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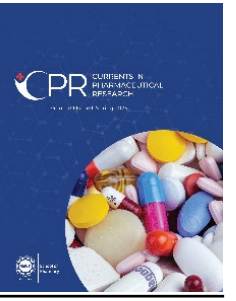

Maternal and Perinatal Outcomes in Women with Pre-eclampsia and Eclampsia Treated with $MgSO_4$ at a Tertiary Care Hospital in Quetta, Pakistan: A Retrospective Observational Study

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Maternal and Perinatal Outcomes in Women with Pre-eclampsia and Eclampsia Treated with $MgSO_4$ at a Tertiary Care Hospital in Quetta, Pakistan: A Retrospective Observational Study

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ABSTRACT

Pre-eclampsia and eclampsia continue to be important causes of morbidity and mortality in developing countries. These conditions are often associated with delayed diagnosis and limited access to appropriate healthcare services. $MgSO_4$ is the recommended anticonvulsant therapy for the prevention and management of seizures in pre-eclampsia and eclampsia. However, its use is not standardized in most places. To determine the maternal and perinatal outcomes among women with pre-eclampsia and eclampsia managed with $MgSO_4$ at the Bolan Medical Complex Hospital in Quetta, Pakistan. This retrospective observational study was conducted at the Department of Obstetrics and Gynecology, Bolan Medical Complex Hospital, Quetta, Pakistan from February 2025 to September 2025. The study included 60 women with pre-eclampsia/eclampsia who had received $MgSO_4$ therapy. Information regarding demographic characteristics, clinical presentation, treatment, maternal complications, and neonatal outcomes was collected using a structured proforma and analyzed using SPSS (version 20.0). Among the 60 patients enrolled, 28 (46.7%) had pre-eclampsia and 32 (53.3%) had eclampsia. The majority of participants were aged 39–45 years (45.0%), had a gestational age of 37–42 weeks (48.3%), and presented with eclampsia (51.7%). Sixty-five percent (39) of participants completed the full $MgSO_4$ regimen, whereas 35% (21) received partial treatment. Fifty-five percent (33) of participants experienced recurrent convulsions, although two-thirds (66.7%) had no serious maternal complications. Such complications included placental abruption (20.0%), HELLP syndrome (10.0%), and pulmonary edema (3.3%). A poor 5-minute

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Apgar score (<7) was observed in 35 (58.3%) neonates and there were 26 (43.3%) adverse perinatal outcomes. In the multivariable logistic regression analysis, there were no significant association found between maternal age, gestational age, parity, or complete $MgSO_4$ administration and poor Apgar scores or adverse perinatal outcomes (all $p > 0.05$). Although most women did not experience major maternal complications (66.7%), recurrent seizures remained frequent (55.0%) and adverse neonatal outcomes occurred in 43.3% of neonates. These findings highlight the continued burden of neonatal complications among women with pre-eclampsia and eclampsia despite $MgSO_4$ therapy.

Keywords: eclampsia, maternal outcomes, $MgSO_4$, perinatal outcomes, pre-eclampsia

Highlights

- A standardized $MgSO_4$ protocol was applied to 60 women with pre-eclampsia or eclampsia in a tertiary care hospital setting.
- Eclampsia constituted a higher proportion of cases (53.3%) as compared with pre-eclampsia (46.7%).
- $MgSO_4$ administration resulted in effective maternal stabilization with reduced recurrence of convulsions.

1. INTRODUCTION

Pre-eclampsia is a serious hypertensive disorder in pregnancy that develops after 20 weeks of gestation and is characterized by new-onset hypertension, with or without proteinuria, and accompanied by the evidence of maternal organ dysfunction [1]. According to recent estimates from the World Health Organization (WHO), approximately 260,000 women die each year from pregnancy-related complications, with hypertensive disorders including pre-eclampsia and eclampsia accounting for approximately 16% of maternal deaths [2]. Pre-eclampsia occurs in about 3–5% of all pregnancies and is associated with serious maternal complications including eclampsia, stroke, renal dysfunction, and multiple organ failure, as well as adverse neonatal outcomes such as preterm birth, fetal growth restriction, low Apgar scores, NICU admission, and neonatal death [3]. The rates of the hypertensive disorders in pregnancy have been reported to be more than seven times higher in developing countries than in developed countries [4]. In Pakistan, hypertensive disorders in pregnancy

remain an important public health problem and continue to contribute substantially to maternal and perinatal mortality, particularly in resource-limited provinces such as Balochistan.

