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Original Research Article

Efficacy of $MgSO_4$ to prevent eclampsia in women with severe pre-eclampsia and impending eclampsia

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ABSTRACT

Background: Preeclampsia is a multi-system disorder that is frequently accompanied by proteinuria and new-onset hypertension. Poor placental perfusion and a general disease process that may affect multiple organ systems are the hallmarks of the syndrome. While eclampsia is a complicated condition brought on by cerebral dysrhythmia due to various pathogenesis steps that include abnormal trophoblastic invasion which led to vasospasm, endothelial dysfunction, and platelet aggregation. Maternal complications of severe preeclampsia/eclampsia can lead to maternal, fetal, and neonatal morbidity and mortality. One of the anticonvulsants $MgSO_4$ is known to reduce the risk of eclampsia. The present study was conducted with the aim to analyse the effect of $MgSO_4$ to reduce the incidence of eclampsia in pregnant women with preeclampsia and impending eclampsia.
Methods: A total of 114 women with preeclampsia and impending eclampsia were included in present study. $Mgso_4$ was given as a loading dose and the Zuspan regimen as required. Women were categorised based on raised blood pressure (>140/90 mmHg), deranged lab parameters which includes renal function tests (urea, uric acid, creatinine), coagulation profile (PT, APTT, INR, LDH, platelet count), liver function tests (total bilirubin, SGOT/SGPT) and clinical symptoms which include headache, blurring of vision, epigastric pain. The incidence of eclampsia even after a dose of $MgSO_4$ was calculated.
Results: The mean age of the women was 28.17±4.69 years. The diagnosis of pre-eclampsia was made based on systolic and diastolic blood pressure. Out of 114 pregnant women with severe preeclampsia or impending eclampsia who were given a dose of $MgSO_4$, only 2 women have developed eclampsia.
Conclusions: The incidence of eclampsia after the dose of $MgSO_4$ among women with preeclampsia or impending eclampsia was reported to be only 1.75% which confirms $MgSO_4$ therapy as an effective tool in preventing perinatal morbidity and mortality.

Keywords: Hypertension, Impending eclampsia, $MgSO_4$, Preeclampsia

INTRODUCTION

Pre-eclampsia is a hypertensive disorder and a serious condition that typically develops after 20 weeks of pregnancy. It is one of the most important and morbid complications during pregnancy.[1] The classic definition of pre-eclampsia is the occurrence of the triad of hypertension, proteinuria, and edema after 20 weeks of gestation in a woman who was previously normotensive.[2]

Pre-eclampsia and eclampsia have global incidence rates of 2.16 percent and 0.28 percent, respectively.[3, 4]

Most women with mild pre-eclampsia generally deliver with less serious complications and with a better outcome. However, severe preeclampsia can causes multiple systemic derangements .This disorder affects kidney causing oliguria in most cases, liver and also can cause coagulation defects.[5] A persistent systolic blood pressure

greater than 140 mmHg and diastolic blood pressure greater than 90 mmHg and the presence of proteinuria greater than or equal to 0.3 grams in a 24-hour urine sample are the generally accepted criteria for diagnosing pre-eclampsia.[1,6] The onset of eclampsia is linked to an increased risk of negative outcomes for both the mother and the foetus, especially in developing countries.[7] Eclampsia, on the other hand, is characterised by preeclampsia toxaemia associated with seizures in a women with severe pre-eclampsia with premonitory signs and symptoms (includes headache, epigastric pain, blurring of vision, edema, brisk deep tendon reflexes). Severe pre-eclampsia eventually progresses to the more serious condition of eclampsia, which results in about 50,000 maternal deaths annually which approximates to 1 in 200 women.[8] Eclampsia-related pregnancies necessitate a thoughtful management strategy. The medication of choice used to stop recurrent seizures in eclampsia is magnesium sulphate.[7] $MgSO_4$ has been used frequently as an efficacious drug for severe pre-eclampsia for well over 70 years, and some studies support this use.[2,7,9,10]

The reports of clinical success among pre-eclamptic women with lower serum magnesium levels in a few cases supports the lack of understanding of how $MgSO_4$ functions.[11,12]

The objective of the present study was to assess the women with severe preeclampsia and impending eclampsia treated with $MgSO_4$ to prevent eclampsia.

Aim

To assess the women with severe pre-eclampsia and impending eclampsia treated with injection $MgSO_4$ (loading dose/Zuspan regimen) to prevent eclampsia.

Objectives

To categorize women into severe pre-eclampsia and impending eclampsia. To assess need for $MgSo_4$ based on BP, biochemical parameters and clinical symptoms. To analyse the effect of $MgSO_4$ as a preventive therapy for eclampsia.

