them, more than 70,000 (13%) are associated with severe pre-eclampsia and eclampsia[1]. Pre-eclampsia is a multisystem disorder of unknown etiology, unique to pregnancy. Women with pre-eclampsia usually develop raised blood pressure and proteinuria, but the condition is also associated with abnormalities of the coagulation system, disturbed liver function, renal failure and cerebral ischaemia[2]. Though various risk factors of pre-eclampsia are recognized but it is very much influenced by the presence of existing hypertension in the patients[3]. While preeclampsia affects 3-8% of pregnancies, the mortality rate of young mothers is 5-20%[4,5]. Like other developing countries, in Bangladesh, the incidence of eclampsia is high (7.9%) according to the results of a house-to-house survey and remains the 3rd major cause of maternal death[6]. Pre-eclampsia usually occurs after 20 weeks of gestation and is a multi-system disorder[7]. But it may occur as late as 6 weeks of post-partum period[8]. Mortality of women with pregnancy, complicated by hypertension, is due to cerebrovascular incidents and preeclampsia itself is associated with a 4-fold increase in stroke during pregnancy, childbirth and puerperium[9].

Evidence supports the use of magnesium sulfate ($MgSO_4$) as the first line treatment option for severe

[1]Akterun Naher, Associate Professor, Dept. of Obstetrics & Gynaecology, Cumilla Medical College & Hospital, Cumilla, Bangladesh.
[2]Kamrun Naher, Assistant Professor, Dept. of Obstetrics & Gynaecology, Eastern Medical College & Hospital, Cumilla, Bangladesh.
[3]Anwara Begum, Professor, Dept. of Obstetrics & Gynaecology, Sylhet MAG Osmani Medical College & Hospital, Sylhet, Bangladesh.

Address of Correspondence: Dr. Akterun Naher, Associate Professor, Department of Obstetrics and Gynaecology, Cumilla Medical College & Hospital, Cumilla, Bangladesh. Mobile: +8801711360040. Email: akhee0609@gmail.com

pre-eclampsia and eclampsia to reduce morbidity and mortality[10,11]. Magnesium sulphate is therefore the anticonvulsant of choice for both prevention and treatment of eclampsia[12]. In addition, magnesium sulphate, through the reduction of acetylcholine secretion, blocks neuromuscular transmission[13]. The two most widely used regimens of magnesium sulphate administration are the intramuscular regimen popularized by Pritchard and the continuous intravenous regimen recommended by Zuspan[14,15]. i. **The intramuscular regimen:** An intravenous loading dose of 10-14 gm of magnesium sulphate is given over 10-15 minutes followed immediately by 5 gm as a deep intramuscular injection into each buttock. The maintenance therapy is in the form of 5 gm intramuscularly every 4 hours interval for up to 24 hours of last convulsion or delivery. ii. **The intravenous regimen:** the intravenous regimen involves a loading dose of 4 gm magnesium sulphate intravenously (5 gm or 6gm used in some centers), which is followed by an intravenous infusion of 1 gm to 2 gm/hour and continued for up to 24 hours since the last convulsion/fit. For both the intramuscular and intravenous regimens, a further 2-4 gm should be given as a bonus over 5 minutes in case of recurrence of convulsion[14,15].

Magnesium sulphate is used through intravenous (IV) and intramuscular (IM) routes consisting of a loading dose followed by a maintenance dose. The recommended dose schedule according to the guidelines published by the Eclampsia Working Group in Bangladesh is currently being followed in our country, where 4 gm of magnesium sulphate has been used as a bolus and 2 gm to 2.5 gm in every 4 hours as maintenance dose, which is comparatively lower than the Pritchard and Zuspan regimen[16]. Though magnesium sulphate is very effective in controlling convulsions in eclampsia, it is also a toxic drug. The therapeutic index is very narrow in the case of magnesium sulphate. Significant toxicities of magnesium sulphate are decreased patellar tendon reflex, muscle weakness, paralytic ileus, renal failure, respiratory muscle paralysis and even cardiac arrest[17]. So that, magnesium sulphate should be used judiciously, and the dose should be kept to a limit within therapeutic level.

