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ORIGINAL ARTICLE *Volume 14 (Issue 4), 2025*

PAKISTAN JOURNAL OF MEDICINE & DENTISTRY

Efficacy of Sofosbuvir and Velpatasvir in Achieving Sustained Virological Response in Patients with End- Stage Renal Disease Infected with Hepatitis C Virus

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ABSTRACT

Background: Eclampsia is a major contributor to maternal morbidity and mortality, and although magnesium sulphate ($MgSO_4$) is the standard for seizure prophylaxis, its potential link to postpartum haemorrhage (PPH) remains a concern. This study aimed to determine the frequency of primary PPH in eclamptic women receiving $MgSO_4$ and to assess its association with maternal characteristics, labour variables, and outcomes.

Methods: A cross-sectional study was conducted on 83 women diagnosed with eclampsia at the Khyber Teaching Hospital, Peshawar from June to November 2024. The sample size (n=83) was calculated using the WHO sample size calculator. A consecutive non-probability sampling technique was applied to recruit patients. Demographic, clinical, and labor-related data were recorded, and PPH was defined according to WHO criteria. Associations between PPH and study variables were analyzed in SPSS using chi-square tests with Cramer's V for strength of association.

Results: Primary PPH occurred in 25.3% of women, predominantly due to uterine atony (61.9%) within the first hour after delivery. Strong associations were found between PPH occurrence and both its type and onset (Cramer's V = 1.000, $p < 0.001$). PPH was significantly associated with blood transfusion requirements (Cramer's V = 0.706, $p < 0.001$), but not with age, parity, gestational age, severity of eclampsia, blood pressure, proteinuria, or delivery mode. No maternal deaths or ICU admissions were attributed to PPH.

Conclusion: PPH was mainly atonic and early onset, often requiring transfusion, while $MgSO_4$ did not raise PPH risk; strengthening third-stage management and preparedness may reduce morbidity.

Keywords: Eclampsia, Magnesium sulphate, Postpartum haemorrhage, Uterine atony, Pregnancy Outcome, Blood transfusion.

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How to cite: Pervez FS, Mazhar T, Bibi N, Babar KA, Mohit F, Bibi H. The Frequency of Primary Post-Partum Haemorrhage in Patients with Eclampsia Receiving Injection Magnesium Sulphate during Labour: A Cross-Sectional Study. Pak J Med Dent. 2025 September ;14(4): A-B. Doi: https://doi.org/10.36283/ziun-pjmd14-4/087.

Received: Thu, August 14, 2025 **Accepted:** Sun, September 28, 2025**. Published:** Mon, September 29, 2025

INTRODUCTION

Hypertensive disorders of pregnancy, particularly preeclampsia and eclampsia, are major contributors to maternal morbidity and mortality worldwide[1]. The World Health Organization (WHO) estimates that these conditions account for approximately 14% of global maternal deaths, with the burden disproportionately higher in low-resource settings [2]. Magnesium sulphate ($MgSO_4$) remains the gold standard for seizure prophylaxis in women with eclampsia, significantly reducing recurrent seizures and maternal mortality [3].

Despite its proven benefits, concerns have been raised about a potential association between $MgSO_4$ and postpartum haemorrhage (PPH) due to its smooth muscle relaxant properties, which could theoretically impair uterine contractility [4]. PPH is the leading cause of maternal death globally, responsible for over 27% of maternal deaths in low-income countries [5]. Studies from high-income countries have shown conflicting results—while some found no significant association between $MgSO_4$ and PPH [6], others reported increased risk in vaginal deliveries [7]. In South Asian settings, including Pakistan, the situation is compounded by delays in PPH recognition, suboptimal referral pathways, and limited access to blood transfusion services [8, 9].

In Pakistan, maternal mortality remains unacceptably high, estimated at 186 deaths per 100,000 live births (Pakistan Demographic and Health Survey, 2019) [10]. Hypertensive disorders and haemorrhage together account for a significant proportion of these deaths. While $MgSO_4$ use is now standard in tertiary centres, there is limited local evidence on its relationship with PPH in eclamptic women.