The efficacy of $MgSO_4$ has been established through several randomized controlled trials, particularly the landmark MAGPIE trial, which demonstrated that $MgSO_4$ significantly reduces the risk of eclampsia and maternal mortality, as compared with placebo and other anticonvulsant therapies [5]. Accordingly, the World Health Organization (WHO) [6] and the American College of Obstetricians and Gynecologists (ACOG) [7] recommend $MgSO_4$ as the first-line treatment for women with severe pre-eclampsia and eclampsia [8]. When administered according to the recommended dosing protocols and with appropriate clinical supervision, $MgSO_4$ has been shown to be highly effective and safe in both mothers and neonates [9-11]. Despite its proven efficacy, the implementation of $MgSO_4$ therapy remains challenging in many resource-constrained healthcare settings because of overcrowded maternity units, inadequate staffing, insufficient monitoring facilities, poor documentation, and interruptions in treatment [12]. Failure to administer appropriate doses or following recommended maintenance therapy schedules may reduce the effectiveness of seizure prevention while exposing mothers to complications, such as recurrent seizures and magnesium toxicity [13].

Although the effectiveness of $MgSO_4$ has been well-established through international clinical trials and systematic reviews, important knowledge gaps remain regarding its use in routine healthcare practice, particularly in resource-limited settings. Most existing literature focuses on seizure prevention and maternal mortality, whereas fewer studies have evaluated adherence to the recommended $MgSO_4$ protocols and associated maternal and neonatal outcomes [14].

In Pakistan, particularly in Balochistan, limited information is available regarding local $MgSO_4$ administration practices, maternal complications, and neonatal outcomes following treatment. Therefore, evaluating $MgSO_4$ therapy in routine hospital practice is essential to assess the implementation and effectiveness of internationally recognized treatment guidelines.

This study aimed to evaluate $MgSO_4$ administration practices and maternal and perinatal outcomes among women with pre-eclampsia and eclampsia treated at Bolan Medical Complex Hospital, Quetta, Pakistan. In

addition, the study examined whether maternal age, gestational age, parity, and $MgSO_4$ dose completion are associated with adverse neonatal outcomes. Moreover, the study also assessed protocol compliance during routine clinical practice and evaluated the associated maternal and neonatal outcomes.

2. MATERIALS AND METHODS

2.1 Study Design and Setting

A retrospective observational study was conducted at the Department of Obstetrics and Gynaecology (Unit II), Bolan Medical Complex Hospital, Quetta, Pakistan between February 2025 and September 2025. Bolan Medical Complex Hospital is a tertiary referral centre that manages a high volume of high-risk obstetric cases referred from across the province.

2.2 Ethical Approval

Ethical approval was obtained from the Institutional Review Board (IRB) of Bolan Medical Complex Hospital before the commencement of the study. Since this was a retrospective record-based study, the requirement for informed consent was waived. Patient confidentiality was maintained by anonymizing all extracted data.

2.3 Study Population

2.3.1. Inclusion Criteria.

- Women diagnosed with moderate or severe pre-eclampsia or eclampsia after 20 weeks of gestation.
- Women who received $MgSO_4$ according to hospital protocol.
- Women with either primigravida or multigravida were included.
- Women with complete medical records.

2.3.2. Exclusion Criteria.

- Their seizure was due to reasons other than hypertension in pregnancy.
- They had received other anticonvulsants (such as diazepam or phenytoin) before $MgSO_4$ administration.

2.4 Sampling Method

A consecutive sampling approach was adopted whereby all eligible

medical records available during the study period were included. Since this was a retrospective observational study, no formal sample size calculation was performed. All eligible patients meeting the inclusion criteria during the study period were included. Consequently, the final sample consisted of 60 women with complete medical records.

2.5 Data Collection

The data were obtained from patients' medical records using a structured data collection form. The collected variables included maternal demographic characteristics (age, parity, booking status, and gestational age), clinical presentation, diagnosis, $MgSO_4$ administration details (loading dose, maintenance dose, and duration), maternal outcomes (blood pressure control, seizure recurrence, side effects, maternal complications, mode of delivery, and survival), and neonatal outcomes (birth weight, Apgar score, NICU admission, neonatal complications, and survival).

2.6 Statistical Analysis

Continuous variables were assessed for normality and presented as mean ± standard deviation (SD) or median (interquartile range), as appropriate. Categorical variables were summarized as frequencies and percentages. Associations between categorical variables were assessed using the Chi-square test or Fisher's exact test, where appropriate. Variables potentially associated with neonatal outcomes were further evaluated using multivariable logistic regression analysis. Adjusted odds ratios (aORs) with 95% confidence intervals (CIs) were calculated. A p-value of < 0.05 was considered statistically significant. Statistical analyses were performed using SPSS (version 20.0).

3. RESULTS

Data from 60 participants were analyzed using SPSS. Categorical data were expressed as n (%). The association between candidate predictor variables (maternal age category, gestational age category, parity, gravida, timing of the first maintenance dose of $MgSO_4$, and dose completion) and the two dichotomous outcome variables (poor Apgar score < 7 at 5 minutes and adverse perinatal outcome) was examined using the chi-square test. Adverse perinatal outcome was defined as stillbirth, neonatal death, or intrauterine death. Fisher's exact test was applied where appropriate for 2×2 contingency tables. Multivariable logistic regression analysis was performed with simultaneous adjustment for maternal age, gestational age,

parity, and dose completion to estimate adjusted odds ratios (aORs) with 95% confidence intervals (CIs).