METHODS

The present hospital-based prospective observational study was conducted in the department of Obstetrics and Gynaecology, Bharati Vidyapeeth (DTU) Medical College, Pune.

The study has been conducted for a period of 1 year from January 2022 to January 2023

Inclusion criteria

IPD women with severe pre-eclampsia and impending eclampsia who have received $MgsO_4$ as preventive therapy

Exclusion criteria

Women with chronic hypertension, gestational hypertension and mild pre-eclampsia, eclampsia.

Data collection

114 IPD women with severe preeclampsia and impending eclampsia who had received $MgSO_4$ as preventive therapy were included, after informed consent from each participant. Women with gestational hypertension, and mild preeclampsia, eclampsia are excluded. All the women with severe preeclampsia and impending eclampsia were audited. Women were categorised based on accepted criteria for pre-eclampsia toxaemia which includes raised blood pressure (systolic BP>140 and diastolic BP>90 mmHg), deranged lab parameters, and clinical symptoms.

Injection $MgsO_4$ 4 gm in 20 ml diluted solution for 20 minutes was given as a loading dose and the Zuspan regimen (1gm/hour for 24 hours) as required. An action plan was made to assess the women who had eclampsia even after giving treatment with $MgSO_4$. The incidence of eclampsia even after a dose of $MgSO_4$ was calculated using the below formula.

$$Formula = \frac{\text{Actual eclampsia}}{\text{Impending eclampsia} + \text{severe preeclampsia}} \times 100$$

Ethical approval

The study was approved by the institutional ethics committee.

Data analysis

Statistical analyses were performed using the STATA software. Tabular columns were used to assess the efficacy of magnesium sulphate in women with severe pre-eclampsia.

RESULTS

The present study was conducted with the aim of finding the incidence of eclampsia in women with severe preeclampsia and impending eclampsia.

Table 1: Distribution of age.

Age in years	Number	Percentage
<22	10	8.77
22-26	33	28.95
26-28	20	17.54
28-32	29	25.44
>32	22	19.30
Total	114	100.00

A total of 114 women for the period of 1 year from July 2021 to June 2022 were evaluated after a dose of $MgSO_4$ till the development of eclampsia or delivery. The mean age of the women was 28.17±4.69 years, majority of the women were in age group 22 to 26 years.

Table 2: Mean values of systolic and diastolic blood pressure.

Blood pressure	Mean
Systolic BP (mmHg)	160.88
Diastolic BP (mmHg)	101.93

The diagnosis of pre-eclampsia was made based on systolic and diastolic blood pressure. The mean values of systolic and diastolic blood pressures were 160.88±16.31 mmHg and 101.93±7.59 mmHg.

Table 3: Distribution of women as per derangements in lab parameters.

Biochemical parameters	Derangement	n	%
RFT	Yes	82	71.93
	No	32	28.07
LFT	Yes	13	11.40
	No	101	88.60
Coagulation profile	Yes	58	50.88
	No	56	49.12

Among the study population the RFTs were deranged in 82 women (71.93%), while LFTs were deranged in 13 (11.40%) and coagulation profile among 58 women (50.88%).

Table 4: Distribution of women as per clinical symptoms and deranged lab parameters.

Premonitory symptoms/signs	Derangements	N	%
Clinical symptoms	Yes	79	69.30
	No	35	30.70
Deranged lab parameters	Yes	82	71.93
	No	31	27.19

The clinical symptoms were reported among 79/114 (69.30%) of pregnant women with severe preeclampsia or impending eclampsia.

Table 5: Eclampsia development.

Seizures	Number	Percentage
No	112	98.25
Yes	2	1.75
Total	114	100

All the pregnant women with severe preeclampsia and impending eclampsia were given a dose of MgSO4 at the time of diagnosis of severe preeclampsia or impending eclampsia. Among those, 67 women received the Zuspan regimen.

The outcome was measured among the study participants in the form of whether eclampsia developed or not. Out of 114 pregnant women with severe preeclampsia or impending eclampsia who were given a dose of $MgSO_4$, only 2 developed eclampsia.

