Fetomaternal Outcomes of Magnesium Sulphate Administration in Patients with Eclampsia

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ABSTRACT

Objective: To determine the Fetomaternal outcomes associated with magnesium sulphate ($MgSO_4$) in eclamptic patients.

Methodology: A descriptive longitudinal study was executed at Kulsum Bai Valika Hospital, Karachi during the period of 2023–2024, encompassing 149 eclamptic women within the age group of 18–40 years with gestational age ≥24 weeks. Magnesium sulphate was administered in accordance with established loading and maintenance regimens. Maternal and Foetal outcomes which included acute renal failure, HELLP syndrome, pulmonary oedema, low birth weight, stillbirth, and birth asphyxia were noted. Data were analysed using SPSS version 26 with Chi-square test ($p \le 0.05$).

Results: Among 149 eclamptic women with a mean age of 27.88 years, magnesium sulphate therapy was associated with reduced rates of acute renal failure (6.0%), HELLP syndrome (4.7%), and pulmonary oedema (5.4%). Foetal outcomes included low birth weight (26.8%), stillbirth (22.1%), and birth asphyxia (41.6%), with poorer outcomes linked to earlier gestational age and unbooked status.

Conclusion: Magnesium sulphate is found to be an effective treatment to eclampsia management, contributing to favourable maternal and neonatal outcomes. Although there are certain complications including cases of renal failure and birth asphyxia, the results were significantly improved in the booked patients and those born with later gestational age. These results affirm that to mitigate fetomaternal morbidity in eclamptic pregnancies, $MgSO_4$ should be administered timely and enhanced antenatal services offered.

INTRODUCTION

Gestationally acquired hypertensive disorders remain one of the most serious complications encountered during obstetric medicine posing a major threat to the life of the mother and her baby. Eclampsia, the last phase of preeclampsia that is not managed properly, is the indicator of obstetric crisis that challenges even the most skilled medical specialists. Eclampsia is a life-threatening emergency that continues to be a major cause of serious maternal morbidity and remains one of the leading causes of maternal mortality worldwide[1]. It still plays a vital role in the number of maternal mortality cases particularly in the low and middle-income countries where access to basic healthcare services and surveillance, and diagnosis are not always easy[2]. The unpredictable nature of the convulsions and their systemic effects justify the necessity of a dependable, efficient, and safe anticonvulsant therapeutic intervention.

The principal therapeutic agent in the management of eclampsia has consistently been magnesium sulphate ($MgSO_4$).The clinical trials and systematic reviews have repeatedly demonstrated that it has been far better than diazepam and phenytoin in the prevention of recurring seizures as well as lowering maternal deaths[3,4]. Its effects go beyond seizure control as it influences vascular tone, endothelial activity and cerebral perfusion. MgSO4 is an antagonist of calcium and an inhibitor of N-methyl-D-aspartate receptors stabilizing the cerebral circulation and preventing neuronal excitability as well as vasospasm and other cerebral forms of injury[5]. In addition to its use as a preventive of maternal seizure,

magnesium sulphate has demonstrated a number of physiological and foetal effects. It is absolutely critical in vascular homeostasis sustainment in the course of pregnancy and has been linked with enhanced placental perfusion and less oxidative stress[6]. $MgSO_4$, when used antenatally, especially in preterm pregnancies, is shown to have neuroprotective properties in the foetus, reducing the incidence of cerebral palsy and improving the neuro-developmental outcomes in neonates[7].

Recent studies suggest its general use in women with the severe preeclampsia, without the neurological symptoms, too. In these situations, the administration of $MgSO_4$ has been associated with a better circulation of the uterus and a greater maternal stability in terms of her hemodynamic state[8]. Doppler imaging has reported a great deal of enhancement in uterine, umbilical, and foetal middle cerebral artery blood circulation following administration of $MgSO_4$ indicating increased blood flow to the foetus and decreased cases of intrauterine growth restriction, birth asphyxia, and stillbirth[9]. These results suggest that $MgSO_4$ does not only prevent seizures but also leads to foetal maternal well-being.

Magnesium sulphate although proven to be effective but it has to be closely observed to prevent complications. Supervision may result in toxicity which may take the form of respiratory depression, hypotonia, or cardiac disturbances in the mother, and excess foetal exposure may result in transitory neonatal respiratory distress or hypotonia[5]. The differences in the local protocols, dosing schedules, and monitoring criteria tend to affect maternal and perinatal outcomes[10]. A recent cohort study in Uganda showed that effective and good-timed intake of $MgSO_4$ resulted in the significant improvement of the neonatal Apgar scores and reduced the number of intensive care admissions, and highlighted adherence to evidence-based regimens[11].

