International Journal of Reproduction, Contraception, Obstetrics and Gynecology
Singh R et al. Int J Reprod Contracept Obstet Gynecol. 2016 Nov;5(11):3667-3670
www.ijrcog.org

pISSN 2320-1770 | eISSN 2320-1789

DOI: http://dx.doi.org/10.18203/2320-1770.ijrcog20163542

Original Research Article

Assessment of the effect of injection magnesium sulphate on fetal heart rate pattern in patients of eclampsia and preeclampsia

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Received: 29 September 2016
Accepted: 05 October 2016

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ABSTRACT

Background: To assess the effect of injection magnesium sulphate on fetal heart rate pattern in severe preeclampsia and eclampsia.

Methods: This is a hospital-based prospective observational study. It was conducted in the Dept. of Obstetrics and Gynaecology, BRD Medical College, Gorakhpur over period of one year from August 2014 to July 2015.Total 122 patients with diagnosis of severe preeclampsia and eclampsia who received injection $MgSO_4$ were included in the study. Patients who delivered within 1 to 2 hrs of injection $MgSO_4$, had pulmonary edema, respiratory depression, renal insufficiency, patients with recurrent convulsions not controlled by $MgSO_4$ alone, fetus who had abnormal fetal heart rate pattern prior to administration of injection $MgSO_4$, IUD baby, baby of gestetional age <28 weeks were excluded from the study. Fetal heart rate pattern tracings were taken by CTG machine before administration of injection magnesium sulphate. Injection magnesium sulphate was given according to Pritchard Regime. Fetal heart rate pattern after injection $MgSO_4$ were compared with fetal heart rate pattern before injection magnesium sulphate regarding all four parameters fetal heart rate, variability, accelerations and deceleration.

Results: Before injection magnesium sulphate mean fetal heart rate was 148.7 bpm+10.78. After 15 minutes mean fetal heart rate was 147.8 bpm+10.32.After 1hour, 2 hour and 4 hour of injection magnesium sulphate mean fetal heart rate was139.1 bpm+9.6,139.2 bpm+9.8 and 137 bpm+9.4 respectively which was statistically significant (p value <0.001). Only patients with good variability were included in the study. After 1 hour of injection magnesium sulphate 16.4%, after 2 hour 23% and after 4 hour 31.1 % developed poor variability i.e. <5. Before injection magnesium sulphate only 4% had no acceleration, after 15 minutes, 1 hour, 2 hour and 4 hour of injection magnesium sulphate 4.9%, 29.5%, 49% and 55% patients had no acceleration respectively. Before injection magnesium sulphate no patient had late deceleration. After 15 min only 2 patients had variable prolonged deceleration. After 1 hour, 2 hour and 4 hour 0%, 4.1% and 6.6% had late deceleration respectively.

Conclusions: Maternal exposure to magnesium sulphate in severe preeclampsia and eclampsia is associated with persistent fall in baseline fetal heart rate by approximately 9-11 bpm which appeared at 1 hr of injection $MgSO_4$ but it is within the accepted normal range (110 bpm - 160bpm). Statistically significant patients developed decreased beat to beat variability <5 after 1 hr of injection $MgSO_4$. Statistically significant patients developed absent acceleration. Few patients developed late decelerations but it was not significant.

Keywords: $MgSO_4$ - Magnesium Sulphate, CTG - Cardiotocography

INTRODUCTION

Hypertensive disorders are among the commonest medical disorders during pregnancy and continue to be a major cause of maternal and perinatal morbidity and mortality. In developing countries they rank second only to anaemia with approximately 5-10% of all pregnancies complicated by some form of hypertensive disorder.[1] In India incidence of preeclampsia as recorded from hospital statistics vary widely from 5-15%.[2] Preeclampsia is a multisystem, highly variable disorder, unique to pregnancy characterized by hypertension and proteinuria. If left untreated, it can develop into eclampsia, the life-threatening occurrence of seizures during pregnancy.[1]

Injection magnesium sulphate is given for prevention and treatment of convulsion in severe preeclampsia and eclampsia respectively. Dosage for severe preeclampsia is the same as for eclampsia. An effect of $MgSO_4$ on FHR patterns is plausible because magnesium ions cross the fetal-placental membranes and fetal serum Mg++ levels rapidly equilibrate with maternal levels. Magnesium is a peripheral vasodilator and is assumed to cross the fetal blood-brain barrier, as it does in the mother. The FHR could potentially be affected through peripheral and central mechanisms. The effect of magnesium sulphate on fetal heart rate in case of severe preeclampsia and eclampsia has been studied. The effect of $MgSO_4$ on fetal heart rate is observed by electronic fetal monitoring. Cardiotocography (CTG) is a special test for evaluation of fetal status. The basic objectives of CTG is to assess co-ordination between fetal central nervous system and the cardiovascular system based on the fact that a well-oxygenated healthy fetus with functionally intact CNS-cardiac axis will show accelerations(rise of FHR 15 beats/min for 15 seconds above baseline) with fetal movement-the so called reactive CTG. In addition, good FHR variability ($\geq$5) suggest normal balance of sympathetic-parasympathetic activity, an indirect evidence of adequate oxygenation of fetal regulatory centers; indeed a normal FHR variability is the hallmark of fetal well-being.

Accepted normal parameters are:

1. Baseline FHR 110-160 beats/min.
2. Normal beat to beat variability should be 6-25 beats/min
3. Presence of two or more accelerations of FHR exceeding 15 beats/min above the baseline and sustained for at least 15 seconds in a 20-min period. This pattern is termed as reactive.
4. Absence of deceleration.[3]

CTG is used to detect fetal compromise related to fetoplacental pathology, cord compression, or other processes that may result in altered fetal cardiovascular function, such as fetal immaturity or maternal administration of central nervous system-depressant drugs.