Given these gaps, this study was conducted to determine the frequency, timing, and causes of primary PPH in women with eclampsia receiving $MgSO_4$ and to assess its association with demographic, clinical, and obstetric variables. Findings from this work aim to guide clinicians in balancing seizure prophylaxis with haemorrhage prevention strategies in high-risk obstetric populations.

Methodology

This was a cross-sectional study conducted to determine the frequency of primary postpartum haemorrhage (PPH) among patients with eclampsia receiving magnesium sulphate during labour. The study design was chosen to allow assessment of both the prevalence and associated maternal outcomes within a defined period. The study protocol was reviewed and approved by the Institutional Research and Ethical Review Board (IREB) of Khyber Medical College/Khyber Teaching Hospital, Peshawar under reference number 430/DME/KMC, dated 30 May 2024. All procedures adhered to the ethical standards of the institutional research committee and complied with the Declaration of Helsinki (2013 revision).

Additionally, the research synopsis was reviewed and approved by the Research Evaluation Unit (REU) of the College of Physicians and Surgeons Pakistan (CPSP) under reference number CPSP/REUOBG-2022-020-11429, dated 25 December 2024.

Patient confidentiality was maintained throughout the study, with all data anonymized before analysis. As the study involved a review of medical records without direct patient interaction, the requirement for written informed consent was formally waived by the ethics committees.

The research was carried out in the Department of Obstetrics and Gynaecology at Khyber Teaching Hospital (KTH), Peshawar, a tertiary care facility that manages high-risk obstetric cases. Data collection was performed over a six-month period from June 2024 to November 2024.

The sample size was calculated using the World Health Organization (WHO) sample size calculator. The calculation was based on a previously reported prevalence of primary PPH in eclamptic patients of 20%, with a 95% confidence level and a margin of error of 7%. The formula used was Where: n = (Z^2 × p × (1 − p)) / d^2. Z=1.96Z = 1.96 (standard normal deviate at 95% CI), p=0.20p = 0.20 (expected prevalence), d=0.07d = 0.07 (precision) and The calculated sample size was 83 patients.

The study population comprised all women admitted with a confirmed diagnosis of eclampsia and receiving magnesium sulphate during labour.

Inclusion Criteria were women diagnosed with eclampsia based on clinical presentation and blood pressure criteria. Patients receiving magnesium sulphate therapy as per hospital protocol. And women delivering within the study period at KTH.

Exclusion Criteria were patients with antepartum hemorrhage. Women with known bleeding disorders or thrombocytopenia unrelated to eclampsia. Patients referred after delivery from other hospitals. And incomplete medical records.

A consecutive non-probability sampling method was used, whereby all eligible patients meeting the inclusion criteria during the study period were enrolled until the sample size was achieved.

A structured proforma was developed to record demographic data, obstetric history, details of magnesium sulphate administration, mode of delivery, and occurrence of PPH. The form also documented associated maternal outcomes, including blood transfusion, surgical intervention, ICU admission, and maternal mortality.

Primary Postpartum Haemorrhage (PPH): Blood loss of ≥500 mL within 24 hours after vaginal delivery or ≥1000 mL after cesarean section, or any blood loss sufficient to cause hemodynamic instability. And Eclampsia: New-onset seizures in a woman with preeclampsia not attributable to other causes.

Eligible patients were identified upon admission. After stabilization, the attending obstetric team recorded the required clinical and demographic details. The diagnosis of PPH was made clinically and confirmed by the attending consultant. Where applicable, blood transfusion and surgical interventions were documented from patient charts.

Content validity of the proforma was established through expert review by two senior obstetricians. Data reliability was ensured by cross-checking medical records against operative notes and nursing charts. And ambiguities in data were resolved through discussion with the attending consultant.

Data were entered and analysed using SPSS version 26.0. Quantitative variables such as age were expressed as mean ± standard deviation. Categorical variables, including PPH occurrence and maternal outcomes, were presented as frequencies and percentages. Associations between PPH and maternal outcomes were assessed using the Chi-square test or Fisher's Exact test where appropriate. A p-value of <0.05 was considered statistically significant. Effect sizes were reported using Cramer's V for categorical associations.

