Magnesium Sulphate as a Tocolytic Agent in Preventing Preterm Labour

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Abstract

Background: Preterm labor is an obstetric emergency. Magnesium Sulfate ($MgSO_4$) is often used as a first-line therapy for that purpose as it is a highly effective tocolytic with fewer side effects than other tocolytics. This study aimed to evaluate effectiveness of $MgSO_4$ as a tocolytic agent in preterm labor.

Materials and methods: A prospective comparative study was conducted in the Department of Obstetrics and Gynecology of CMCH, Chattogram, from June 2020 to November 2020. One hundred singleton pregnant women with preterm labor were included in this prospective comparative study. Patients were divided into two groups according to their cervical dilatation. Fifty patients who had cervical dilatation <4 cm got an injection of $MgSO_4$ as tocolytic (Group A) and for 50 patients who had cervical dilatation >4 cm, spontaneous vaginal delivery was allowed (Group B). Both groups were observed for at least 48 hours to see labor progression.

Results: Both groups were comparable regarding their demographic and obstetric characteristics. In Group A, 23 (46%) patients needed 30 minutes- 1 hour for the arrest of preterm labor compared to only 1 (2%) patient's preterm labor was arrested <30 minutes in Group B ($p<0.001$). In Group A, most of the patients (76%) had 24-48 hours of delay in their preterm labor compared to 98% of patients who had experienced no delay in their preterm labor in Group B ($p<0.001$). Regarding side effect, most of the 37(74%) patients had hot flashes, followed by vomiting in 23(46%) nausea in 21(42%) headache in 13(26%) and hypotension in 7(14%) patients.

Conclusion: The present study revealed that $MgSO_4$ is an effective tocolytic agent with some tolerable and manageable side effects.

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Introduction

Preterm labor is between >20 weeks and before 37 weeks of gestation.[1] Preterm birth (<37 weeks of gestation) is a global burden considered to be one of the main risk factors for neonatal and under five years mortality and is associated with short-term and long-term poor outcomes, such as poor neurodevelopmental outcomes, intellectual and mental disabilities, and early onset of chronic diseases.[1-4]

Tocolytics are drugs that delay preterm delivery, allowing antenatal corticosteroids to be administered to improve neonatal outcomes.[5] Many different drugs have been utilized as tocolytic therapy, and several Cochrane reviews have compared individual tocolytic drugs with placebo or other tocolytics.[6-10] However, a standard first-line drug has not emerged.[11] Magnesium sulfate ($MgSO_4$) is used for >25 years to treat preterm labor. $MgSO_4$ effectively delays delivery for at least 48 hours in patients with preterm labor when used in higher dosages. However, further studies are warranted for its safety recommendation.[12]

Chittagong Medical College Hospital (CMCH) is a tertiary care hospital in the Chattogram division where most critical patients are referred from the periphery. In this hospital, there were 738 patients in preterm labor in the year 2019, and 75 babies died due to prematurity. Now, $MgSO_4$ is being used in this hospital for the management of preterm labor. However, there was a scarcity of information regarding the efficacy of $MgSO^4$ as a tocolytic agent. Hence, the objective of this study was to evaluate the effectiveness of $MgSO_4$ as a tocolytic agent in preterm labor. Dissemination of the study findings could help to decide the gynecologist for using MgSO4 as a tocolytic agent regularly in preterm labor.

Materials and methods

A prospective comparative study was conducted in the Department of Obstetrics and Gynecology of CMCH, Chattogram, from June 2020 to November 2020. The participants gave written informed consent. The CMC Ethical and Review Committee approved the study protocol.

Women with singleton pregnancy with preterm labor, irrespective of their parity and gravida, were included in this study. Women with preterm labor with fetal distress, pregnancy with PROM, chorioamnionitis in the presence of preterm rupture of membrane, fetal demise or fetal anomaly, and hemodynamically unstable women were excluded.

There were two groups of patients. Group A was the women with cervical dilatation less than 4 cm who got injection $MgSO_4$ with 4 g loading dose followed by 1-2g/hr until successful tocolysis or 24 hrs (>24 gm/day).[13] Group B was women with cervical dilatation of more than 4 cm; spontaneous vaginal delivery was allowed. Patients were observed for at least 48 hours to evaluate the effectiveness of MgSO4. The effectiveness of magnesium sulfate was declared if uterine contractions with cervical dilatation of at least 2 cm, not progressing to 4cm, Gestational age 24 -33 weeks and four days, intact fetal membrane, no maternal or fetal complications necessitating preterm delivery.[1]

Data were processed and analyzed by using SPSS version 25. Categorical variables were compared by Chi-square test. p-value <0.05 was considered statistically significant.