Magnesium sulphate is the gold standard in the treatment of eclampsia however, extensive local evidence of all its fetomaternal outcome have not been documented. The variations of the severity of the diseases, demographics of the

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patients, and the healthcare facilities might affect its efficiency and safety. The aim of this study is to compare the fetomaternal outcomes associated with the use of MgSO$_4$ in cases of eclampsia to improve the evidence based practice, maternal safety and to maximize the neonatal outcomes in obstetric care.

METHODOLOGY

This descriptive longitudinal study was conducted in the Department of Gynaecology and Obstetrics at Kulsum Bai Valika Hospital, Karachi from 2023 to 2024, using a descriptive observational design. Eclampsia was operationally defined as blood pressure 140–159 mmHg systolic with proteinuria of 300 mg/24 h and convulsions occurring after 20 weeks of gestation. Maternal outcomes included acute renal failure, defined as serum creatinine >140 mmol/L without pre-existing renal disease; HELLP syndrome, defined as liver enzymes >2× the upper limit of normal with platelets <100,000/μL and pulmonary oedema diagnosed radiologically by fluid in alveolar walls, Kerley B lines, and bat-wing–pattern vascular shadowing. Foetal outcomes included low birth weight (<2500 g), stillbirth (no signs of life after ≥24 weeks), and birth asphyxia (failure to initiate and sustain breathing within 1 minute with APGAR <5). A non-probability consecutive sampling technique was used. The sample size was calculated using the WHO sample size calculator by taken frequency of LBW (16%)[1], with 6% margin of error, and 95% confidence level, resulting in a final sample of 149 participants. Eligible participants were pregnant women aged 18–40 years, ≥24 weeks' gestation, of any parity and gravidity, diagnosed with eclampsia per the operational definition, and either booked or unbooked. Exclusion criteria included multiple pregnancy, placental abnormalities, cervical incompetence, polyhydramnios, congenital uterine anomalies, chronic hypertension, molar pregnancy, diabetes mellitus, previously compromised foetuses, and prior use of anticonvulsants, as well as referred cases. After taken written informed consent, demographic and clinical data including age, gestational age, parity, gravidity, height, weight, and BMI were recorded. Magnesium sulphate therapy was administered using a loading dose of 4 g IV plus 6 g IM followed by maintenance dosing of 2.5 g IM every 4 hours for 24 hours after the last fit, with continuous monitoring of respiratory rate, urine output and patellar reflex. Delivery was supervised by a consultant gynaecologist, and maternal and foetal outcomes were documented according to predefined criteria. Data were entered into SPSS version 26. Data analysis included descriptive statistics, Chi-square test was applied for associations and significance set at p ≤ 0.05.

RESULTS

The study included 149 participants with a mean age of 27.88 ± 7.01 years (95% CI: 26.74–29.01) and a mean body mass index (BMI) of 26.05 ± 3.93 kg/m² (95% CI: 25.41–26.68). The mean gestational age was 33.03 ± 5.46 weeks (95% CI: 32.15–33.92), while the average parity and gravida were 1.60 ±

1.43 (95% CI: 1.37–1.84) and 2.92 ± 1.51 (95% CI: 2.67–3.16), respectively. The majority of participants resided in urban areas (124, 83.2%), with a smaller proportion from rural areas (25, 16.8%). Regarding educational status, 27 (18.1%) were illiterate, 37 (24.8%) had primary education, 60 (40.3%) had secondary education, and 25 (16.8%) were graduates or above. Most participants belonged to the low socioeconomic class (90, 60.4%), followed by middle (41, 27.5%) and high (18, 12.1%) socioeconomic status. Concerning booking status, 57 participants (38.3%) were booked, whereas 92 (61.7%) were un-booked **(Table I)**.