RESULTS

Demographic characteristics of women with eclampsia and their association with primary postpartum haemorrhage are shown in **Table 1**. The majority of participants were aged 20–29 years (55.4%), multiparous (68.7%), and delivered at term (73.5%). Educational levels were generally low, with 33.7% illiterate and 39.8% having only primary education. Primary postpartum haemorrhage occurred in 25.3% of women. Chi-square tests showed no significant association between PPH occurrence and age group ($\chi^2 = 2.075$, df = 4, p = 0.722), parity ($\chi^2 = 0.053$, df = 1, p = 0.818), gestational age ($\chi^2 = 4.239$, df = 2, p = 0.120), or educational status ($\chi^2 = 0.255$, df = 2, p = 0.880).

Table 1: Demographic Characteristics of Women with Eclampsia and Their Association with Primary Postpartum Haemorrhage (n = 83)

Variable	Category	n	%	PPH Yes n (%)	PPH No n (%)	χ^2	df	p-value
Age group (years)	<20	11	13.3	4 (36.4)	7 (63.6)	2.075	4	0.722
	20–24	27	32.5	5 (18.5)	22 (81.5)			
	25–29	19	22.9	6 (31.6)	13 (68.4)			
	30–34	15	18.1	4 (26.7)	11 (73.3)			
	≥35	11	13.3	2 (18.2)	9 (81.8)			
Parity	Primiparous	26	31.3	7 (26.9)	19 (73.1)	0.053	1	0.818
	Multiparous	57	68.7	14 (24.6)	43 (75.4)			
Gestational age	Preterm	14	16.9	1 (7.1)	13 (92.9)	4.239	2	0.120
	Term	61	73.5	19 (31.1)	42 (68.9)			

	Post-term	8	9.6	1 (12.5)	7 (87.5)			
Educational status	Illiterate	28	33.7	8 (28.6)	20 (71.4)	0.255	2	0.880
	Primary	33	39.8	8 (24.2)	25 (75.8)			
	Secondary+	22	26.5	5 (22.7)	17 (77.3)			

Table 2 shows the clinical characteristics of women with eclampsia and their association with primary postpartum haemorrhage. Most women (69.9%) presented with severe eclampsia, and 77.1% had systolic BP ≥160 mmHg on admission. Two-thirds (67.5%) had diastolic BP ≥110 mmHg. Proteinuria of 2+ or higher was seen in 80.7% of cases. Almost all participants (97.6%) received the standard magnesium sulphate regimen. Although a higher proportion of PPH was observed in women with severe eclampsia, high systolic/diastolic BP, and greater proteinuria, none of these associations reached statistical significance (all $p > 0.05$).

Table 2: Clinical Characteristics of Women with Eclampsia and Their Association with Primary Postpartum Haemorrhage (n = 83)

Variable	Category	n	%	PPH Yes n (%)	PPH No n (%)	χ^2	df	p-value
Severity of eclampsia	Mild	25	30.1	4 (16.0)	21 (84.0)	1.638	1	0.201
	Severe	58	69.9	17 (29.3)	41 (70.7)			
Systolic BP (mmHg)	<160	19	22.9	2 (10.5)	17 (89.5)	2.846	1	0.092
	≥160	64	77.1	19 (29.7)	45 (70.3)			
Diastolic BP (mmHg)	<110	27	32.5	9 (33.3)	18 (66.7)	1.366	1	0.242
	≥110	56	67.5	12 (21.4)	44 (78.6)			
Proteinuria	1+	16	19.3	2 (12.5)	14 (87.5)	1.732	2	0.421
	2+	36	43.4	10 (27.8)	26 (72.2)			
	3+	31	37.3	9 (29.0)	22 (71.0)			
$MgSO_4$ regimen	Modified	2	2.4	0 (0.0)	2 (100.0)	0.694	1	0.405
	Standard	81	97.6	21 (25.9)	60 (74.1)			

Labour and delivery characteristics and their association with primary postpartum haemorrhage are shown in **Table 3**. More than half of the participants (54.2%) had spontaneous labour onset, and the majority delivered vaginally (77.1%). Almost all women (91.6%) received uterotonics, and active management of the third stage was performed in 80.7% of cases. Although PPH was slightly more common in spontaneous labour and vaginal delivery, no statistically significant associations were found between PPH occurrence and any labour or delivery variable (all $p > 0.05$).