Results

This prospective study included a total of 100 Singleton pregnant women in preterm labor and was categorized based on intervention for preterm labor. Table I shows that most of the patients (38) were 16-20 years old. Half of the participant's patients completed the SSC level of education. Maximum (79) women were housewives. Most of the patients (46) were from the middle-class income group. However, both groups were comparable in age, education, occupation and monthly income.

Table I Sociodemographic characteristics of the patients

Characteristics		Group-A (n=50)	Group-B (n=50)	p value*
Age (Years)	16-20	17 (34)	21 (42)	0.103
	21-25	15 (30)	19 (38)	
	26-30	13 (26)	7 (14)	
	31-35	(2)	(6)	
	>35	(8)	(0)	
Education 0.232	Illiterate	(22)	(22)	
	Primary	(36)	(20)	
	Secondary	(28)	(30)	
	Higher secondary	(12)	(18)	
	Graduate	(2)	(10)	
Occupation 0.085	Housewife	(86)	(72)	
	Employed	(14)	(28)	
Monthly family income group	Low	26 (52)	19 (38)	
	Middle	22 (44)	24 (48)	0.139
	High	2 (4)	7 (14)	

Group A: Patient received $MgSO_4$, Group B: Patient did not received $MgSO_4$, Data were expressed as frequency (%) *Chi-square test.

Among the 100 patients, most (61%) were married for 1-5 years. Regarding para and gravida, 59 were nulliparous, and 52 were pregnant with primi gravida. The majority (91) had no history of IUFD. The duration of marital life, parity, gravida, history of IUFD, ANC pattern, gestational age, and weight were similar between the two groups (Table II).

Table II Obstetric profile of the patients (n=100)

Characteristics		Group-A (n=50)	Group-B (n=50)	p value*
Para	Nulliparous	28 (56)	31 (62)	0.486
	1	8 (16)	10 (20)	
	2	8 (16)	7 (14)	
	3	(12)	(4)	
	Primigravida	(50)	(62)	
	Multigravida	(50)	(38)	
	3rd	(20)	(12)	
	4th	(12)	(4)	
	5th	(4)	(0)	
	Yes	(6)	(12)	
	No	(94)	(88)	
	No	(14)	(28)	
	Irregular	(58)	(40)	
	Regular	(28)	(32)	
	28-30	(20)	(26)	
	31-34	(60)	(48)	
	35-37	(20)	(26)	

		Group-A (n=50)	Group-B (n=50)	p value*
Gravida				0.092
H/O IUFD				0.295
ANC pattern				0.127
Gestational age (Weeks)				0.485
	<50	1 (2)	5 (10)	
	51-60	24 (48)	22 (44)	
Weight (Kg)	61-70	20 (40)	14 (28)	0.239
	71-80	5 (10)	8 (16)	
	>80	0 (0)	1 (2)	

Group A: Patient received $MgSO_4$, Group B: Patient did not received $MgSO_4$, Data were expressed as frequency (%) *Chi-square test, IUFD: Intrauterine Fetal Death.

Table III shows that most of the (40) patients had a history of preeclampsia. About 33 patients had UTI and 32 patients had DM. Regarding the history of preterm labor, 16 had a history of preterm labor. Bacterial vaginosis was found among ten patients. Clotting disorder and H/O previous CS were among the six each. Both Uterine anomalies and polyhydramnios were among the four patients. Moreover, placenta previa was found in 5 cases.

Table III Risk factors for preterm labour among the respondents

Clinical presentations	Frequency	Percent (%)
Preeclampsia	40	40
Diabetes mellitus	32	32
Urinary tract infection	33	33
H/O preterm labour	16	16
Bacterial vaginosis	10	10
Clotting disorder	6	6
H/O previous cesarean delivery	6	6
Placenta previa	5	5
Polyhydromnius	4	4
Uterine anomalies	4	4

Multiple response variable.

Figure 1 Time taken for arrest of labour of the respondents

The bar chart (Figure 1) shows that in Group A, 23 (46%) patients needed 30 minutes- 1 hour for the arrest of preterm labor, but in Group B, only 1 (2%) patient's preterm labor was arrested <30 minutes. A highly significant difference was found between the groups according to the p-value.