This study was done to evaluate the use and efficacy of a low dose of magnesium sulphate (6 gm) in controlling convulsion amongst women with eclampsia in Obstetrics and Gynecology word of Sylhet MAG Osmani Medical College Hospital, Bangladesh.

Materials and Methods

This comparative intervention study was conducted in Sylhet MAG Osmani Medical College Hospital from January to December 2007. Hundreds (100) eclampsia patients have been selected by consecutive sampling who were admitted in the eclampsia unit under the Obstetrics and Gynaecology department after fulfilling the inclusion criteria (patients with current incidence of convulsion beyond 20 weeks of pregnancy associated with hypertension (≥140/90 mmHg) and proteinuria (≥300 mg/day) and exclusion criteria (eclampsia with any complications, i.e. associated with pulmonary edema, renal failure, cardiovascular disease, HELLP syndrome, deep coma, contraindication for $MgSO_4$ therapy and other medical disorders e.g. heart disease, diabetes mellitus. The outcome of the patients was measured by eclampsia, control of convulsion, control of blood pressure, recurrent convulsion, respiratory depression, loss of knee jerk reflex, patellar reflex, renal failure, cardiac arrest and toxicity of Magnesium Sulphate. Hundreds (100) patients were divided into 2 groups by random selection. Group-A contains 50 patients who received a low dose and group-B also contains 50 patients who received a loading plus maintenance dose of $MgSO_4$.

Group-A: They received only an initial 6 gm (loading 4 gm + 2 gm within 1st hour). Loading 4 gm of magnesium sulphate (=100 ml) was given intravenously as a rapid IV infusion at 60-70 drops/minute over a period of 15-20 minutes as a bolus. This dose was immediately followed by 2 gm (50 ml) magnesium sulphate as a slow IV infusion at 12 drops/minute within the 1st hour. **Group-B:** They received a full standard/conventional intravenous regimen. Initial 4 gm of magnesium sulphate (=100 ml) was given intravenously as a rapid IV infusion at 60-70 drops/minute over a period of 15-20 minutes as a bolus. This dose was followed by 2 gm (50 ml) as a slow IV infusion at 12 drops/minute within the 1st hour and within the next 4 hours another 4 gm (maintenance dose) at 6-8 drops/minute was given. For both regimens, a further 2 gm (50 ml) was used as a bolus in case of any recurrence of convulsion. For control of recurrent convulsions in patients who received only loading dose, a further maintenance schedule was started and continued for 4 hours. If there was a recurrent convulsion after the completion of the maintenance dose, the convulsion was then controlled by other anticonvulsants like injection Diazepam.

Patients were monitored at every 10-15 minutes interval for vital signs, rate of recurrent convulsion and for toxicities of magnesium sulphate (e.g. respiratory depression <16 breaths/minute, urine output <30 ml/hrs, absent patellar reflex, blood pressure level, urine output). Antidote (injection calcium gluconate 1 gm) kept ready to manage any sign of toxicity. The efficacy of both regimens was assessed by measuring 1: the time required to

control convulsion, 2: time required to regain consciousness, 3: rate of recurrent convulsion and 4: any toxicities of magnesium sulphate. Information about maternal mortality, morbidity, delivery outcome and fetal outcome was also recorded using a clinical data sheet. All necessary investigations were done, and enrolled participants were in close observation till discharge or death.

The study was approved by the ethical committee of Sylhet MAG Osmani Medical College and consent from the study subjects was obtained from the patients or legal guardian. Data was coded and entered using SPSS for analysis. Quantitative data was designed by mean and standard deviation and statistical analysis was done by using Chi-square and unpaired Student's 't' tests. $p<0.05$ taken as significant.

Results

Among 100 patients the mean age of the participants for group A and group B was 23.98 ±5.26 and 23.92±3.85 years, respectively. Most of the women from both group A (60%) and group B (50%) belonged to low socio-economic status. Mean gestational age was 37.38±2.88 weeks for Group A and 36.94±3.13 weeks for Group B. A high proportion of women in group B were primigravida (78%) compared to group A (58%) and 42% of women in Group A and 22% in Group B were multigravida (Table-I).