Table 3: Labour and Delivery Characteristics and Their Association with Primary Postpartum Haemorrhage (n = 83).

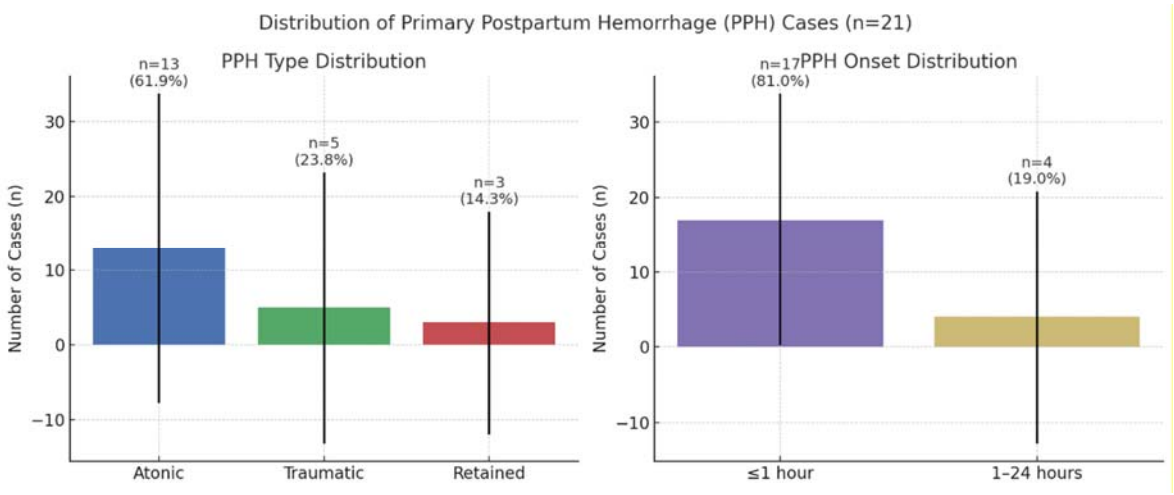
Variable	Category	n	%	PPH Yes n (%)	PPH No n (%)	χ^2	df	p-value
Labour onset	Induced	38	45.8	8 (21.1)	30 (78.9)	0.669	1	0.413
	Spontaneous	45	54.2	13 (28.9)	32 (71.1)			
Mode of delivery	Assisted	5	6.0	0 (0.0)	5 (100.0)	3.244	2	0.198
	Cesarean	14	16.9	2 (14.3)	12 (85.7)			
	Vaginal	64	77.1	19 (29.7)	45 (70.3)			
Uterotonic use	No	7	8.4	1 (14.3)	6 (85.7)	0.491	1	0.484
	Yes	76	91.6	20 (26.3)	56 (73.7)			
Third stage management	Active	67	80.7	18 (26.9)	49 (73.1)	0.450	1	0.502
	Expectant	16	19.3	3 (18.8)	13 (81.3)			

Table 4 shows that among the 83 women studied, 25.3% experienced primary postpartum haemorrhage, most commonly due to atonic uterus (61.9% of PPH cases), followed by traumatic causes (23.8%) and retained products (14.3%). The majority (81.0%) of PPH cases occurred within one hour of delivery.