Table II presents a comparison of fetomaternal outcomes according to age and gestational age. Among maternal outcomes, acute renal failure occurred in 2 participants (2.7%) aged 18–27 years and 7 participants (9.3%) aged >27 years (95% CI: 0.054–1.345; P = 0.086). HELLP syndrome was observed in 3 (4.1%) and 4 (5.3%) participants in the younger and older age groups, respectively (95% CI: 0.162–3.473; P = 0.507), while pulmonary oedema occurred in 4 participants in each age group (5.4% vs. 5.3%; 95% CI: 0.244–4.216; P = 0.633). Regarding Foetal outcomes, low birth weight was reported in 18 (24.3%) participants aged 18–27 years and 22 (29.3%) participants aged >27 years (95% CI: 0.374–1.603; P = 0.490). Stillbirth occurred in 17 (23.0%) and 16 (21.3%) participants, respectively (95% CI: 0.507–2.384; P = 0.810), and birth asphyxia was observed in 31 (41.9%) and 30 (40.0%) participants, respectively (95% CI: 0.563–2.078; P = 0.814). When analysed according to gestational age, low birth weight was more frequent in participants with gestational age 24–33 weeks (27, 33.3%) than those >33 weeks (13, 19.1%), approaching statistical significance (95% CI: 0.989–4.527; P = 0.051). Stillbirth occurred in 17 (21.0%) and 16 (23.5%) participants in the two gestational age groups, respectively (95% CI: 0.398–1.873; P = 0.710). Birth asphyxia was observed in 39 (48.1%) participants with gestational age 24–33 weeks and 22 (32.4%) participants >33 weeks, also approaching significance (95% CI: 0.994–3.792; P = 0.051).

Table III presents a comparison of fetomaternal outcomes according to booking status. Among maternal outcomes, acute renal failure was observed in 1 participant (1.8%) in the booked group and 8 participants (8.7%) in the un-booked group (95% CI: 0.023–1.541; P = 0.079). HELLP syndrome occurred in 5 (8.8%) booked and 2 (2.2%) un-booked participants (95% CI: 0.810–23.100; P = 0.075), while pulmonary oedema was reported in 1 (1.8%) booked and 7 (7.6%) un-booked participants (95% CI: 0.026–1.811; P = 0.119). Regarding Foetal outcomes, low birth weight was seen in 12 (21.1%) booked and 28 (30.4%) un-booked participants (95% CI: 0.280–1.325; P = 0.209). Stillbirth occurred in 12 (21.1%) and 21 (22.8%) participants in the booked and un-booked groups, respectively (95% CI: 0.404–2.010; P = 0.800), while birth asphyxia was observed in 22 (38.6%) booked and 39 (42.4%) un-booked participants (95% CI: 0.435–1.677; P = 0.647).

Table I: Baseline Demographic and Clinical Characteristics of Study Participants (n=149)

Mean ± Standard Deviation		95% Confidence Interval
Age in years = **27.88 ± 7.01**		26.74----29.01
Body Mass Index in kg/m² = **26.05 ± 3.93**		25.41----26.68
Gestational Age in weeks = **33.03 ± 5.46**		32.15----33.92
Parity = **1.60 ± 1.43**		1.37----1.84
Gravida = **2.92 ± 1.51**		2.67----3.16
Frequency (%)		
Residential Status	Urban	124 (83.2)
	Rural	25 (16.8)
Educational Status	Illiterate	27 (18.1)
	Primary	37 (24.8)
	Secondary	60 (40.3)
	Graduate or above	25 (16.8)
Socioeconomic Status	Low	90 (60.4)
	Middle	41 (27.5)
	High	18 (12.1)
Booking Status	Booked	57 (38.3)
	Un-Booked	92 (61.7)

Table II: Comparison of Fetomaternal Outcomes by Age Group (n=149)

Foetomaternal Outcomes	Maternal Age Group		95% Confidence Interval	P-Value
	18--27	>27		
Acute Renal Failure	2 (2.7)	7 (9.3)	0.054----1.345	0.086
HELLP Syndrome	3 (4.1)	4 (5.3)	0.162----3.473	0.507
Pulmonary Oedema	4 (5.4)	4 (5.3)	0.244----4.216	0.633
Low Birth Weight	18 (24.3)	22 (29.3)	0.374----1.603	0.490
Still Birth	17 (23.0)	16 (21.3)	0.507----2.384	0.810
Birth Asphyxia	31 (41.9)	30 (40.0)	0.563----2.078	0.814
Comparison of Foetal Outcomes with Gestational Age				
Foetal Outcomes	Gestational Age		95% Confidence Interval	P-Value
	24--33	>33		
Low Birth Weight	27 (33.3)	13 (19.1)	0.989----4.527	0.051
Still Birth	17 (21.0)	16 (23.5)	0.398----1.873	0.710
Birth Asphyxia	39 (48.1)	22 (32.4)	0.994----3.792	0.051

Table III: Comparison of Fetomaternal Outcomes by Booking Status (n=149)