Table 1. Demographic and Clinical Characteristics of Study Participants (*N*=60)

Characteristic	Category	*n* (%)
Maternal age (years)	18–24	10 (16.7%)
	25–31	14 (23.3%)
	32–38	9 (15.0%)
	39–45	27 (45.0%)
Gestational age (weeks)	25–31	15 (25.0%)
	31–36	16 (26.7%)
	37–42	29 (48.3%)
Blood pressure	Normal	29 (48.3%)
	High	31 (51.7%)
Study group	Pre-eclamptic	28 (46.7%)
	Eclamptic	32 (53.3%)

A total of 60 women were included in the study. The largest number of participants (45.0%) were aged 39–45 years, 23.3% were 25–31 years, 16.7% were 18–24 years, and 15.0% were 32–38 years. Regarding gestational age, 48.3% of women presented at 37–42 weeks of gestation, followed by 26.7% at 31–36 weeks, and 25.0% at 25–31 weeks. More than half of the participants (51.7%) had hypertension, whereas 48.3% had blood pressure values within the normal range at presentation. Regarding diagnostic categories, 32 women (53.3%) were diagnosed with eclampsia, while 28 women (46.7%) had pre-eclampsia.

Table 2. $MgSO_4$ Administration Patterns among Participating Women (*N*=60)

Characteristic	Category	*n* (%)
Timing of 1st maintenance $MgSO_4$ dose	4-hourly (per protocol)	6 (10.0%)
	<4-hourly	12 (20.0%)
	>4-hourly	31 (51.7%)
	Loading dose only	11 (18.3%)
$MgSO_4$ dose-completion status	Full dose	39 (65.0%)
	Partial dose	21 (35.0%)

3.1. Timing of the First Dose of $MgSO_4$ ($MgSO_4$)

Of the 60 women enrolled in the study, only 6 (10.0%) received the first dose of $MgSO_4$ after a 4-hour interval, as per the recommended treatment protocol. While 12 (20.0%) women received their maintenance dose before 4 hours, the majority of 31 (51.7%) women had their maintenance dose after the recommended 4-hour interval. In addition, 11 (18.3%) women were given only the loading dose but no maintenance dose was administered to them.

3.2. Status of $MgSO_4$ Treatment Completion

Regarding the treatment completion of $MgSO_4$, 39 women (65.0%) completed the recommended treatment regimen, while 21 (35.0%) received partial $MgSO_4$ treatment.

Table 3. Association of $MgSO_4$ ($MgSO_4$) Dose Completion with Neonatal Apgar Score and Adverse Perinatal Outcomes

$MgSO_4$ dose status	*n* (%) of cohort	Poor Apgar <7 *n*/*N* (%)	Adverse perinatal outcome *n*/*N* (%)
Full dose	39 (65.0%)	22/39 (56.4%)	15/39 (38.5%)
Partial dose	21 (35.0%)	13/21 (61.9%)	11/21 (52.4%)
Total	60 (100%)	35/60 (58.3%)	26/60 (43.3%)

3.3. Effect of Complete versus Partial $MgSO_4$ Regimen Completion on Perinatal Outcomes

Among the 60 patients enrolled in the study, 39 (65.0%) were administered the full recommended course of $MgSO_4$ therapy, while 21 (35.0%) patients received partial treatment. Overall, 35 neonates (58.3%) had a 5-minute Apgar score of <7 and 26 (43.3%) experienced adverse perinatal outcomes.

Conversely, among neonates born to mothers who received a partial $MgSO_4$ regimen, 13 out of 21 (61.9%) had an Apgar score of <7 and 11 out of 21 (52.4%) experienced adverse perinatal outcomes. These findings suggest that partial $MgSO_4$ regimen completion was associated with a higher proportion of poor Apgar scores and adverse perinatal outcomes as compared to complete regimen completion; however, further statistical testing is required to determine whether these differences are statistically significant.

Table 4. Bivariate Associations with Poor Apgar Score and Adverse Perinatal Outcome

