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Role of Magnesium Sulphate as Tocolysis in Preterm Labour

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ABSTRACT

Background: Preterm labour is a major cause of neonatal morbidity and mortality worldwide. Magnesium sulphate is commonly used as a tocolytic agent due to its ability to reduce uterine contractions and provide fetal neuroprotection. **Objective:** To assess the role of magnesium sulphate as a tocolytic in preterm labour, focusing on its effectiveness in reducing uterine contractions and delaying delivery beyond 48 hours. **Methodology:** This descriptive study was conducted at the Obstetrics and Gynecology Department, Shaikh Zaid Women Hospital, Larkana, enrolling 100 females aged 18–40 years with parity ≤5 and gestational age >28 weeks presenting with preterm labour. Participants received a loading dose of 4 grams of magnesium sulphate intravenously, followed by a maintenance infusion of 1.0–2.0 grams per hour, titrated according to uterine activity. **Results:** The mean age of participants was 28.6 ± 5.1 years, with a mean gestational age of 31.2 ± 1.9 weeks. Reduction in uterine contractions was observed in 67% of patients, while 62% achieved a delay in delivery beyond 48 hours. Stratification showed a statistically significant association between BMI and reduction in uterine contractions ($p = 0.04$), whereas no significant association was observed with other variables. **Conclusion:** Magnesium sulphate effectively reduces uterine contractions and delays delivery beyond 48 hours in a significant proportion of patients with preterm labour. Its role as both a tocolytic and a fetal neuroprotective agent supports its continued use in clinical practice, especially in settings with limited resources.

INTRODUCTION

Preterm birth is a condition that occurs in 6.0–15% of all deliveries and is the most frequent cause of fetal and neonatal death and morbidity. The incidence of preterm births ranges between 10 and 15% and 75% of all perinatal deaths occur in preterm infants [1]. Even short-term postponement of birth when labour begins early (before 37 weeks) can help improve outcomes for babies, as the woman can take corticosteroid drugs to help develop the baby's lungs in a short time. Magnesium sulphate is one of the drugs that has been used to try to stop the uterus contracting in women who go into labour too soon [2]. A wide range of tocolytics is used to suppress uterine contractions [3]. Magnesium sulfate is used in many centers. Tocolysis is not recommended before 24 weeks of gestation but may be considered based on individual circumstances at 23 weeks [4]. However, few trials found that magnesium sulphate is ineffective at delaying birth or preventing preterm birth, and its use is associated with an increased mortality for the infant [5,6]. It is possible that the prophylactic administration of much lower dosages of magnesium sulphate, in selected cases of preterm labour, may have a neuroprotective effect for a small number of infants [7]. Kawagoe et al. conducted a trial and found that administration of magnesium sulphate causes a delay of 48 hours in labor and delivery in 86% cases (14% delivered before 48 hours), and in 50% females' uterine contractions were reduced [8]. Magnesium sulphate acts at the cellular level as a physiological calcium antagonist, inhibiting myometrial contractility by competing with calcium ions at voltage-gated channels and modulating cellular calcium influx. It also influences prostaglandin synthesis and smooth muscle tone regulation. These mechanisms contribute to its capacity to reduce uterine contractions and delay delivery temporarily. Clinically, magnesium sulphate is usually administered intravenously in a loading dose followed by a continuous infusion, with dosing protocols adjusted according to local guidelines and patient tolerability [9].

In addition to its tocolytic properties, magnesium sulphate has garnered strong evidence for its neuroprotective effects in preterm neonates. Multiple randomized controlled trials, including large-scale studies such as the Magnesium Sulphate for Prevention of Cerebral Palsy (MAGPIE) trial, have demonstrated that administration of magnesium sulphate before early preterm birth is associated with a significant reduction in the risk of cerebral palsy [10]. This dual benefit, combining uterine relaxation with fetal neuroprotection, makes magnesium

