Original Article

Intramuscular injection of magnesium sulphate in the treatment of eclampsia

Jahanara[1], Chowdhury S[2], Akhter F[3], Sultana N[4], Shuvon AAA[5]

Conflict of Interest: None
Received: 19.04.2026
Accepted: 22.06.2026
www.banglajol.info/index.php/JSSMC

ABSTRACT:

Background: *Eclampsia remains a significant cause of maternal and neonatal morbidity and mortality globally. The standard treatment to prevent and control eclamptic seizures is the administration of magnesium sulfate. In Bangladesh, the commonly used "Dhaka regimen" involves both intravenous (IV) and intramuscular (IM) routes, but its implementation in primary healthcare settings is often challenging due to the need for intravenous access.*

Objective: *This study aimed to compare the effectiveness and safety of intramuscular magnesium sulfate against the traditional combined intravenous and intramuscular regimen in the management of eclampsia.*

Methods: *A randomized controlled trial was conducted at Chittagong Medical College Hospital from September 2017 to February 2018. A total of 100 patients with eclampsia were randomly assigned into two groups: the IM group (n=50) and the IV+IM group (n=50). The primary outcome measure was the recurrence of convulsions. Secondary outcomes included maternal and fetal outcome, adverse effects, and signs of magnesium sulfate toxicity. Data were collected via a structured questionnaire and analyzed using SPSS-22.*

Results: *The recurrence of convulsions was observed in 10% of patients in the IM group and 8% in the IV+IM group. Maternal mortality was consistent across both groups, with 4% mortality in each. The stillbirth rate was 20.5% in the IM group compared to 23.8% in the IV+IM group. Injection site pain was more prevalent in the IM group (10% vs. 6%), although no abscesses or significant inflammation were noted. Magnesium toxicity was minimal and comparable between the two groups, with instances of diminished knee jerks (4% vs. 6%) and oliguria (4% vs. 2%), and no cases of respiratory depression. The mode of delivery did not differ significantly between groups.*

Conclusion: *Intramuscular magnesium sulfate is comparable to the standard IV+IM regimen for the management of eclampsia in terms of seizure control. It presents practical benefits, including ease of administration, lower cost, and reduced need for skilled personnel, making it a viable alternative for use in primary healthcare settings.*

Key Words: Eclampsia, Magnesium sulphate, Intramuscular administration, Maternal outcome, Seizure control

[J Shaheed Suhrawardy Med Coll 2025; 17(1): 66-72]
DOI: https://doi.org/10.3329/jssmc.v17i1.92335

Authors:

1. Jahanara, MBBS, FCPS (Obstetrics & Gynaecology), Specialist, Evercare Hospital Chattogram, Bangladesh
2. Suparna Chowdhury, MS (Obstetrics & Gynaecology), Resistrar, Department of Obs and Gynae, MH Samorita medical college and Hospital, Dhaka- Bangladesh
3. Fahmida Akhter, MBBS, FCPS (Obstetrics & Gynaecology)Assistant Professor, Army Medical College, Chattogram- Bangladesh
4. Nargis Sultana, MBBS, FCPS (Obstetrics & Gynaecology), Medical officer, Sher Shah Urban Dispensary, Chattogram- Bangladesh
5. Ashfak Al Arif Shuvon, MBBS, MPH, Bangladesh University of Health Sciences, Dhaka- Bangladesh

Correspondence:
Dr. Ashfak Al Arif Shuvon, MBBS, MPH, Bangladesh University of Health Sciences, Dhaka- Bangladesh. Email: ashfakalarifshuvon@gmail.com, Mobile: 01675425747

Introduction

Eclampsia is a severe obstetric complication, marked by generalized tonic-clonic seizures in women with pre-eclampsia, and continues to be a leading cause of maternal and perinatal morbidity and mortality worldwide (Dutta, 2018). According to Magley and Hinson (2024), eclampsia is a life-threatening condition associated with hypertensive disorders during pregnancy, characterized by generalized tonic-clonic seizures, and remains a major contributor to maternal mortality and morbidity. Globally, eclampsia accounts for an estimated 50,000 maternal deaths annually, with the overwhelming majority occurring in low- and middle-income countries (Langer et al., 2008). In Bangladesh, the impact is especially pronounced, with eclampsia responsible for nearly 20% of maternal deaths, with incidence rates considerably higher than those found in developed countries (NIPORT, 2012; BIRPERHT, 1994).