Predictor / Category	Poor Apgar <7 *n/N* (%)	Test, *p*-value	Adverse outcome *n/N* (%)	Test, *p*-value
Maternal age				
18–24	5/10 (50.0%)	$\chi^2(3)=0.56$ $p=0.905$	5/10 (50.0%)	$\chi^2(3)=5.96$ $p=0.114$
25–31	8/14 (57.1%)		5/14 (35.7%)	
32–38	5/9 (55.6%)		1/9 (11.1%)	
39–45	17/27 (63.0%)		15/27 (55.6%)	
Gestational age				
25–31 wks	7/15 (46.7%)	$\chi^2(2)=4.61$ $p=0.100$	8/15 (53.3%)	$\chi^2(2)=5.93$ $p=0.051$
31–36 wks	7/16 (43.8%)		10/16 (62.5%)	
37–42 wks	21/29 (72.4%)		8/29 (27.6%)	
Parity (Gravida)				
PG	14/23 (60.9%)	$\chi^2(3)=0.87$ $p=0.832$	8/23 (34.8%)	$\chi^2(3)=6.03$ $p=0.110$
2–5	10/19 (52.6%)		8/19 (42.1%)	
6–9	6/11 (54.5%)		4/11 (36.4%)	
10–13	5/7 (71.4%)		6/7 (85.7%)	
Timing of maintenance dose				
4-hourly	1/6 (16.7%)	$\chi^2(3)=5.34$ p=0.149	4/6 (66.7%)	$\chi^2(3)=2.69$ $p=0.443$
<4-hourly	7/12 (58.3%)		5/12 (41.7%)	
>4-hourly	19/31 (61.3%)		11/31 (35.5%)	
Loading dose	8/11 (72.7%)		6/11 (54.5%)	
Dose-completion status				
Full dose	22/39 (56.4%)	$\chi^2(1)=0.02$, $p=0.891$ Fisher $p=0.787$	15/39 (38.5%)	$\chi^2(1)=0.58$, $p=0.444$ Fisher $p=0.414$
Partial dose	13/21 (61.9%)		11/21 (52.4%)	

3.4. Predictors of Poor Neonatal Outcomes

The relationship between maternal characteristics, $MgSO_4$ administration, and neonatal outcomes is shown in Table 4. None of the assessed maternal or $MgSO_4$ administration factors appeared to have a significant relationship with either poor Apgar scores or poor perinatal outcomes.

In terms of maternal age, poor Apgar scores were most often seen in women aged 39-45 (63.0%), followed by women aged 25-31 years (57.1%), 32-38 years (55.6%), and 18-24 years (50.0%). Similarly, the highest incidence of adverse perinatal outcomes occurred in women aged 39-45 (55.6%). However, there was found no significant relationship between maternal age and either poor Apgar scores ($\chi^2 = 0.56$, $p = 0.905$) or adverse perinatal outcomes ($\chi^2 = 5.96$, $p = 0.114$).

Regarding gestational age, neonates born at 37–42 weeks had the highest prevalence of poor Apgar scores (72.4%), whereas adverse perinatal outcomes were most prevalent among deliveries at 31–36 weeks (62.5%), followed by deliveries at 25–31 weeks (53.3%). Although gestational age showed a trend toward an association with poor perinatal outcomes (χ^2 = 5.93, p = 0.051), it did not reach statistical significance. Likewise, there was no significant association between poor Apgar scores (χ^2 = 4.61, p = 0.100).

The results from the analysis based on gravidity revealed that women with gravida 10–13 had the highest proportion of poor Apgar scores (71.4%) and poor perinatal outcomes (85.7%). Nonetheless, parity was not found to be significantly related to poor Apgar scores (χ^2 = 0.87, p = 0.832) and poor perinatal outcomes (χ^2 = 6.03, p = 0.110).

The analysis of the timing for $MgSO_4$ maintenance dose administration showed that the patients who had been administered only the loading dose of the drug had the greatest percentage of poor Apgar scores (72.7%), while women who were administered the maintenance doses at an interval of 4 hours showed the worst perinatal outcomes (66.7%). There were no significant correlations between maintenance-dose timing and poor Apgar scores (χ^2 = 5.34, p = 0.149) and poor perinatal outcomes (χ^2 = 2.69, p = 0.443).

In addition, the completion of $MgSO_4$ therapy protocol was not statistically linked with neonatal results. Indeed, 56.4% of infants born to mothers on the full dose of $MgSO_4$ therapy showed poor Apgar scores, as compared to 61.9% in the partial dose group (χ^2 = 0.02, p = 0.891; Fisher's exact p = 0.787). Similarly, perinatal complications were noted in 38.5% of patients from the full-dose group and 52.4% of those from the partial dose group, without a statistically significant difference (χ^2 = 0.58, p = 0.444; Fisher's exact p = 0.410).

Table 5a. Predictors of Poor Apgar Score (<7) Adjusted for All Listed Predictors

Predictor (per category increase)	aOR	95% CI	p
Maternal age group	1.13	0.69–1.86	0.615
Gestational age group	1.81	0.94–3.46	0.075
Parity (Gravida) group	1.04	0.60–1.83	0.879
Dose-completion (partial vs. full)	1.21	0.40–3.73	0.735

Model fit: likelihood-ratio p=0.413; pseudo R^2=0.048 (n=60).

3.5. Multivariable Logistic Regression Analysis

A multivariable logistic regression analysis was performed to identify the predictors of poor Apgar score (<7 at 5 minutes), as shown in (Tables 5a and 5b). The variables considered included maternal age, gestational age, parity, and whether the patient had taken complete or partial $MgSO_4$ regimen.