sulphate unique among tocolytic agents and justifies its inclusion in several international obstetric guidelines, including those from the World Health Organization (WHO) and the American College of Obstetricians and Gynecologists (ACOG). However, the clinical use of magnesium sulphate is not without limitations. Its efficacy as a tocolytic is generally regarded as modest; most studies suggest that while it can delay delivery by 48 hours to 7 days, it is unlikely to prevent preterm birth entirely [11]. Furthermore, maternal side effects such as nausea, flushing, hypotension, muscle weakness, and respiratory depression require vigilant monitoring. Severe toxicity can occur if serum magnesium levels rise excessively, necessitating careful dosing and monitoring protocols [12]. Fetal side effects may include transient hypotonia and respiratory depression, although these effects are usually self-limiting. Controversy also exists regarding the optimal dosing regimen and duration of magnesium sulphate therapy. While many protocols limit administration to 24–48 hours, some practitioners may adjust treatment duration based on clinical response. The balance between prolonging pregnancy and avoiding maternal-fetal complications requires individualized clinical judgment. Another point of debate is whether magnesium sulphate should be the first-line tocolytic compared to other agents like nifedipine, which may offer similar efficacy with fewer side effects [13]. These considerations underline the importance of context-specific research, particularly in settings with limited access to alternative therapies. Given these complexities, evaluating the role of magnesium sulphate as a tocolytic in preterm labour remains relevant. This study specifically aims to assess its effectiveness in delaying preterm birth, its safety profile, and its impact on neonatal health outcomes within the framework of current clinical practice. By doing so, it seeks to contribute evidence-based recommendations to improve obstetric care protocols, especially in regions where magnesium sulphate continues to serve as a frontline therapy due to cost, availability, and clinician familiarity [14].

Objective

The basic aim of the study is to determine the outcome of magnesium sulphate in females presenting with preterm labour.

METHODOLOGY

This Descriptive study was conducted at Obstetrics & Gynecology Department, Shaikh Zaid Women Hospital, Larkana from 22-11-23 to 10- 06-24 Sample size of 100 cases is calculated with 95% confidence level, 10% margin of error and percentage of reduced labour pains i.e. 50% in females with preterm labour taking magnesium sulphate. Data were collected through non-probability, consecutive sampling.

Inclusion Criteria:

- Females of age 18–40 years, parity ≤5, presenting at gestational age >28 weeks with preterm labour (as per operational definition).

Exclusion Criteria:

1. Gestational or chronic hypertension (BP ≥140/90 mmHg) or pre-eclampsia.
2. Placenta previa, accreta, increta or abruption, twin pregnancy.
3. PROM (on clinical examination) or active vaginal bleeding.
4. History of preterm delivery in previous pregnancy.

Data collection

One hundred eligible females who fulfilled the inclusion and exclusion criteria were enrolled from the emergency labour room of the Department of Obstetrics and Gynecology, Shaikh Zaid Women Hospital, Larkana. Written informed consent was obtained from all participants. Baseline demographic information was documented, including patient name, age, height, weight, BMI, gestational age at presentation, parity, and duration of preterm labour symptoms. All enrolled females received magnesium sulphate therapy consisting of a loading dose of 4 grams administered intravenously over 30 minutes, followed by a maintenance infusion of 1.0–2.0 grams per hour. The infusion rate was titrated according to changes in uterine contractions. The primary outcome was the reduction in uterine contractions as assessed by clinical examination. Patients were observed for 48 hours in the gynecology ward following magnesium sulphate administration. If labour commenced after 48 hours, it was documented in line with the study's operational definition. Participants were advised to return if they developed signs of active labour after discharge. Management of all cases followed standard clinical protocols. All collected data were recorded using a structured proforma designed specifically for this study.

Data Analysis

Data were entered and analyzed using SPSS version 21. Normality of continuous variables was assessed using the Shapiro-Wilk test. Quantitative variables such as age, height, weight, BMI, gestational age at diagnosis, duration of symptoms, and gestational age at delivery were expressed as mean ± standard deviation. Qualitative variables, including reduction in uterine contractions and delay in delivery beyond 48 hours, were presented as frequencies and percentages. Parity was also recorded as a categorical variable. To explore associations, data were stratified according to age, gestational age at diagnosis, duration of symptoms, BMI, and parity. Post-stratification analysis was performed using the chi-square test. A p-value of ≤0.05 was considered statistically significant.

RESULTS

Data were collected from 100 patients, mean age of the participants was 28.6 ± 5.1 years, with an age range from 18 to 40 years. The mean BMI was 26.4 ± 3.7 kg/m^2. The mean gestational age at diagnosis was 31.2 ± 1.9 weeks, indicating the stage of pregnancy when the participants were diagnosed. Regarding parity, 42% were primigravida (Parity 0), and 58% were multigravida (Parity 1–5).