Table-I: Baseline characteristics of the study population (n=100)

Parameters	Group A (n=50) Frequency (%)	Group B (n=50) Frequency (%)
Age (years)	23.98±5.2	23.92±3.85
Socioeconomic status		
Low	30 (60)	25 (50)
Middle	18 (36)	23 (46)
High	2 (4)	2 (4)
Gestational age (weeks)		
Preterm (<37)	16 (32)	14 (28)
Term (≥37)	34 (68)	36 (72)
Mean±SD	37.38±2.88	36.94±3.13
Gravidity		
Primi	29 (58)	39 (78)
Multi	21 (42)	11 (22)

Table-IIa: Findings related to convulsion/eclampsia at the time of admission (n=100)

Parameters	Group A (n=50) Frequency (%)	Group B (n=50) Frequency (%)	p-value Significancy
Type of convulsion			
Antepartum	45 (90)	43 (86)	p>0.05 Not Significant
Intrapartum	00	1 (2)	
Postpartum	5 (10)	6 (12)	
Conscious level on admission			
Conscious	15 (30)	9 (18)	p>0.05 Not Significant
Unconscious	35 (70)	41 (82)	
Knee reflex			
Normal	33 (66)	32 (64)	p>0.05 Not Significant
Brisk	17 (34)	18 (36)	

p-value obtained from $\chi 2$ test

Table-IIb: Findings related to convulsion/eclampsia at the time of admission (n=100)

Parameters	Group A (n=50) Frequency (%)	Group B (n=50) Frequency (%)	p-value Significancy
Number of convulsions before admission	3.90±1.99	4.06±2.45	p>0.05 Not Significant
Time interval between 1st convulsion and admission (hours)	6.72±4.97	6.11±4.87	p>0.05 Not Significant

p-value obtained from unpaired Student's 't' test

Table-III: Findings related to convulsion/eclampsia after initiation of treatment (n=100)

Parameters		Group A (n=50) Frequency (%)	Group B (n=50) Frequency (%)	p-value Significancy
Recurrence of convulsion	Yes	4 (8)	5 (10)	p>0.05* Not Significant
	No	46 (92)	45 (90)	
Time taken for control of convulsion (hours)		0.42±2.10	1.17±4.00	p>0.05** Not Significant
Time taken to regain Consciousness (hours)		15.73±10.96	17.94±12.73	p>0.05** Not Significant
Time taken for control of blood pressure (hours)		63.24±44.09	68.68±43.29	p>0.05** Not Significant

* p-value obtained from $\chi 2$ test and ** unpaired Student's 't' test

Table-IV: Summary of findings of maternal outcomes (n=100)

Parameters	Group A (n=50) Frequency (%)	Group B (n=50) Frequency (%)	p-value Significancy
Complications			
CVA	0	1 (2)	p>0.05 Not Significant
Pulmonary oedema	1 (2)	0	
None	49 (98)	49 (98)	
Maternal death			
Yes	1 (2)	1 (2)	p>0.05 Not Significant
No	49 (98)	49 (98)	

p-value obtained from $\chi 2$ test

Table-II demonstrates the findings related to convulsion/eclampsia at the time of admission. Types of convulsions identified were mostly antepartum (Group A 90% and Group B 86%) in nature. Most of the participants from both groups (70% from Group A and 82% from Group B) were found unconscious, at the time of hospital admission. The Knee reflex was found to be normal in most cases from both groups (66% and 64% in Group A and Group B, respectively) (Table-IIb). There was no significant difference in the number of convulsions before admission between the two groups (Table-IIb).