Magnesium sulfate is widely recognized as the preferred anticonvulsant for preventing and managing eclampsia (WHO, 2011). Several large randomized trials, such as the Magpie Trial, have shown that magnesium sulfate significantly lowers the risk of recurrent seizures and improves maternal outcomes when compared to alternative anticonvulsants like diazepam and phenytoin (Altman et al., 2002; Eclampsia Trial Collaborative Group, 1995). As a result, it has become the standard of care in clinical practice across the globe.

Despite its proven efficacy, the use of magnesium sulphate remains limited at primary healthcare levels in many developing countries. One of the major barriers is the requirement for intravenous administration in standard regimens, such as the Pritchard and Dhaka regimens, which necessitates skilled personnel and appropriate monitoring facilities (Begum et al., 2001). In rural and resource-constrained settings, delays in initiating treatment due to lack of intravenous access may contribute to poor maternal outcomes. In their study, Akbar et al. (2025) found that eclampsia continues to contribute to high rates of maternal and perinatal morbidity, including ICU admissions and neonatal complications, especially in low-resource settings.

Recent evidence suggests that intramuscular administration of magnesium sulphate may offer a practical alternative, particularly in settings where intravenous access is not readily available (Okusanya et al., 2012). Intramuscular regimens are easier to administer, require less technical expertise, and may facilitate early initiation of treatment, thereby reducing the risk of complications. Furthermore, concerns regarding toxicity have been mitigated by studies showing that clinical monitoring of reflexes, respiratory rate, and urine output is sufficient for safe administration (Ekele and Badung, 2005).

Given these considerations, evaluating the efficacy and safety of intramuscular magnesium sulphate compared to conventional regimens is essential. Such evidence is crucial to inform clinical practice and improve accessibility of life-saving treatment for eclampsia, particularly in low-resource settings like Bangladesh.

Materials and Methods

This randomized controlled trial was conducted at Chittagong Medical College Hospital in the Department of Obstetrics and Gynaecology from September 2017 to February 2018. A total of 100 eclampsia patients were enrolled using simple random sampling and divided equally into two groups: intramuscular (IM) and combined intravenous and intramuscular (IV+IM), with 50 patients in each group.

Inclusion criteria were all eclampsia cases with convulsions and/or coma, accompanied by pre-eclampsia signs. Patients with conditions like cerebral malaria, renal failure, heart failure, epilepsy, diabetes, or prior anticonvulsant therapy were excluded. Informed consent was obtained before alternate group assignment. The IM group received a 10 g magnesium sulfate loading dose intramuscularly (5 g in each buttock), while the IV+IM group received 4 g intravenously and 3 g intramuscularly. Both groups received 2.5 g magnesium sulfate intramuscularly every four hours for 24 hours after delivery or last convulsion, whichever comes last.

Participants were monitored for convulsion recurrence, vital signs, urine output, respiratory rate, deep tendon reflexes, and local reactions. Primary outcomes included convulsion recurrence, while secondary outcomes were maternal and fetal outcomes, side effects, and magnesium toxicity signs. Data were analyzed using SPSS, with a significance level of $p<0.05$.

Operational Definitions

• Eclampsia: Occurrence of generalized tonic–clonic convulsions and/or coma in a woman with features of pre-eclampsia.

• Recurrence of convulsion: Reappearance of seizures 15 minutes or more after initiation of the loading dose of magnesium sulphate.

• Loading dose: Initial dose of magnesium sulphate given at the start of treatment to rapidly achieve therapeutic drug levels.

• Toxicity (magnesium sulphate): Presence of adverse effects such as loss of knee jerk, respiratory depression, or reduced urine output indicating excessive drug levels.

• Oliguria: Urine output less than 300 ml in 24 hours.

Results

Figure 1 shows the age distribution of study participants in the IM and IVIM groups. The largest proportion of women were in the 21–25 years age group, making up 52% in the IM group and 50% in the IVIM group. Women under 20 years represented 24% in the IM group and 28% in the IVIM group. Participants aged 26–30 years accounted for 18% in the IM group and 14% in the IVIM group, while the 31–35 years group had the smallest proportion in both groups (6% vs 8%). The age distribution between the groups was similar with no significant differences.