All the above mentioned variables failed to show a statistically significant independent predictor of adverse perinatal outcomes. There was no significant effect of maternal age on adverse perinatal outcomes (adjusted odds ratio [aOR] = 1.13, 95% CI: 0.69–1.86; $p = 0.615$). Similarly, parity showed no significant effect as well (aOR = 1.04, 95% CI: 0.60–1.83; $p = 0.879$). Moreover, women with partial regimen were no more likely to have adverse perinatal outcomes than those who took complete regimen (aOR = 1.21, 95% CI: 0.40–3.73; $p = 0.735$).

Gestational age demonstrated the strongest trend toward an association with adverse perinatal outcomes, although this association did not reach statistical significance (aOR=1.81, 95% CI: 0.94–3.46; p=0.075). Although gestational age approached statistical significance in the adjusted model (p=0.063–0.075), it did not meet the predefined threshold for statistical significance. Nevertheless, the observed trend suggests that gestational maturity may influence neonatal outcomes, which should be explored in larger prospective studies.

Table 5b. Predictors of Adverse Perinatal Outcomes (Stillbirth / Neonatal Death / IUD) Adjusted for All Listed Predictors

Predictor (per category increase)	aOR	95% CI	*p*
Maternal age group	1.07	0.64–1.78	0.805
Gestational age group	0.53	0.27–1.04	0.063
Parity (Gravida) group	1.54	0.85–2.76	0.152
Dose-completion (partial vs. full)	1.92	0.61–6.06	0.265

Model fit: likelihood-ratio p=0.093; pseudo R^2=0.097 (n=60). No predictor reached significance at α=0.05; gestational age showed a borderline association (p=0.063), with more advanced gestation associated with lower odds of adverse outcome.

3.6. Analysis Using Multivariable Logistic Regression Model

A multivariable logistic regression analysis was conducted to determine

independent risk factors for a poor neonatal Apgar score (less than 7 at 5 minutes), adjusting for maternal age, gestational age, parity, and completeness of the $MgSO_4$ treatment (Table 5b). None of the factors entered into the regression analysis were found to be statistically significant. Maternal age was not an independent risk factor for a poor neonatal Apgar score (adjusted odds ratio [aOR] = 1.07, 95% CI: 0.64-1.78; p = 0.805). Parity was also not found to be significantly related to a poor score (aOR = 1.54, 95% CI: 0.85-2.76; p = 0.152). A partial $MgSO_4$ regimen was associated with an increased risk of a poor neonatal Apgar score as compared to complete regimen (aOR = 1.92, 95% CI: 0.61-6.06); however, the association was not statistically significant (p = 0.265).

Gestational age showed a trend toward a protective association with adverse perinatal outcomes, with each increasing gestational age category associated with lower odds of adverse outcomes (aOR = 0.53, 95% CI: 0.27–1.04); however, this association did not reach statistical significance.

Contrary to the purely descriptive presentation in the original submission, formal inferential testing (bivariate and multivariable) found no statistically significant predictor of poor Apgar score or adverse perinatal outcome among maternal age, gestational age, parity, or $MgSO_4$ dose-completion status in this cohort (all p>0.05). Gestational age showed a consistent trend (bivariate p=0.051–0.100; adjusted p=0.063–0.075): more advanced gestational age at delivery was associated with a lower rate of adverse perinatal outcome (27.6% at 37–42 weeks vs. 53.3–62.5% at <37 weeks). Paradoxically, there was noted a higher rate of poor Apgar scores (72.4% vs. 43.8–46.7%) — a pattern that may reflect confounding by indication (e.g., more severe early-onset disease prompting earlier iatrogenic delivery) rather than a true dose-response effect. Given the sample size (N=60), the current study is likely underpowered to detect moderate effect sizes. Hence, the discussion should be revised to state that no statistically significant predictors were identified, rather than implying an association from descriptive percentages alone. Further, a larger, more adequately powered study is recommended.

The absence of statistically significant associations should not necessarily be interpreted as the absence of a true relationship. The relatively small sample size may have limited statistical power to detect moderate associations.