Table 1: Demographic and Baseline Characteristics of Study Participants (n = 100)

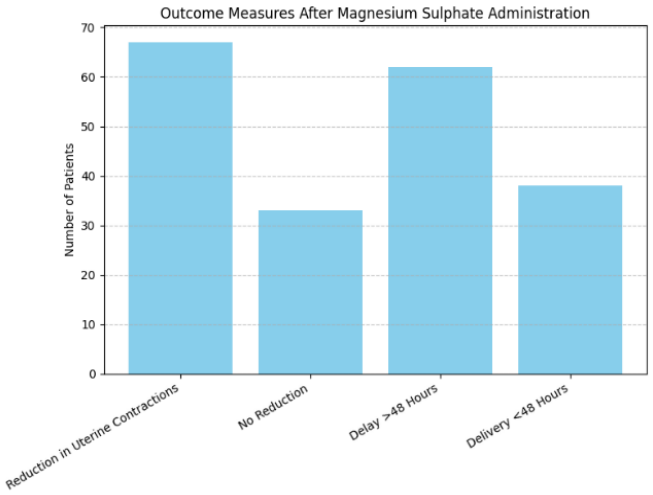
Characteristic	Value
Age (years), Mean ± SD	28.6 ± 5.1
Age Range (years)	18–40
BMI (kg/m^2), Mean ± SD	26.4 ± 3.7
Gestational Age at Diagnosis	31.2 ± 1.9 weeks
Parity	

• Primigravida (Parity 0)	42 (42%)
• Multigravida (Parity 1–5)	58 (58%)

67% of the participants experienced a reduction in uterine contractions, while 33% did not. As for delay in delivery, 62% of the participants had a delay in delivery of more than 48 hours, whereas 38% delivered within 48 hours.

Table 2: Outcome Measures After Magnesium Sulphate Administration (n = 100)

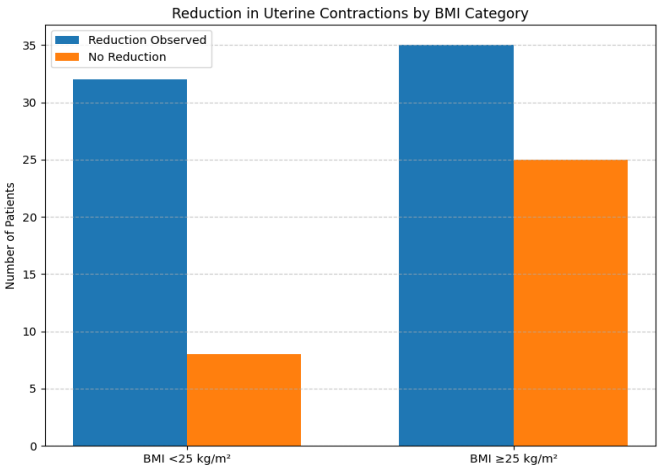
Outcome	Number of Patients (n)	Percentage (%)
Reduction in Uterine Contractions	67	67%
No Reduction in Uterine Contractions	33	33%
Delay in Delivery >48 Hours Achieved	62	62%
Delivery Within 48 Hours	38	38%



Among participants with a BMI of <25 kg/m^2, 80% experienced a reduction in uterine contractions, while 20% did not, with a significant p-value of 0.04. In contrast, among those with a BMI of ≥25 kg/m^2, 58.3% showed a reduction in uterine contractions, and 41.7% did not, with a p-value that suggests a significant difference. The gestational age category did not show a significant difference in the delay in delivery (>48 hours) between those diagnosed at 28–30 weeks and >30–34 weeks (p = 0.26).

Table 3: Stratification of Reduction in Uterine Contractions by BMI (n = 100)

BMI Category	Reduction Observed n (%)	No Reduction n (%)	p-value
<25 kg/m^2	32 (80%)	8 (20%)	0.04*
≥25 kg/m^2	35 (58.3%)	25 (41.7%)	
Gestational Age	**Delay in Delivery >48 Hours**	**Delivery Within 48**	**p-value**
Category	**Hours n (%)**	**Hours n (%)**	
28–30 weeks	24 (60%)	16 (40%)	0.26
>30–34 weeks	38 (63.3%)	22 (36.7%)	



Among primigravida (Parity 0), 71.4% experienced a reduction in uterine contractions, while 28.6% did not. In multigravida (Parity 1–5), 63.8% showed a reduction in uterine contractions, and 36.2% did not. The p-value of 0.18 indicates that there was no significant association between parity and the reduction in uterine contractions.