DISCUSSION

Preeclampsia often has a positive outcome for most of the women, but in rare cases, the condition can be fatal or cause life-threatening complications for the mother and foetus. Eclampsia is a rare but serious complication that is defined as the occurrence of one or more seizures in conjunction with the syndrome of preeclampsia.[13]

Anticonvulsants were given to preeclampsia women in order to prevent the onset of eclampsia and thus improve the outcome. It is challenging to determine who is at risk for an eclamptic seizure because only 1% to 2% of people with even severe pre-eclampsia will progress to eclampsia.[13]

Since more than a century ago, magnesium sulphate ($MgSO_4$) has been used to treat pre-eclampsia and eclampsia, and it is currently the anticonvulsant of choice for the management of eclampsia.[14,15]

In the present study, a total of 114 pregnant women diagnosed as per blood pressure with severe preeclampsia or impending eclampsia were included, with a mean age of 28.17±4.69 years. The women were evaluated for the development of eclampsia after the dose of $MgSO_4$. Out of 114 women, 67 women required the Zuspan regimen. Of 114 pregnant women with severe preeclampsia or impending eclampsia, who were given a dose of $MgSO_4$, only 2 developed eclampsia, with an incidence rate of 1.75%.

$MgSO_4$ and phenytoin were compared for efficacy by Lucas et al.[19] In the phenytoin group, 10 out of 1,089 women experienced eclamptic convulsions, while none of the 1,049 women in the $MgSO_4$ group experienced any eclamptic activity. These findings support the traditional use of $MgSO_4$ in eclampsia prevention.

In a retrospective study with 1045 eclamptic and pre-eclamptic women, Okereke et al reported a decrease in case fatality rates from 20.9 percent to 2.3 percent among eclamptic women after the $MgSO_4$ intervention.[20]

According to a study by Altman et al, magnesium sulphate has no immediate negative effects on either the mother or the foetus.[21] It is also found to lower the risk of death in the mother and cut in half the risk of eclampsia. According to Duley et al, magnesium sulphate was found to reduce

the risk ratio of maternal death and seizure recurrence when compared to diazepam.[22]

$MgSO_4$ is typically administered intravenously or intramuscularly. The IM Pritchard regimen and the solely i.v. Zuspan regimen are the two standard regimens that are most frequently used to treat severe preeclampsia and eclampsia.[23]

The studies have shown that $MgSO_4$ is far superior to other medications in the treatment of eclampsia, despite the risk of side effects and toxicity.[13,19]

There hasn't been a full analysis of the therapeutic serum magnesium concentration to prevent or treat eclamptic seizures yet, and it's still not clear how $MgSO_4$ works to prevent or treat eclampsia.

$MgSO_4$'s effects are mediated by the neuromuscular junction, but its anticonvulsant mechanism is attributed to its actions on the central nervous system (CNS) and vascular endothelium (NMJ). NMDA receptor blockade and NMJ blockade, which reduce calcium conductance, acetylcholine release, and motor endplate excitability to acetylcholine release, cause generalised CNS depression.[24-26]

Vascular endothelial cells may be stimulated to produce more prostacyclin I2 and nitric oxide, which would result in vasodilation.[31] Additionally, it is known that when $MgSO_4$ is used to prevent and treat eclampsia, its vasodilatory effect on the smaller-diameter intracranial vessels reduces cerebral ischemia.[24,27,28]

Limitations of the study were it was a single center study and the sample size was less.

CONCLUSION

The incidence of eclampsia after the usage of $MgSO_4$ among women with preeclampsia or impending eclampsia was reported to be only 1.75%. this in turn confirms that $MgSO_4$ therapy is an effective tool in preventing perinatal morbidity and mortality. In a low resource setting country like ours, $MgSo_4$ is particularly attractive as it is very cheap and toxicity can be adequately monitored clinically. Several other studies have also supported the findings of the study and its efficacy over other drugs which are used to prevent eclampsia.

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Ethical approval: The study was approved by the Institutional Ethics Committee