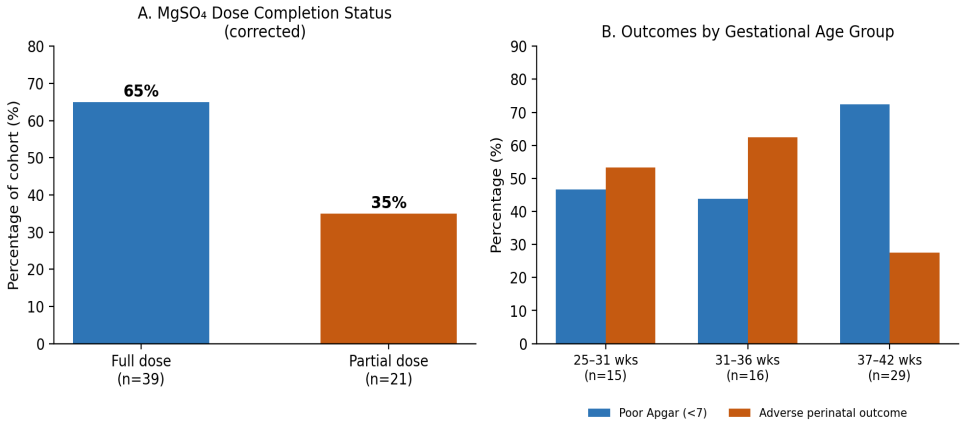

Figure 1. (A) $MgSO_4$ Dose Completion among Study Participants (n=60): 65.0% Received the Complete Regimen and 35.0% Received an Incomplete Regimen. (B) Poor Apgar Score (<7) and Adverse Perinatal Outcome Rates among Gestational-Age Groups; Gestational Age Showed the Strongest Trend toward Association with Adverse Outcomes (p=0.051)

4. DISCUSSION

The current study reviewed the maternal features, $MgSO_4$ treatment, and short-term outcomes for mothers and infants associated with pre-eclampsia and eclampsia in a tertiary care facility in Quetta, Pakistan. In this cohort, women with hypertensive disorders of pregnancy were predominantly of advanced maternal age, later gestational age, and higher gravidity. While the majority of the patients received the entire course of $MgSO_4$, there was a wide difference regarding the time of administration of maintenance doses. More than half of the babies had poor Apgar scores at 5 minutes and the rate of perinatal complications was high. Yet, no significant associations were seen between poor neonatal outcomes and maternal age, gestational age, parity, or $MgSO_4$ dosing.

Demographic characteristics of the study group showed that the highest percentage was made up of women aged 39-45 years, followed by those in the age group of 25-31 years. Also, almost half of the subjects were between the 37^{th} and 42^{nd} weeks of gestation and over half of the women had hypertensive disorders complicated by eclampsia. This is consistent with the findings reported by studies carried out in South Asian and Sub-Saharan African countries, where hypertensive disorders of pregnancy are common

in referral hospitals managing complicated pregnancy cases. Advanced maternal age has been associated with an increased risk of pre-eclampsia in previous studies [15]. On the other hand, young women are still at risk due to immunological maladaptation during their first pregnancy.

An interesting finding regarding gestational age was also observed. Around half of the women delivered at term, while nearly one-fourth delivered before 32 weeks of gestation. Severe cases of hypertension necessitate medically indicated preterm delivery due to increased risks for both mother and fetus, as a result of prolonged gestation. Early-onset pre-eclampsia has been previously shown to be associated with a greater degree of placental insufficiency and intrauterine growth restriction, as compared with late-onset pre-eclampsia in several multicentre studies. The higher proportion of term deliveries may reflect successful obstetric management or differences in disease severity among women included in this cohort.

$MgSO_4$ is still the internationally recommended first-line anticonvulsant therapy in both the prevention and management of eclampsia because of its superior efficacy, as compared with diazepam and phenytoin. In the present study, 65% of women completed the recommended $MgSO_4$ regimen. Similar completion rates have been reported from tertiary hospitals in Ethiopia and Nigeria, whereas lower adherence has been observed in facilities with limited staffing and monitoring resources [16].

The neonatal outcomes were still suboptimal. Over half of the neonates had a 5-minute Apgar score of < 7 and almost 43% had adverse perinatal outcomes. These results are similar to those found in other studies showing that fetal compromise during pregnancy with pre-eclampsia was primarily due to placental insufficiency, rather than exposure to anticonvulsive therapy. Abnormal placental vasculature causes chronic hypoxia in the fetus, impairs nutrient transport to the fetus, causes fetal growth restriction (FGR), and may necessitate preterm delivery. Previous studies have shown that the administration of $MgSO_4$ at the recommended therapeutic dose does not increase neonatal mortality or neurodevelopmental impairment [17].

The proportion of neonates with poor Apgar scores was higher among partially treated women (61.9% vs. 56.4%), as was the proportion with adverse perinatal outcomes (52.4% vs. 38.5%). Although these differences were clinically important, they were not statistically significant. These findings suggest that partial treatment was not significantly associated with

neonatal outcomes, especially in a relatively small sample, where many other maternal and fetal factors affect the prognosis. These findings are consistent with previous studies, in which maternal disease severity, timing of delivery, placental insufficiency, and fetal maturity had more impact on neonatal outcomes than anticonvulsant therapy.

Maternal age, gestational age, parity, timing of the maintenance dose, and completion of the $MgSO_4$ regimen were also not significantly associated with poor Apgar scores or adverse neonatal outcomes. Although gestational age approached statistical significance in the adjusted model ($p = 0.063–0.075$), it did not meet the predefined threshold for statistical significance. Nevertheless, the observed trend suggests that gestational maturity may influence neonatal outcomes, which should be explored in larger prospective studies.