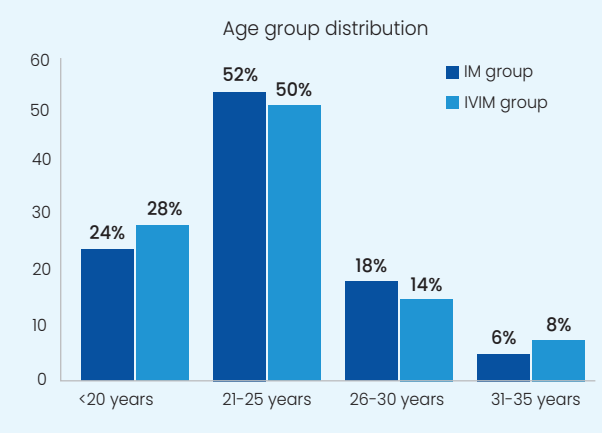


Figure 1: Age group distribution of the study participants (n=50 in each group)

The sociodemographic characteristics of participants were similar between the IM and IVIM groups. The majority of women in both groups were housewives (88% in each group). Most participants were from rural areas, representing 70% in the IM group and 72% in the IVIM group. In terms of socioeconomic status, the largest proportion of women came from the lower socioeconomic category (66% in the IM group and 70% in the IVIM group). Lower middle-class participants made up 30% in both groups, with only a small percentage from the upper middle class. No statistically significant differences were found between the groups for occupation, locality, or socioeconomic status (p>0.05).

Table 1: Sociodemographic Features of the Study Participants

Characteristics	Categories	IM Group (n=50)	IVIM Group (n=50)	p Value*
Occupation	Housewife	44 (88%)	44 (88%)	>0.05
	Service holder	4 (8%)	6 (12%)	
	Student	2 (4%)	0 (0%)	
Locality	Rural	35 (70%)	36 (72%)	>0.05
	Urban	15 (30%)	14 (28%)	
Socioeconomic Status	Poor	33 (66%)	35 (70%)	>0.05
	Lower middle class	15 (30%)	15 (30%)	
	Upper middle class	2 (4%)	0 (0%)	

Table 2 demonstrates the educational status and parity distribution of the study participants. The majority of women in both groups had completed primary education, accounting for 70% in the IM group and 64% in the IVIM group. Women with no formal education constituted 12% and 16% in the IM and IVIM groups, respectively. Regarding parity, most participants were nulliparous, representing 66% in the IM group and 58% in the IVIM group. No statistically significant differences were observed between the two groups in terms of educational level or parity (p>0.05).

Table 2: Educational Status and Parity of the Study Participants

Characteristics	Categories	IM Group (n=50)	IVIM Group (n=50)	p Value*
Level of Education	No education	6 (12%)	8 (16%)	>0.05
	Primary	35 (70%)	32 (64%)	
	Secondary	7 (14%)	6 (12%)	
	Above secondary	2 (4%)	4 (8%)	
Parity	0	33 (66%)	29 (58%)	>0.05
	1–5	17 (34%)	21 (42%)	

Figure 2 illustrates the distribution of antenatal care (ANC) checkups among the study participants. The majority of women in both groups had irregular ANC visits, accounting for 80% in the IM group and 78% in

the IVIM group. Regular ANC checkups were reported by only 20% of women in the IM group and 22% in the IVIM group. The pattern of ANC attendance was comparable between the two groups without any statistically significant difference.

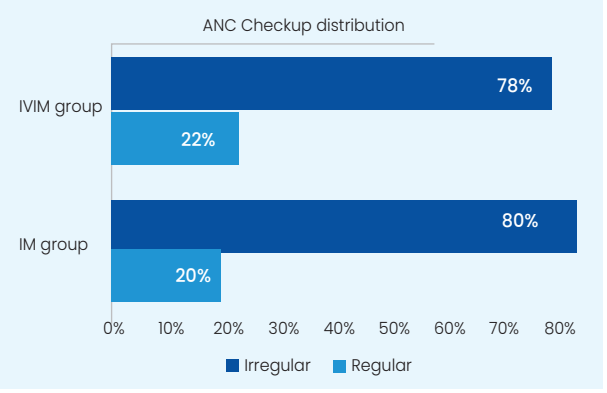


Figure 2: Distribution of Antenatal Care (ANC) Checkup Status Among Study Participants

Most women in both groups presented after 36 weeks of gestation. In the IM group, 71.8% presented at more than 36 weeks compared to 71.4% in the IVIM group. Presentation between 33–36 weeks was observed in 25.6% of the IM group and 28.6% of the IVIM group. Only 2.56% of women in the IM group presented between 28–32 weeks, while none were observed in the IVIM group. The difference in gestational age distribution between the two groups was not statistically significant (p>0.05).