In this study, no significant difference was observed in terms of the time taken to control convulsion, recurrence of convulsion, time taken to control blood pressure and time taken to regain consciousness between study and control groups. No further recurrence of convulsion was noticed among a significantly high proportion of women from both the study and control groups (92% form Group A and 90% from Group B). Alternatively, recurrence of convulsion was only observed in 8% of women from Group A and 10% from Group B. It was also observed that women from Group A took less time to control convulsion than woman from Group B (0.42 vs 1.17 hours) although this difference was not statistically significant (Table-III).

Table-IV describes observed maternal complications and death during this study. Maternal complications were seen in only 1 (2%) woman from each group. They are namely, pulmonary oedema in women from Group A and cerebo-vascular accident (CVA) in women from Group B, resulting in the death of both women.

Discussion

The present comparative intervention study was designed to assess the effectiveness of the intravenous low dose (6 gm) of magnesium sulphate, when used for women with eclampsia in Sylhet MAG Osmani Medical College Hospital. A comparison of effects and outcomes was made between the low dose (6 gm) and the conventional full dose (10 gm) of magnesium sulphate. There was no significant difference observed in age, socioeconomic status, antenatal care and gestational age between the two groups. Most of the study women were primigravida, at term pregnancy, from low socio-economic status and with poor nutritional background and aged between 18-29 years at the time of hospital admission. Eclampsia was to be

found significantly high among primigravida of both group (58% vs 78%), whereas 21 (42%) eclamptic women in Group A and 11 (22%) in Group B were multigravida. There is sufficient evidence also here in Bangladesh to support these findings[18,19].

Antepartum eclampsia was found to be more common than intra- or post-partum eclampsia. The aim of the treatment protocol used here was to achieve maximum benefits from minimum utilization of magnesium sulphate in a cost-effective manner. This study successfully achieved that goal and revealed that a low dose regimen can control convulsion much more effectively within a very short period than a conventional full dose regimen. In this present study using 6 gm magnesium sulphate, reported recurrence of convulsion was 8% in Group A and 10% in Group B, which is lower than Collaborative Eclampsia Trials[12] but slightly higher than Begum, et al[18]. In the current study, the mortality rate was only 2%, which is much lower than other studies. Dose related toxicities were almost zero in this study. One patient died in Group A due to pulmonary edema and one patient died due to cerebo-vascular accident (CVA) in Group B. Another study in Bangladesh also showed a maternal mortality rate of 2%, where the causes of death were due to cerebro-vascular accident and acute renal failure[20].

As pre-eclampsia and eclampsia are common in our country, it needs to develop an integrated model for the estimation of patient-specific risk factors for the development of preeclampsia based on maternal demographic, socio-economic, obstetrics, nutritional and anthropometric parameters[21].

Conclusion

A single low dose of magnesium sulphate is potentially as effective as that of a conventional full dose in controlling and preventing convulsions in eclampsia. The recurrence rate of convulsion was not significant with this low dose and has the advantage of lower magnesium toxicities. It is also cost effective. Implementing low doses of magnesium sulphate for the prevention and treatment of eclampsia in low-income countries like Bangladesh could potentially benefit hundreds of women. However, many studies with large scales can evaluate the actual effectiveness of low doses of magnesium sulphate.

Conflict of Interest

The authors declared that they have no conflicts of interest.