Multivariable logistic regression analysis also did not identify maternal age, gestational age, parity, or completion of the $MgSO_4$ regimen as independent predictors of poor Apgar scores or adverse perinatal outcomes after adjustment for potential confounders. Although partial completion of the $MgSO_4$ regimen was associated with increased odds of poor neonatal outcomes, the confidence intervals were wide and included unity, indicating considerable uncertainty. Similarly, although gestational age showed borderline statistical significance, the findings suggest that fetal maturity may play an important role in neonatal outcomes. Overall, these findings indicate that neonatal outcomes in hypertensive disorders of pregnancy are influenced by multiple factors beyond maternal demographic characteristics and $MgSO_4$ administration.

4.1. Practical Implications

The present research has several practical implications. The study provides empirical evidence on maternal and neonatal outcomes following the use of $MgSO_4$ in a tertiary referral hospital in a developing province of Pakistan. The findings support the established safety of $MgSO_4$ while highlighting the substantial burden of neonatal complications associated with severe hypertensive disorders in pregnancy. Enhancing prenatal monitoring, ensuring timely referral of complicated pregnancies, optimizing maternal stabilization before delivery, and strengthening neonatal intensive care services may have a greater impact on neonatal outcomes than $MgSO_4$ administration alone.

4.2. Clinical Implications

The findings of this study have important implications for obstetric practice in healthcare facilities with limited resources. Though international guidelines emphasize the importance of standardized $MgSO_4$ therapy for women with severe pre-eclampsia and eclampsia, it is clear that gaps remain in the implementation of these treatment protocols. Addressing these gaps requires several practical measures. Firstly, standardized treatment checklists outlining the recommended loading dose, maintenance doses, dosing intervals, and treatment completion should be incorporated into patients' medical records. Secondly, competency-based training and regular refresher courses on WHO recommendations and the recognition of magnesium toxicity should be provided for obstetricians, residents, nurses, and midwives. Thirdly, maternity units should be equipped with adequate monitoring equipment, including blood pressure monitors, pulse oximeters, urine output measurement devices, and facilities for assessing deep tendon reflexes.

4.3. Strengths of the Study

The current study contributes to the limited body of evidence on $MgSO_4$ administration practices and their effects on maternal and neonatal outcomes in Balochistan, Pakistan. As the study included patients from a major tertiary referral hospital, it allowed the evaluation of real-world $MgSO_4$ administration practices outside the controlled setting of a clinical trial. In addition, treatment adherence and neonatal outcomes were evaluated concurrently.

4.4. Limitations of the Study

A number of limitations must be noted while analyzing the findings of the current study. Firstly, the retrospective observational design relied on routinely collected medical records, increasing the possibility of incomplete data and information bias. Secondly, the study was conducted in a single tertiary referral hospital, limiting the generalizability of the findings to other hospitals in Pakistan. Thirdly, the relatively small sample size limited the ability to perform more robust statistical analyses and make comparisons among different subgroups. Fourthly, the absence of a comparison group made it impossible to compare outcomes between women who received the complete $MgSO_4$ regimen and those who received partial therapy or alternative interventions. Finally, although bivariate and multivariable

analyses were performed, the observational retrospective design prevents establishing causal relationships between $MgSO_4$ administration patterns and maternal or neonatal outcomes.

4.5. Conclusion

In this study, women with pre-eclampsia and eclampsia treated with $MgSO_4$ generally experienced satisfactory maternal outcomes; however, adverse neonatal outcomes remained relatively common. Variations in $MgSO_4$ administration practices were observed; nevertheless, maternal age, gestational age, parity, and dose-completion status were not independently associated with poor Apgar scores or adverse perinatal outcomes after adjustment for potential confounders. The findings suggest that neonatal outcomes are influenced by multiple clinical factors beyond $MgSO_4$ administration alone. This study provides additional evidence regarding the management and outcomes of hypertensive disorders during pregnancy in a tertiary care hospital in Pakistan. Further prospective multicenter studies with larger sample sizes are required to identify factors and associations that may not have been detected in the current study due to its limited statistical power.

Author Contribution

Safia Umar: writing – original draft. **Najma Ghaffar:** writing – review & editing. **Mir Abdul Qadir:** resources. **Faisal Islam:** data curation. **Saquib Jalil:** formal analysis, writing – review & editing. **Raffia Arshad:** validation, visualization.

Conflicts of Interest

The authors of the manuscript have no financial or non-financial conflict of interest in the subject matter or materials discussed in this manuscript.

Data Availability Statement

Data supporting the findings of this study will be made available by the corresponding author upon request.