Table 3: Gestational Age Distribution

Gestational Age (Weeks)	IM Group (n=39)	IVIM Group (n=42)	p Value*
28–32	1 (2.56%)	0	>0.05
33–36	10 (25.6%)	12 (28.6%)	
>36	28 (71.8%)	30 (71.4%)	

Antepartum/intrapartum eclampsia was the most common type observed in both groups. It was seen in 78% of women in the IM group and 84% in the combined IVIM group. Postpartum eclampsia occurred in 22% of the IM group compared to 16% of the combined IVIM group. The distribution of types of eclampsia was comparable between the two groups. No statistically significant difference was observed between the groups (p>0.05).

Table 4: Distribution of Types of Eclampsia

Types of Eclampsia	IM Group (n=50)	IVIM Group (n=50)	p Value*
Antepartum/Intrapartum	39 (78%)	42 (84%)	>0.05
Postpartum	11 (22%)	8 (16%)	

The average systolic blood pressure of the participants was 168.60 ± 19.73 mmHg, and the average diastolic blood pressure was 112.10 ± 11.40 mmHg. Systolic blood pressure ranged from 130 mmHg to 240 mmHg, while diastolic blood pressure ranged from 55 mmHg to 120 mmHg. These results show that most participants had significantly high blood pressure at the time of admission.

Table 5: Mean Systolic and Diastolic Blood Pressure at the Time of Admission

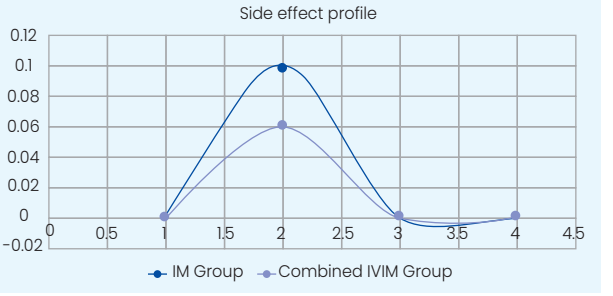
Variables	N	Minimum (mmHg)	Maximum (mmHg)	Mean ± SD (mmHg)
Systolic Blood Pressure (SBP)	100	130	240	168.60 ± 19.73
Diastolic Blood Pressure (DBP)	100	55	120	112.10 ± 11.40

Pedal oedema was seen in 72% of participants in the IM group and 76% in the combined IVIM group. Urine heat coagulation test positivity was found in 84% of the IM group and 90% in the IVIM group. While both clinical findings were slightly more common in the combined IVIM group, the differences between the two groups were not statistically significant (p > 0.05). These results indicate similar clinical presentations in both treatment groups.

Table 6: Clinical Findings

Findings	IM Group (n=50)	Combined IVIM Group (n=50)	p Value*
Pedal Oedema	36 (72%)	38 (76%)	>0.05
Urine for Heat Coagulation Test Positive	42 (84%)	45 (90%)	

Injection site pain was reported in 10% of women in the IM group and 6% in the combined IVIM group. No cases of abscess or redness were observed in either group. The incidence of side effects was slightly higher in the IM group, but the difference between the groups was not statistically significant (p > 0.05). Overall, both treatment regimens were well tolerated, with minimal local side effects.