Table 4: Frequency and Type of Primary Postpartum Haemorrhage (PPH) and Time of Onset (n = 83)

Variable	Category	n	%	PPH Yes n (%)	PPH No n (%)

PPH type	Atonic	13	15.7	13 (100.0)	0 (0.0)
	Traumatic	5	6.0	5 (100.0)	0 (0.0)
	Retained	3	3.6	3 (100.0)	0 (0.0)
	No PPH	62	74.7	0 (0.0)	62 (100.0)
PPH onset	≤1 hour	17	20.5	17 (100.0)	0 (0.0)
	1–24 hours	4	4.8	4 (100.0)	0 (0.0)
	No PPH	62	74.7	0 (0.0)	62 (100.0)



A strong association was found between PPH occurrence and blood transfusion requirement (Cramer's V = 0.706, p < 0.001), with over half of the women experiencing PPH requiring transfusion (**Table 5**). Surgical intervention was more frequent in the PPH group, but this difference did not reach statistical significance (p = 0.084). ICU admission and maternal mortality rates were identical across both groups, precluding statistical testing.

Table 5. Association Between Maternal Outcomes and PPH Occurrence (n = 83)

Outcome	Category	No PPH n (%)	PPH n (%)	χ^2	df	p-value	Cramer's V
Blood transfusion	Yes	0 (0.0)	12 (57.1)	41.42	1	<0.001	0.706
	No	62 (100.0)	9 (42.9)				

Surgical intervention	Yes	0 (0.0)	1 (4.8)	2.99	1	0.084	0.190
	No	62 (100.0)	20 (95.2)				
ICU admission	Yes	0 (0.0)	0 (0.0)	—	—	—	—
	No	62 (100.0)	21 (100.0)				
Maternal mortality	Yes	0 (0.0)	0 (0.0)	—	—	—	—
	No	62 (100.0)	21 (100.0)				

ICU admission and maternal mortality variables showed no variation between groups; chi-square statistics could not be computed.

The visual representation (**Figure 1**) clearly demonstrates a marked disparity in blood transfusion requirement between the PPH and No PPH groups, highlighting a strong association (Cramer's V = 0.706, $p < 0.001$). While surgical interventions were more common in the PPH group, the difference did not reach statistical significance ($p = 0.084$). The absence of variation in ICU admission and maternal mortality underscores that these outcomes were not influenced by PPH occurrence in this cohort. The graph (Figure 1) illustrates the percentage of women experiencing each maternal outcome in the PPH and No PPH groups. Blood transfusion was required in 57.1% of women with PPH compared to none in the No PPH group. Surgical intervention was needed in 4.8% of PPH cases and in none without PPH. ICU admission and maternal mortality rates were identical in both groups (0%).