References

1. Duley L. Maternal mortality associated with hypertensive disorders of pregnancy in Africa, Asia, Latin America and the Caribbean. Br J Obstet Gynaecol. 1992; 99 (7): 547-53. doi: 10.1111/j.1471-0528.1992.tb13818.x.
2. Roberts JM, Redman CW. Pre-eclampsia: more than pregnancy-induced hypertension. Lancet. 1993; 341 (8858): 1447-51. doi: 10.1016/0140-6736(93)90889-o.
3. Broughton Pipkin F. Risk factors for preeclampsia. N Engl J Med. 2001; 344 (12): 925-6. doi: 10.1056/NEJM200103223441209.
4. Moodley J, Kalane G. A review of the management of eclampsia: practical issues. Hypertens Pregnancy. 2006; 25 (2): 47-62. doi: 10.1080/10641950500543897.
5. Habli M, Levine RJ, Qian C, Sibai B. Neonatal outcomes in pregnancies with preeclampsia or gestational hypertension and in normotensive pregnancies that delivered at 35, 36 or 37 weeks of gestation. Am J Obstet Gynecol. 2007; 197 (4): 406.e1-7. doi: 10.1016/j.ajog.2007.06.059.
6. Begum MR, Begum A, Quadir E, Akhter S, Shamsuddin L. Eclampsia: still a problem in Bangladesh. Med Gen Med. 2004; 6 (4): 52.
7. James PR, Nelson-Piercy C. Management of hypertension before, during, and after pregnancy. Heart. 2004; 90 (12): 1499-504. doi: 10.1136/hrt.2004.035444.
8. Reynolds C, Mabie WC, Sibai BM. Hypertensive States of Pregnancy. In: De Cherney, AH, et al., Editors. Current Obstetric & Gynecologic Diagnosis & Treatment, 9th Edition, New York: McGraw Hill; 2003. pp 338-53.
9. James AH, Bushnell CD, Jamison MG, Myers ER. Incidence and risk factors for stroke in pregnancy and the puerperium. Obstet Gynecol. 2005; 106 (3): 509-16. doi: 10.1097/01.AOG.0000172428.78411.b0.
10. Altman D, Carroli G, Duley L, Farrell B, Moodley J, Neilson J, et al. 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): 1877-90. doi: 10.1016/s0140-6736(02)08778-0.
11. Magpie Trial Follow-Up Study Collaborative Group. The Magpie Trial: a randomized trial comparing magnesium sulphate with placebo for pre-eclampsia. Outcome for women at 2 years. BJOG: Int J Obstet Gynaecol. 2007; 114 (3): 300-9. doi: 10.1111/j.1471-0528.2006.01166.x.
12. Which anticonvulsant for women with eclampsia? Evidence from the Collaborative Eclampsia Trial. Lancet. 1995; 345 (8963): 1455-63.
13. ACOG Committee on Obstetric Practice. ACOG practice bulletin. Diagnosis and management of preeclampsia and eclampsia. American College of Obstetricians and

Gynecologists. Int J Gynaecol Obstet. 2002; 77 (1): 67-75.
14. Pritchard JA. The use of the magnesium ion in the management of eclamptogenic toxemias. Surg Gynecol Obstet. 1955; 100 (2): 131-40.
15. Zuspan FP. Problems encountered in the treatment of pregnancy-induced hypertension. A point of view. Am J Obstet Gynecol. 1978; 131 (6): 591-7. doi: 10.1016/0002-9378(78) 90816-5.
16. The Eclampsia Working Group. Eclampsia in Bangladesh: a review and a guideline. Bangladesh J Obstet Gynaecol. 1997; 12: 1-27.
17. Idama TO, Lindow SW. Magnesium sulphate: a review of clinical pharmacology applied to obstetrics. British J Obstet Gynaecol. 1998; 105 (3): 260-8.
18. Begum MR, Begum A, Quadir E. Loading dose versus standard regime of magnesium sulfate in the management of eclampsia: a randomized trial. J Obstet Gynaecol Res. 2002; 28 (3): 154-9. doi: 10.1046/j.1341-8076.2002.00029.x.
19. Begum MR, Nahar K, Akhter S, Begum A. Loading dose of Magnesium Sulphate-Is it Enough for Controlling Convulsion in Eclampsia? Bangladesh J Obstet Gynaecol. 2001; 16 (2): 60-3.
20. Khanum M, Ashraf F, Sahrin H. A Clinical Study of 100 Cases of Eclampsia in Rajshahi Medical College Hospital. Teachers Asso J. 2004; 17 (2): 80-3.
21. Yu CK, Smith GC, Papageorghiou AT, Cacho AM, Nicolaides KH. Fetal Medicine Foundation Second Trimester Screening Group. An integrated model for the prediction of preeclampsia using maternal factors and uterine artery Doppler velocimetry in unselected low-risk women. Am J Obstet Gynecol. 2005; 193 (2): 429-36. doi: 10.1016/j.ajog.2004.12.014.

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