P-value= >0.05

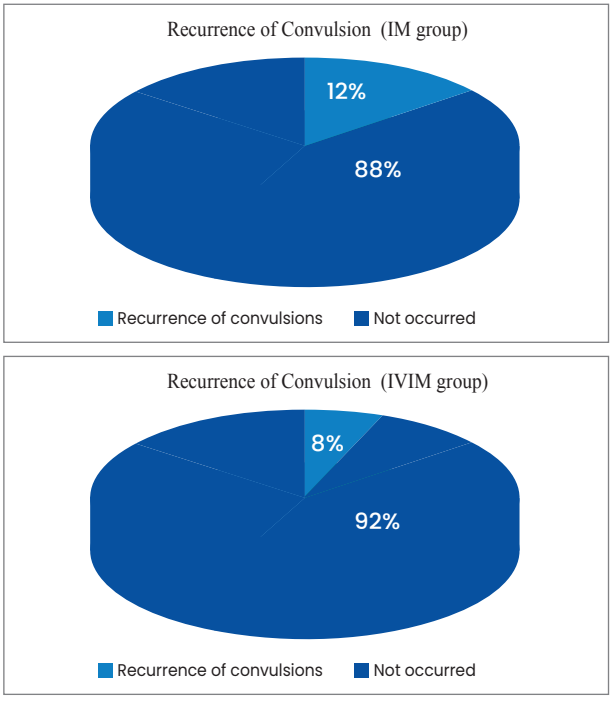
Figure 3: Side effects at the injection site

Loss of knee jerk was observed in 4% of participants in the IM group and 6% in the combined IVIM group. Oliguria was reported in 4% of the IM group and 2% of the combined IVIM group. Respiratory depression was not observed in either group during the study period. The differences in toxic effects between the two groups were not statistically significant ($p > 0.05$). These findings indicate that both treatment regimens had a comparable and acceptable safety profile.

Table 7: Toxic Effects

Toxic Effects	IM Group (n=50)	Combined IVIM Group (n=50)	p Value*
Loss of Knee Jerk	2 (4%)	3 (6%)	>0.05
Oliguria	2 (4%)	1 (2%)	
Respiratory Depression	0 (0%)	0 (0%)	

Recurrence of convulsions occurred in 12% of participants in the IM group and 8% in the combined IVIM group. Most women in both groups did not experience recurrent convulsions during the study. Although the recurrence rate was slightly lower in the combined IVIM group, the difference was not statistically significant ($p > 0.05$). These results suggest that both treatment regimens were equally effective in preventing convulsion recurrence, with the combined IVIM regimen showing comparable clinical efficacy to the IM regimen.



P- value= >0.05

Figure 4: Recurrence of convulsion

Vaginal delivery was conducted in 41.03% of women in the IM group and 45.2% in the combined IVIM group. Instrumental delivery was observed in 7.7% and 9.5% of participants in the IM and combined IVIM groups, respectively. Caesarean section was the most common mode of delivery in the IM group (51.3%), while 45.2% of women in the combined IVIM group underwent caesarean section. The differences in mode of delivery between the two groups were not statistically significant ($p > 0.05$). These findings indicate comparable obstetric outcomes in both treatment groups.

Table 8: Mode of Delivery

Mode of Delivery	IM Group (n=39)	Combined IVIM Group (n=42)	p Value*
Vaginal Delivery	16 (41.03%)	19 (45.2%)	>0.05
Instrumental Delivery	3 (7.7%)	4 (9.5%)	
Caesarean Section	20 (51.3%)	19 (45.2%)	

Pulmonary oedema was observed in 4% of women in the IM group and 6% in the combined IVIM group. HELLP syndrome occurred only in the IM group (4%), while disseminated intravascular coagulation (DIC) was noted equally in both groups (2%). Cerebrovascular accident was slightly higher in the combined IVIM group (4%) compared to the IM group (2%). No cases of psychosis were reported in either group. Maternal mortality was 4% in both groups, and none of the differences in maternal outcomes were statistically significant ($p > 0.05$).

Table 9: Maternal Outcome

Complications	IM Group (n=50)	Combined IVIM Group (n=50)	p Value*
Pulmonary Oedema	2 (4%)	3 (6%)	>0.05
HELLP Syndrome	2 (4%)	0 (0%)	
DIC	1 (2%)	1 (2%)	
Cerebrovascular Accident	1 (2%)	2 (4%)	
Psychosis	0 (0%)	0 (0%)	
Maternal Death	2 (4%)	2 (4%)	

Live birth rates were 79.5% in the IM group and 76.2% in the combined IVIM group. Stillbirth occurred in 20.5% of the IM group and 23.8% of the IVIM group. Low birth weight (<2.5 kg) was seen in 43.6% of neonates in the IM group and 45.2% in the IVIM group. APGAR scores below 7 at 5 minutes and NICU admissions were more frequent in the IM group. However, none of the differences in fetal outcomes between the groups were statistically significant ($p > 0.05$).