REFERENCES

1. Khanum S, Naz N, Souza M. Prevention of pre-eclampsia and eclampsia. A systematic review. Open J Nurs. 2018;8:26-44.
2. Lu JF, Nightingale CH. Magnesium sulfate in eclampsia and pre-eclampsia: pharmacokinetic principles. Clin Pharmacokinet. 2000;38(4):305-14.
3. Nagaria T, Mitra S, Banjare SP. Single loading low dose MgSo4 regimen: a simple, safe and effective alternative to Pritchard's regimen for Indian Women. J Clin Diagn Res. 2017;11(8):QC08-12.
4. Abalos E, Cuesta C, Carroli G, Qureshi Z, Widmer M, Vogel JP, et al. WHO multicountry survey on maternal and newborn health research network. Pre-eclampsia, eclampsia and adverse maternal and perinatal outcomes: a secondary analysis of the World Health Organization Multicountry Survey on Maternal and Newborn Health. BJOG. 2014;121(1):14-24.
5. Steyn DW, Steyn P. Low-dose dopamine for women with severe pre-eclampsia. Cochrane Database Syst Rev. 2007;2007(1):CD003515.
6. WHO Recommendations for Prevention and Treatment of Pre-Eclampsia and Eclampsia. Geneva: World Health Organization; 2011. Available from: https://www.ncbi.nlm.nih.gov/books/NBK140561/. Accessed on 1 May 2022.
7. Sibai BM. Diagnosis, prevention, and management of eclampsia. Obstet Gynecol. 2005;105(2):402-10.
8. Khan KS, Wojdyla D, Say L, Gu¨lmezoglu AM, Van Look PFA. WHO analysis of causes of maternal death: a systematic review. Lancet, 2006;367:1066-74.
9. Lazard EM. A preliminary report on the intravenous use of magnesium sulphate in puerperal eclampsia. Am J Obstet Gynecol. 1925;9:178-88.
10. Coetzee EJ, Dommisse J, Anthony J. A randomized controlled trial of intravenous magnesium sulphate versus placebo in the management of women with pre-eclampsia. Br J Obstet Gynecol. 1998;105:300-3.
11. Charoenvidhya D, Manotaya S. Magnesium sulfate maintenance infusion in women with preeclampsia: a randomized comparison between 2 gram per hour and 1 gram per hour. J Med Assoc Thai. 2013;96:395-8.
12. Aali BS, Khazaeli P, Ghasemi F. Ionized and total magnesium concentration in women with severe preeclampsia-eclampsia undergoing magnesium sulfate therapy. J Obstet Gynecol Res. 2007;33:138-43.
13. Duley L, Gülmezoglu AM, Henderson-Smart DJ, Chou D. Magnesium sulphate and other anticonvulsants for women with pre-eclampsia. Cochrane Database Syst Rev. 2010;2010(11):CD000025.
14. The Eclampsia Trial Collaborative Group. Which anticonvulsant for women with eclampsia? Evidence from the Collaborative Eclampsia Trial. Lancet. 1995;354:1455-63.
15. Chesley LC, Tepper I. Levels of magnesium attained in magnesium sulfate therapy for preeclampsia and eclampsia. Surg Clin North Am. 1957;37:353-67.
16. Eastman NJ, Steptoe PP. The management of pre-eclampsia. Can Med Assoc J. 1945;52:562-8.

17. Sibai BM, Graham JM, McCubbin JH. A comparison of intravenous and intramuscular magnesium sulfate regimens in preeclampsia. Am J Obstet Gynecol. 1984;150:728-33.
18. Lucas MJ, Leveno KJ, Cunningham FG. A comparison of magnesium sulfate with phenytoin for the prevention of eclampsia. N Engl J Med. 1995;333(4):201-5.
19. Okereke E, Ahonsi B, Tukur J, Ishaku SM, Oginni AB. Benefits of using magnesium sulphate ($MgSO_4$) for eclampsia management and maternal mortality reduction: lessons from Kano State in Northern Nigeria. BMC Res Notes. 2012;5:421.
20. 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.
21. Duley L, Henderson-Smart DJ, Walker GJ, Chou D. Magnesium sulphate versus diazepam for eclampsia. Cochrane Database Syst Rev. 2010;2010(12):CD000127.
22. Tukur J. The use of magnesium sulphate for the treatment of severe pre-eclampsia and eclampsia. Ann Afr Med. 2009;8(2):76-80.
23. Padda J, Khalid K, Colaco LB, Padda S, Boddeti NL, Khan AS, et al. Efficacy of Magnesium Sulfate on Maternal Mortality in Eclampsia. Cureus. 2021;13(8):e17322.
24. Cotton DB, Janusz CA, Berman RF. Anticonvulsant effects of magnesium sulfate on hippocampal seizures: therapeutic implications in preeclampsia-eclampsia. Am J Obstet Gynecol. 1992;166(4):1127-34.
25. Altura BM, Altura BT, Carella A, Gebrewold A, Murakawa T, Nishio A. Mg^{2+} -Ca^{2+} interaction in contractility of vascular smooth muscle: Mg^{2+} versus organic calcium channel blockers on myogenic tone and agonist-induced responsiveness of blood vessels. Can J Physiol Pharmacol. 1987;65(4):729-45.
26. Zheng XY, Yao J, Zhu JM, Li M, Qiu SQ, Zhu ZX, et al. Effect of magnesium sulfate, nifedipine tablet combined salvia injection on ET-1/NO, TXA2/PGI2 and hemorheology of preeclampsia women. Zhongguo Zhong Xi Yi Jie He Za Zhi. 2015;35(8):962-5.
27. Belfort MA, Moise KJ Jr. Effect of magnesium sulfate on maternal brain blood flow in preeclampsia: a randomized, placebo-controlled study. Am J Obstet Gynecol. 1992;167(3):661-6.

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