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REFERENCES

1. Sadiqi H, Amiri GM, Rezaee Q, Ahmadzada M, Jamalzada GH. The global impact of preeclampsia on maternal mortality: A comparative analysis of healthcare accessibility and outcomes in low- and middle-

income countries comparing high-income countries. *Kateb Journal of Medical Science & Biotechnology.* 2026;2(2):33–47. https://doi.org/10.66943/kjmsb.v2i2.66

2. Okikiade A, Kanu C, Iyapo O, et al. Revised pathophysiology of pregnancy-induced hypertension (pre-eclampsia): A multisystemic spectrum of the maternal complications. *International Journal of Research and Reports in Gynaecology.* 2025;8(1):176–195. https://doi.org/10.9734/ijrrgy/2025/v8i1129
3. Lakshmanan K, Liu BM. Impact of point-of-care testing on diagnosis, treatment, and surveillance of vaccine-preventable viral infections. *Diagnostics (Basel).* 2025;15(2):123. https://doi.org/10.3390/diagnostics15020123
4. Khan ZL, Balie GM, Chauke L. Hypertensive disorders of pregnancy deaths: A four-year review at a tertiary/quaternary academic hospital. *Int J Environ Res Public Health.* 2025;22(7):978. https://doi.org/10.3390/ijerph22070978
5. Sibai BM. The Magpie Trial. *Lancet.* 2002;360(9342):1329. https://doi.org/10.1016/S0140-6736(02)11321-3
6. da Silva Gama ZA, Medeiros WR, Saturno-Hernández PJ, et al. The WHO Safe Childbirth Checklist implementation: Impact on the prescription of magnesium sulphate through a one-year longitudinal study. *BMC Pregnancy Childbirth.* 2020;20:154. https://doi.org/10.1186/s12884-020-2836-z
7. Pauli JM, Repke JT. Pitfalls with the new American College of Obstetricians and Gynecologists Task Force on Hypertension in Pregnancy. *Clin Obstet Gynecol.* 2017;60(1):141–152. https://doi.org/10.1097/GRF.0000000000000247
8. Wanjari M, Late S, Umate S, et al. Role of magnesium sulfate in pregnancy: A comprehensive review of benefits and risks. *Multidiscip Rev.* 2024;7(11):2024094. https://doi.org/10.31893/multirev.2024094
9. Zhang Y, Hillman S, Pereira M, Anderson K, Cross RM. Preliminary findings on psychometric properties of the adolescent story stem profile. *Front Psychol.* 2025;16:1478372. https://doi.org/10.3389/fpsyg.2025.1478372

10. Marín R, Abad CL, Rojas D, Fernández M, Ruette F. Magnesium sulfate in oxidative stress-associated pathologies: Clinical, cellular, and molecular perspectives. *Biophys Rev.* 2025;17(2):511–535. https://doi.org/10.1007/s12551-025-01292-z

11. ALhrare H, Bellael M, Ben Taher M. Effect of magnesium sulfate on intraoperative hemodynamics, anesthetic consumption, and postoperative pain in elective laparoscopic cholecystectomy. *AlQalam J Med Appl Sci.* 2025;8(2):846–851. https://doi.org/10.54361/ajmas.258244

12. Pithara-McKeown C, Stone T, Treloar E, et al. Lessons from using the Normalisation Process Theory to understand adherence to guidance on $MgSO_4$ in preterm labour. *Implement Sci Commun.* 2025;6:75. https://doi.org/10.1186/s43058-025-00758-1

13. Gessesse AD, Belete MB, Tadesse F. Time, cause of early neonatal death, and its predictors among neonates admitted to neonatal intensive care units at Bahir Dar City public hospitals, northwest Ethiopia: A prospective follow-up study. *Front Pediatr.* 2024;12:1335858. https://doi.org/10.3389/fped.2024.1335858

14. Cunningham FG, Nelson DB. Magnesium sulfate for the prevention of seizures in preeclampsia: Origin, experimental basis, clinical studies, and the evolution in obstetrical practice. *Am J Obstet Gynecol.* 2026;234(5):1277–1285. https://doi.org/10.1016/j.ajog.2025.09.045.

15. Haavaldsen C, Thomas O, Eskild A. Risk of pre-eclampsia according to gestational age across three decades: Population-based study. *Ultrasound Obstet Gynecol.* 2026;67(2):155–161. https://doi.org/10.1002/uog.70160.

16. Tegegne GA, Rade BK, Yismaw AE, Taye W, Mengistie BA. Predictors of successful trial of labor after cesarean section (TOLAC) in women with one prior transverse cesarean section at tertiary hospitals in northwest Ethiopia: A multicenter study. *BMC Pregnancy Childbirth.* 2024;24:240. https://doi.org/10.1186/s12884-024-06432-z.

17. Wixey JA, White TA, Piscopo BR, Chand KK, Colditz PB, Miller SL. The effects of therapeutic drugs on brain development in infants with fetal growth restriction. *J Physiol.* Published online January 28, 2026. https://doi.org/10.1113/JP289645.