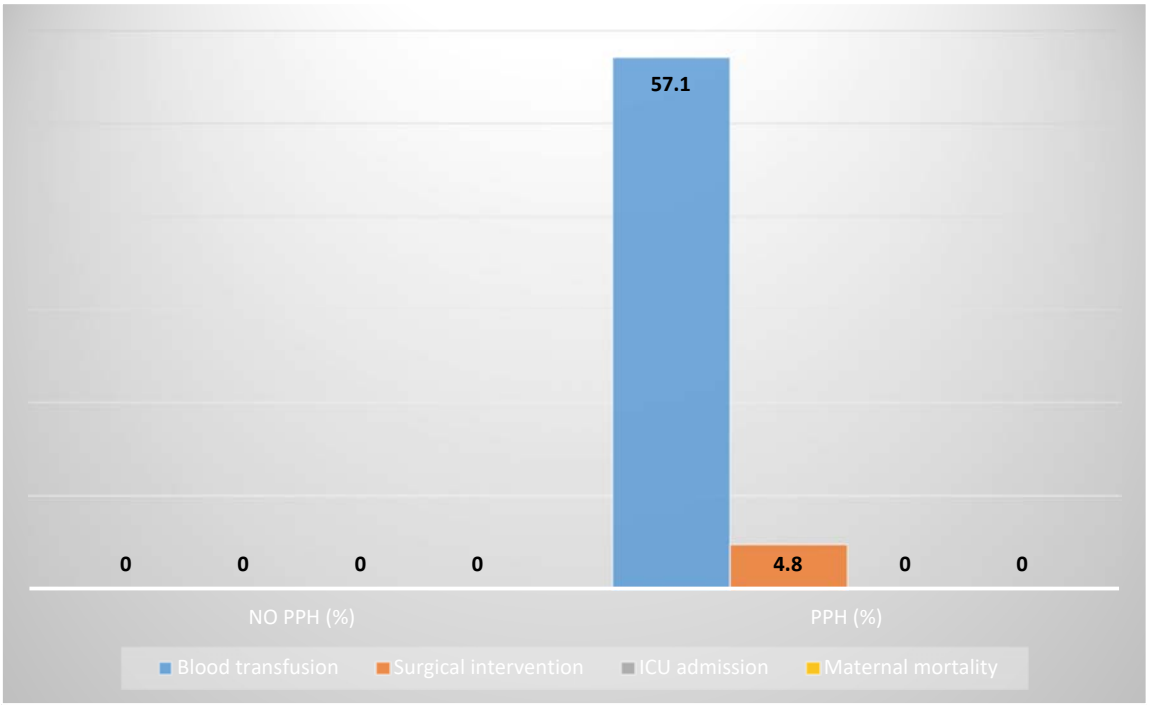


Figure 1: Comparison of maternal outcomes between women with and without primary postpartum haemorrhage (PPH).

DISCUSSION

In this cross-sectional series of women with eclampsia treated with magnesium sulphate ($MgSO_4$), primary postpartum haemorrhage (PPH) occurred in 25.3%, most often from uterine atony and typically within the first hour after delivery. The strong link between PPH and blood transfusion in our cohort is expected given the acuity of atonic bleeding.

Our results fit well with several reports showing no material increase in PPH or uterine atony with $MgSO_4$. One study found that $MgSO_4$ in mild preeclampsia did not increase obstetric haemorrhage or other adverse maternal outcomes, supporting our observation that PPH risk is driven more by underlying disease than by the anticonvulsant itself [11]. Another report similarly reported no excess PPH among women given $MgSO_4$, despite longer labours in some patient [12]. A pooled analysis of >11,000 participants and estimated a pooled relative risk of 0.964 (95% CI 0.886–1.050) again, no significant increase in PPH with $MgSO_4$ [13]. Meta-analytic data concluded that the risk of postpartum uterine atony is similar in women receiving $MgSO_4$ versus not receiving it, although heterogeneity warrants caution this was consistent with our finding that $MgSO_4$ exposure per se was not the dominant driver of bleeding[4].

By contrast, some contemporary observational work suggests higher PPH odds with intrapartum $MgSO_4$. A previous study reported greater PPH frequency among women who received $MgSO_4$ for hypertensive disorders compared with those who did not (12.4% vs 9.3%), even after adjustment; their group had more nulliparity and inductions, factors that can independently raise PPH risk [14]. Earlier meeting data from the same group also linked $MgSO_4$ with increased odds of atony and transfusion [15]. Importantly, other recent analyses nuance this signal and found no difference in PPH when comparing continuous vs interrupted intrapartum $MgSO_4$ infusions, implying that delivery factors and comorbidity mix may explain much of the observed variation rather than $MgSO_4$ itself [16].

Additional supporting evidence strengthens these interpretations. Hypertensive disorders independently elevate PPH risk, regardless of $MgSO_4$ exposure, and their abstract emphasized that "PPH risk is strongly associated with severity of hypertensive disease and baseline anemia" [17]. A study highlighted that prolonged labour and induction protocols are stronger determinants of atony than $MgSO_4$, and concluded that labour induction and augmentation are among the principal

contributors to PPH in high-risk pregnancies [18]. A Cochrane review reaffirmed that $MgSO_4$ reduces eclampsia risk by more than half, with no significant maternal bleeding trade-off, stating that "magnesium sulphate halves the risk of eclampsia and has little effect on postpartum hemorrhage"[19]. Similarly, another study demonstrated that $MgSO_4$ does not significantly alter coagulation parameters, noting that "no clinically relevant differences in clotting profiles were observed between exposed and unexposed groups" [20]. Large database analyses also confirmed no independent association between $MgSO_4$ and severe maternal morbidity including haemorrhage [21]. Studies emphasized that case-mix and management practices, rather than $MgSO_4$ exposure itself, largely explain variation in reported PPH outcomes, concluding that variation in PPH risk is better explained by clinical management and patient characteristics than by magnesium sulphate therapy [21, 22].