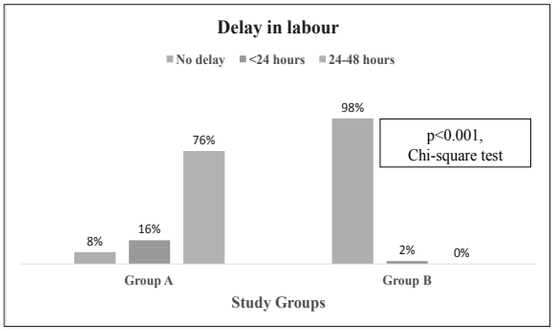

Figure 2 Delay of preterm labour among the patients

Figure 2 shows that in Group A, most patients (76%) had 24-48 hours of delay in their preterm labor. However, in Group B, a maximum (98%) of patients had experienced no delay in their preterm labor. According to the p-value, there was a highly significant difference between the groups.

Regarding side effects, the most frequently reported events were hot flashes (74%), vomiting (46%), nausea (42%) and headache (26%). Seven hypotension (14%) (Table IV).

Table IV Side effects of $MgSO_4$ among the respondents (n=50)

Side effects	Frequency	Percent (%)
Hot flash	37	74
Vomiting	23	46
Nausea	21	42
Headache	13	26
Hypotension	7	14

Multiple response variable.

Discussion

Tocolytics are commonly used to prevent or delay preterm birth. MgSO4 is one of the most widely used tocolytics.[12] So, the present prospective comparative study was conducted to evaluate the effectiveness of $MgSO_4$ as a tocolytic agent in preterm labor in a tertiary-level hospital in Chattogram, Bangladesh. In this study, 100 women with preterm labor were included, where 50 received $MgSO_4$ and 50 were in active labor whose labor progressed without any intervention

to delay it. The time interval between the administration of $MgSO_4$ and the arrest of preterm labor, as well as the patient's side effects and risk factors, were evaluated.

The patients' age distribution and sociodemographic and obstetric characteristics were similar between the two groups and in line with the previous studies.[13-18] Regarding risk factors of preterm labor, the present study found preeclampsia as the most common, followed by urinary tract infection, diabetes, history of preterm labor, and bacterial vaginosis, which agreed with the previous studies.[13-19]

In this study, $MgSO_4$ administration was associated with 30 minutes- 1 hour for the arrest of preterm labor in 46% of the patients. In contrast, in patients who did not receive $MgSO_4$, only 1 (2%) patient's preterm labor was arrested <30 minutes. In the present study, regarding the delaying labor regression, most patients (76%) who received $MgSO_4$ had 24-48 hours of delay in their preterm labor. However, in the comparison group, a maximum (98%) of patients had experienced no delay in their preterm labor. A study by Naznin et al. shows that after being given magnesium sulfate, in 86% of cases, labor was delayed by>24 hours.[15] Lipi et al., show preterm labor of 83.33% was delayed for 24-48 hours after giving $MgSO_4$.[16]

Regarding the side effects of $MgSO_4$, most of the (74%) patients had hot flashes, followed by vomiting, nausea, headache, and hypotension. Naznin et al. described flushing and nausea as the most typical side effects.[15] In the study done by Lipi et al. reported that 65.22% of patients experienced hot flashes, and 53.62% of patients had nausea and/or vomiting.[16] Mathuriya and colleagues found that vomiting and nausea were the main adverse effects, followed by hypotension.[19] However, the side effects were not significant and tolerable by the participants.

Limitations

Due to the time constraint, the sample size may need to be revised to give a definite overview of the actual scenario. The sampling technique was not random. Only the patients of singleton preterm labor were taken as samples.

Conclusion

$MgSO_4$is an effective, safe, and well-tolerated tocolytic agent for prolonging preterm labor. The present study revealed that $MgSO_4$ has few tolerable side effects. With proper clinical skills, patient assessment and monitoring, and minimum resources, a definitive plan for managing preterm labor with $MgSO_4$ is effective.

Recommendations

Proper tocolytic effect requires evaluating the optimal dose, therapy duration, and timing. More research should be conducted to find better tocolytic effects with specific uterine action and fewer side effects that benefit patients.

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Contribution of authors

SA-Conception, study design, data collection, data analysis, manuscript writing and final approval.

RAJ-Data analysis, critical revision and final approval.

FR-Conception, manuscript writing and final approval.

RA-Data analysis, critical revision and final approval.

SC-Critical revision, interpretation of data and final approval.

Disclosure

The authors declared no conflicts of interest.

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