Table 4: Association Between Parity and Reduction in Uterine Contractions (n = 100)

Parity Category	Reduction Observed n (%)	No Reduction n (%)	p-value
Primigravida (Parity 0)	30 (71.4%)	12 (28.6%)	0.18
Multigravida (Parity 1–5)	37 (63.8%)	21 (36.2%)	

DISCUSSION

The present study was conducted to evaluate the role of magnesium sulphate as a tocolytic agent in preterm labour and to assess its effectiveness in reducing uterine contractions and delaying delivery beyond 48 hours. Among the 100 females enrolled, reduction in uterine contractions was observed in 67% of cases, while delivery was delayed for more than 48 hours in 62% of the participants. These findings are consistent with previous research, which has demonstrated that magnesium sulphate is effective in temporarily halting uterine activity in a substantial proportion of patients, thereby allowing for critical interventions such as corticosteroid administration. The mean age of participants in this study was 28.6 ± 5.1 years, which aligns with the reproductive age group typically affected by preterm labour. The majority of patients were multigravida (58%), reflecting the population commonly encountered in tertiary care centres. The mean gestational age at diagnosis was 31.2 ± 1.9 weeks, falling within the window where both tocolysis and neuroprotective strategies are clinically meaningful [15].

Reduction in uterine contractions was significantly associated with BMI, with patients having a BMI <25

kg/m^2 showing a higher rate of response (80% vs. 58.3%, p = 0.04). This suggests that maternal weight may influence the pharmacodynamics of magnesium sulphate, possibly due to differences in distribution volume or baseline uterine irritability. No statistically significant associations were observed when stratifying by gestational age at diagnosis or parity, indicating that magnesium sulphate's effectiveness is relatively consistent across these subgroups [16]. Delay in delivery beyond 48 hours was achieved in 62% of participants, which, while not universal, is comparable to findings reported in previous research where magnesium sulphate achieved similar delay rates ranging between 55–70%. The 48-hour window is considered critical in clinical practice as it allows for antenatal corticosteroid therapy to optimize fetal lung maturity, which significantly reduces neonatal respiratory complications. Importantly, while magnesium sulphate was effective in a majority of cases, a substantial proportion of patients (33%) did not show a reduction in uterine contractions [17]. This underscores the modest efficacy profile of magnesium sulphate when compared to other tocolytic agents such as calcium channel blockers like nifedipine, which some studies have reported as having higher success rates with fewer maternal side effects [18]. However, magnesium sulphate retains a unique position due to its dual role in fetal neuroprotection, particularly in preterm deliveries before 32 weeks of gestation. No major adverse effects were documented in the current study, but the known side-effect profile of magnesium sulphate such as flushing, nausea, hypotension, and respiratory depression requires careful monitoring, especially in resource-limited settings where patient-to-staff ratios may be high [19]. This supports the recommendation that magnesium sulphate should be administered in settings equipped with facilities for maternal monitoring. The study's limitations include its single-centre design, relatively small sample size, and lack of long-term neonatal outcome data such as rates of cerebral palsy or neonatal intensive care unit (NICU) admission duration. Future multi-centre studies with larger sample sizes and follow-up data could provide more robust evidence regarding both maternal and neonatal outcomes associated with magnesium sulphate use in preterm labour.

CONCLUSION

It is concluded that magnesium sulphate is an effective tocolytic agent in managing preterm labour, achieving reduction in uterine contractions in approximately two-thirds of cases and delaying delivery beyond 48 hours in 62% of patients. This delay provides a critical window for interventions such as antenatal corticosteroid administration and in utero transfer to facilities with neonatal intensive care support. While magnesium sulphate may not prevent preterm birth entirely, its dual role as both a tocolytic and a neuroprotective agent for the fetus reinforces its continued relevance in obstetric practice, especially in resource-constrained settings.

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