Table 10: Fetal Outcome

Outcomes	IM Group (n=39)	Combined IVIM Group (n=42)	p Value*
Live Birth	31 (79.5%)	32 (76.2%)	>0.05
Stillbirth	8 (20.5%)	10 (23.8%)	
Birth Weight (<2.5 kg)	17 (43.6%)	18 (45.2%)	
APGAR Score (<7) at 5 Minutes	10 (32.3%)	8 (25%)	
NICU Admission	10 (32.3%)	8 (25%)	

Discussion

This study compared the efficacy and safety of intramuscular (IM) magnesium sulphate with the conventional combined intravenous and intramuscular (IV+IM) regimen for treating eclampsia. The results showed both regimens were equally effective in controlling convulsions and produced similar maternal and fetal outcomes. Convulsion recurrence occurred in 10% of the IM group and 8% of the IV+IM group, with no statistically significant difference ($p>0.05$). These results align with the Magpie Trial, which established magnesium sulphate as the gold standard anticonvulsant for eclampsia (Altman et al., 2002). Begum et al. (2001) reported similar recurrence rates using the low-dose "Dhaka regimen" in Bangladeshi women.

The socio-demographic characteristics were comparable between groups. Most women were in the 21–25 years age group (52% vs 50%), from rural areas (70% vs 72%), and from poor socioeconomic backgrounds (66% vs 70%). These findings reflect the typical profile of eclampsia in developing countries, where poor antenatal care and limited healthcare access are major contributors (NIPORT, 2012; Langer et al., 2008). Irregular antenatal care was observed in 80% of women in the IM group and 78% in the IV+IM group, which supports the association between poor antenatal surveillance and increased hypertensive disorder risk in pregnancy (WHO, 2011). This issue is particularly prominent in low-resource settings, where many women do not attend regular ANC sessions (Osman, 2025; Maharjan, 2022).

The frequency of toxic effects was low and similar in both groups. Loss of knee jerk was noted in 4% of the IM group and 6% in the IV+IM group, while oliguria was seen in 4% and 2%, respectively. No cases of respiratory depression were reported. These findings are consistent with Ekele and Badung (2005) and Okusanya et al. (2012), who concluded that magnesium sulphate can be safely administered with simple clinical monitoring, without the need for serum magnesium estimation.

Maternal outcomes were comparable between groups. Maternal mortality was 4% in both regimens, and pulmonary oedema occurred in 4% and 6% of the IM and IV+IM groups, respectively. Caesarean section rates were slightly higher in the IM group (51.3% vs 45.2%), though the difference was not statistically significant. These findings align with the Eclampsia Trial Collaborative Group (1995), which reported no significant difference in maternal complications between different magnesium sulphate regimens. Beacham (2025) also reported no significant differences in maternal outcomes between 12-hour and 24-hour magnesium sulfate protocols, further supporting the idea that various regimens may have similar complication profiles.

Neonatal outcomes were also comparable. Stillbirth rates were 20.5% in the IM group and 23.8% in the IV+IM group, while NICU admissions occurred in 32.3% and 25% of neonates, respectively. These findings are consistent with studies from low-resource settings, where delayed presentation and severe maternal disease contribute to poor perinatal outcomes (Duley, 2009; Okusanya et al., 2012).

The short study duration and lack of long-term maternal and neonatal follow-up may have restricted assessment of delayed outcomes. In addition, serum magnesium levels were not measured due to limited laboratory facilities, and toxicity assessment relied solely on clinical monitoring.

Overall, this study suggests that intramuscular magnesium sulphate is an effective and safe alternative to the conventional IV+IM regimen. Its ease of administration, lower technical requirements, and comparable efficacy make it particularly suitable for primary healthcare facilities and resource-limited settings.

Conclusion

Intramuscular magnesium sulphate was found to be comparable to the conventional intravenous plus intramuscular regimen in controlling eclamptic convulsions and improving maternal outcomes. The recurrence of seizures, maternal complications, and fetal outcomes showed no statistically significant differences between the two groups. Toxic effects were minimal and manageable with routine clinical monitoring. The IM regimen offers practical advantages including ease of administration, reduced need for skilled personnel, and lower

dependency on intravenous access. Therefore, intramuscular magnesium sulphate may serve as an effective alternative in primary healthcare and resource-limited settings. Further multicenter studies with larger sample sizes are recommended to strengthen these findings.