Two points from the broader literature support a balanced interpretation. First, hypertensive disorders themselves are recognized risk factors for PPH, particularly when coupled with anemia or induction features common in eclampsia pathways [23]. Second, $MgSO_4$ remains high-value therapy: pooled trials show >50% reduction in eclampsia with treatment, and modern reviews find no clinically important trade-off in maternal mortality [24]. Thus, our data showing atony-dominant, early PPH but no clear $MgSO_4$-specific signal sit comfortably with meta-analytic conclusions while acknowledging that case-mix (parity, induction, oxytocin exposure) can tilt bleeding risk in either direction [25].

Finally, management implications in settings like ours are practical: early active management of the third stage, rapid availability of blood products, and readiness for second-line measures (e.g., balloon tamponade) are central where atony predominates. Contemporary reviews affirm high success rates and safety of uterine balloon tamponade as part of a stepwise protocol [26]. Emerging evidence on postpartum duration of $MgSO_4$ also suggests that early discontinuation (vs routine 24 h) does not raise postpartum eclampsia risk offering a potential path to reduce sedation and facilitate early mobilization without compromising safety.

Our cohort demonstrated a pattern of early-onset, predominantly atonic PPH, frequently necessitating blood transfusion, with no observed differences in ICU admission or maternal mortality. This profile is consistent with the pathophysiological mechanisms of eclampsia-related haemorrhage and supports the prevailing evidence that magnesium sulphate does not serve as an independent precipitating factor for PPH when evidence-based prophylactic measures such as active management of the third stage of labour were appropriately implemented [26].

This single-center, cross-sectional study cannot determine causality; the sample size (n=83) limits power for smaller effects. Chart-based data introduce documentation bias, and unmeasured

confounders (oxytocin dose, anesthesia type, provider factors) may remain. Future work should include prospective, multicenter cohorts with standardized $MgSO_4$ protocols, granular documentation of induction/oxytocin exposure, and predefined PPH management bundles. Randomized or pragmatic trials addressing postpartum $MgSO_4$ duration and PPH prevention strategies in hypertensive disorders would help reconcile remaining discrepancies in the literature.

CONCLUSION

Among women with eclampsia treated with $MgSO_4$, primary PPH affected one in four, most often due to atony within the first hour. The need for transfusion was substantially higher among those with PPH, yet ICU utilization and mortality did not differ. Taken together with published data, these findings support continued routine use of $MgSO_4$ for seizure prophylaxis, while emphasizing meticulous third-stage management and prompt treatment of atony.

LIST OF ABBREVIATIONS

None

ACKNOWLEDGEMENTS

The authors gratefully acknowledge the support of the Department of Obstetrics and Gynaecology, Khyber Teaching Hospital, Peshawar, for facilitating data collection.

CONFLICT OF INTEREST

None

ETHICS APPROVAL

The study was approved by the Institutional Research and Ethical Review Board (IREB) of Khyber Medical College/Khyber Teaching Hospital, Peshawar (Ref: 430/DME/KMC, dated 30 May 2024), and by the Research Evaluation Unit of the College of Physicians and Surgeons Pakistan (Ref: CPSP/REUOBG-2022-020-11429, dated 25 December 2024). All procedures followed institutional and international ethical guidelines (Declaration of Helsinki, 2013 revision).

FUNDING

No specific funding was received for this study.

AUTHORS' CONTRIBUTIONS

TM, FSP, NB, HB, KAB, and **FM** contributed to the conceptualization, study design, data collection, and drafting of the manuscript. **FSP, NB**, and **HB** were responsible for data analysis, interpretation, and critical revision, while **KAB** and **FM** provided support with the literature review, methodology, and manuscript editing. All authors read and approved the final version of the manuscript.

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 ISSN (Print): 2313-7371 ISSN (Online): 2308-2593

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