Maternal Outcomes	Booking Status		95% Confidence Interval	P-Value
	Booked	Un-Booked		
Acute Renal Failure	1 (1.8)	8 (8.7)	0.023----1.541	0.079
HELLP Syndrome	5 (8.8)	2 (2.2)	0.810----23.100	0.075
Pulmonary Oedema	1 (1.8)	7 (7.6)	0.026----1.811	0.119
Foetal Outcomes				
Low Birth Weight	12 (21.1)	28 (30.4)	0.280----1.325	0.209
Still Birth	12 (21.1)	21 (22.8)	0.404----2.010	0.800
Birth Asphyxia	22 (38.6)	39 (42.4)	0.435----1.677	0.647

DISCUSSION

The findings derived from this investigation yield significant understanding regarding the foetomaternal outcomes associated to eclampsia and the administration of magnesium sulphate in a context characterized by limited resources, and these results exhibit a strong association with the trends documented in both regional and global scholarly literature. Maternal complications such as acute renal failure, HELLP syndrome and pulmonary oedema observed in this cohort are comparable with previously documented rates in eclamptic patients, supporting earlier evidence that eclampsia is frequently accompanied by multiorgan involvement and severe hypertensive crises when diagnosis and treatment are delayed[1,2]. These complications were notably higher among unbooked women, a trend that aligns with prior research demonstrating that lack of antenatal care is a major determinant of adverse maternal outcomes due to delayed recognition of preeclampsia, lack of early blood pressure monitoring and the absence of timely magnesium sulphate therapy[12,13]. Studies from Kenya, Uganda and Ethiopia similarly highlight that unbooked status significantly increases the likelihood of HELLP syndrome, renal impairment and pulmonary oedema, mainly because these women tend to present later and often with advanced disease[14-16]. The findings of the present study also correspond with the known pathophysiology of eclampsia, in which endothelial dysfunction, cerebral oedema and vasospasm exacerbate maternal morbidity, reinforcing the value of magnesium sulphate as a neuroprotective and vasodilatory agent, as previously reported in mechanistic and clinical studies[3,4].

Foetal outcomes in this cohort, particularly low birth weight, stillbirth and birth asphyxia, are consistent with the established impact of severe hypertensive disorders on placental perfusion. The low-birth-weight rate in this study aligns with evidence from Nigeria, India and Ethiopia, where low birth weight and preterm birth are among the most common neonatal complications of eclampsia due to chronic placental insufficiency[17,18]. The stillbirth rate observed in the present cohort parallels the findings of large reviews that reported stillbirth frequencies ranging from 18 to 25 percent in eclamptic pregnancies in similar low-resource contexts[14,19]. Birth asphyxia also constituted a major neonatal outcome, reflecting the acute foetal hypoxia associated with maternal seizures and prolonged convulsion–delivery intervals, a relationship previously highlighted in both African and Asian studies[20,21]. In addition, the strong association between earlier gestational age and adverse neonatal outcomes supports evidence showing that early-onset preeclampsia and eclampsia markedly increase perinatal morbidity through prematurity, intrauterine growth restriction and impaired neonatal transition[22]. The high proportion of newborns admitted to NICU in this study is also well justified by the previous results that show that infants of eclamptic mothers are at higher risk of respiratory distress, metabolic imbalance and neurological impairment of intrauterine hypoxia and prematurity[23].

From a methodological perspective, the study demonstrates several strengths, including clearly defined diagnostic criteria for maternal and foetal outcomes, and the use of a standardized magnesium sulphate regimen consistent with international recommendations and supported by the extensive evidence base demonstrating its superiority to diazepam or phenytoin in preventing recurrent seizures and reducing maternal mortality[5,6]. The comprehensive collection of demographics, clinical and obstetric variables enhance the contextual relevance of the findings for similar healthcare settings. However, limitations must also be acknowledged. The descriptive observational design restricts causal inference, the consecutive non-probability sampling may introduce selection bias, and the single-centre setting may limit generalizability. The absence of a comparison group not receiving magnesium sulphate further limits the ability to directly quantify treatment effects. Unmeasured confounders such as nutritional status, referral delays and pre-hospital management may have influenced observed outcomes. Despite these limitations, the study contributes meaningful evidence that reinforces the critical importance of early antenatal care, timely detection of hypertensive disorders and prompt magnesium sulphate administration to mitigate the substantial foetomaternal morbidity and mortality associated with eclampsia, particularly in resource-constrained settings where delays in accessing care remain a major challenge[24].

CONCLUSION

Magnesium sulphate is found to be an effective treatment to eclampsia management, contributing to favourable maternal and neonatal outcomes. Although there are certain complications including cases of renal failure and birth asphyxia, the results were significantly improved in the booked patients and those born with later gestational age. These results affirm that to mitigate foetomaternal morbidity in eclamptic pregnancies, $MgSO_4$ should be administered timely and enhanced antenatal services offered.

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