Acknowledgment: The authors would like to express their sincere gratitude to the Department of Obstetrics and Gynaecology, Chittagong Medical College Hospital, for their support and cooperation during the study. The authors are also thankful to all the patients and healthcare staff whose participation and assistance made this research possible.

Conflict of Interest: None

Funding: Self

References

1. Altman, D., Carroli, G., Duley, L., Farrell, B. and Moodley, J. (2002) 'Do women with pre-eclampsia benefit from magnesium sulphate? The Magpie Trial', The Lancet, 359(9321), pp. 1877–1890.
2. Akbar, M.I.A., et al., 2025. Impact of eclampsia on maternal and perinatal outcomes. ScienceDirect. https://www.sciencedirect.com/science/article/pii/S2666577825001571
3. Beacham, T., 2025. Comparing a 12 versus 24□h postpartum IV magnesium sulfate protocol. Journal of Obstetrics and Gynaecology, 45(2), pp.159-165. https://pmc.ncbi.nlm.nih.gov/articles/PMC12626847/
4. Begum, R., Begum, A., Johanson, R., Ali, M.N. and Akhtar, S. (2001) 'A low dose ("Dhaka") magnesium sulphate regimen for eclampsia', Acta Obstetricia et Gynecologica Scandinavica, 80(11), pp. 998–1002.
5. BIRPERHT (1994) Proceedings of Dissemination Workshop on Maternal Morbidity Study. Dhaka: Bangladesh Institute of Research for Promotion of Essential and Reproductive Health and Technologies.
6. Duley, L. (2009) 'The global impact of pre-eclampsia and eclampsia', Seminars in Perinatology, 33(3), pp. 130–137.
7. Dutta, D.C. (2018) Textbook of Obstetrics. 9th edn. Kolkata: New Central Book Agency.
8. Eclampsia Trial Collaborative Group (1995) 'Which anticonvulsant for women with eclampsia?', The Lancet, 345, pp. 1455–1463.
9. Ekele, B.A. and Badung, S.L. (2005) 'Is serum magnesium estimation necessary in patients with eclampsia?', African Journal of Reproductive Health, 9(1), pp. 128–132.
10. Goldenberg, R.L., McClure, E.M. and MacGuire, E.R. (2011) 'Lessons for low-income regions following the reduction in hypertension-related maternal mortality in high-income countries', International Journal of Gynecology & Obstetrics, 113(2), pp. 91–95.
11. Langer, A., Villar, J., Tell, K., Kim, T. and Kennedy, S. (2008) 'Reducing eclampsia-related deaths', The Lancet, 371, pp. 705–706.
12. Maharjan, M., 2022. Irregular antenatal care attendance among pregnant women during the COVID□19 pandemic: prevalence and associated factors. https://www.ncbi.nlm.nih.gov/articles/PMC9794940/
13. Magley, M. and Hinson, M.R., 2024. Eclampsia. StatPearls Publishing. Available at: https://www.ncbi.nlm.nih.gov/books/NBK554392/
14. NIPORT (2012) Bangladesh Maternal Mortality and Health Care Survey 2010. Dhaka: National Institute of Population Research and Training.
15. Okusanya, B.O., Garba, K.D. and Ibrahim, H.M. (2012) 'Efficacy of intramuscular magnesium sulphate', Nigerian Postgraduate Medical Journal, 19(3), pp. 143–148.
16. Osman, W.A., 2025. Factors affecting antenatal care attendance among pregnant women in Mogadishu, Somalia. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC12553898/
17. Sibai, B.M. (2005) 'Diagnosis, prevention, and management of eclampsia', Obstetrics & Gynecology, 105(2), pp. 402–410.
18. Tukur, J. (2009) 'The use of magnesium sulphate for the treatment of severe pre-eclampsia and eclampsia', Annals of African Medicine, 8(2), pp. 76–80.
19. World Health Organization (2011) WHO recommendations for prevention and treatment of pre-eclampsia and eclampsia. Geneva: WHO.
20. Witlin, A.G. and Sibai, B.M. (1998) 'Magnesium sulphate therapy in preeclampsia and eclampsia', Obstetrics & Gynecology, 92(5), pp. 883–889.
21. Yücesoy, G., Ozkan, S., Bodur, H. and Tan, T. (2005) 'Maternal and perinatal outcome in pregnancies complicated with hypertensive disorder', Journal of Obstetrics and Gynaecology, 25(3), pp. 244–247.