METHODS

Study was done in the labour room of Obs and Gynae Department of BRD Medical College, Gorakhpur in eastern UP between time periods of August 2014 to July 2015. Patients with severe pre-eclampsia and eclampsia who received injection magnesium sulphate were included in study. Patients who delivered within 1 to 2 hrs of injection $MgSO_4$, had pulmonary edema, respiratory depression, renal insufficiency, patients with recurrent convulsions not controlled by magnesium sulphate alone, fetus who had abnormal fetal heart rate pattern prior to administration, IUD baby, baby of gestational age <28 weeks were excluded from study. A written consent was taken after enrolling the patients. A detailed patient history, general systemic and obstetrical examination was done. Injection $MgSO_4$ was given in severe preeclampsia and eclampsia. Fetal heart rate pattern tracings were taken by CTG machine before administration of injection magnesium sulphate. Injection magnesium sulphate was given according to Pritchard Regime. The loading bolus dose of 4 gram of Magnesium Sulphate is given slowly intravenously as a 20% solution at a rate not to exceed 1g/min. It is followed promptly with 10 gram of 50% $MgSO_4$ deep intramuscularly (5gram in each buttock). Subsequently, 5gram is given 4 hourly deep intramuscularly into alternate buttock. $MgSO_4$ continued after 24 hours of last convulsion or delivery whichever is later. Fetal heart rate pattern tracings were taken after 15 minutes, 1 hour, 2 hour and 4 hour of injection magnesium sulphate. These tracings, after injection magnesium sulphate were compared with tracing before injection magnesium sulphate regarding all four parameters rate, variability, accelerations and decelerations.

RESULTS

Total 122 patients of severe preeclampsia and eclampsia were studied. Women were between the age group of 18-34years.The maximum number of women were b/w 18-25 years. Maximum number of women had education up to secondary level i.e. 63.1% and 18.9% were illiterate. Maximum patients were primipara i.e. 68% followed by G_4P_3 18.9%, G_2P_1 8.9% and G_3P_2 5%. Maximum patients 90.2% were unbooked, rest 9.8% were booked. Approximately 70% patients had pregnancy between 30-34 weeks, rest 30% were above 34 weeks.

Table1: Effect on mean fetal heart rate.

Injection magnesium sulphate	Mean FHR	standard deviation
Before injection magnesium sulphate	148.70	10.78
After 15 minute	147.8	10.32
After 1 hours	139.1	9.6
After 2 hours	139.2	9.8
After 4 hours	137.0	9.4

P value <0.001

Table 1 shows that before injection magnesium sulphate mean fetal heart rate was 148.7 bpm±10.78. After 15 minutes mean fetal heart rate was 147.8 bpm±10.32. After 1hour, 2 hour and 4 hour of injection magnesium sulphate mean fetal heart rate was139.1 bpm±9.6, 139.2 bpm±9.8 and 137 bpm±9.4 respectively.

Table 2 shows that all patients had good variability i.e. >5 before injection $MgSO_4$. After 1 hour of injection magnesium sulphate 16.4%, after 2 hour 23% and after 4 hour 31.1 % developed poor variability i.e. <5 which was in statistically significant patients (p value <0.001).

Table 2: Effect on the beat to beat variability.

FHR variability	Number of patients with percentage				
	Before inj. $MgSO_4$ (base line)	After 15 minute	After 1 hour	After 2 hours	After 4 hours
< 5	0 (0%)	0 (0%)	20 (16.4%)	28 (23%)	38 (31.1%)
>5	122	122	102	94	84
Total	122	122	122	122	122
P-value (compared with baseline)		NA	0.0003	<0.001	<0.001

Table 3: Effect on acceleration.

Accelerations	Before inj $MgSO_4$	After 15 minute	After 1 hour	After 2 hours	After 4 hours
Present	117	116	86	62	55
Absent	5 (4%)	6 (4.9%)	36 (29.5%)	60 (49%)	67 (55%)
Total	122	122	122	122	122
P value (compared with baseline)		0.75	0.0001	<0.001	<0.0001

Table 4: Appearance of deceleration.

Deceleration	Before inj $MgSO_4$	After 15 minute	After 1 hour	After 2 hours	After 4 hours
Present	27 (early)	22 (20early, 2 variable prolonged)	20 (early)	31 (26 early- 5 late	35 (27 early - 8 late)
Percentage of late deceleration	0%	0%	0%	4.1%	6.6%
Absent	95	100	102	91	87
Total	122	122	122	122	122
P value (compared with baseline)		0.42	0.25	0.54	0.23

Table 3 shows, before injection magnesium sulphate only 4% had no acceleration, after 15 minutes, 1 hour, 2 hour and 4 hour of injection magnesium sulphate 4.9%, 29.5%, 49% and 55% patients had no acceleration respectively which was statistically significant (p value <0.001).

Table 4 shows, before injection magnesium sulphate no patient had late deceleration. After 2 hour out of 122, 5 (4.1%) had late deceleration. After 4 hour out of 122, 8 (6.6%) had late deceleration.

DISCUSSION

We observed that persistent drop in fetal heart rate was 9-11 bpm which appeared at 1hour of bolus injection. In context to my study, studies of Stewart et al, Twickler et al, Kamitomo et al showed drop in fetal heart rate after injection magnesium sulphate.[4-6] Stewart et al found fall in FHR mean from 139.9 bpm to 137.5 bpm after injection $MgSO_4$. Twickler et al and Kamitomo et al reported drop of 8-10 bpm and 14-15 bpm in basal FHR respectively. In present study drop of 9-11 bpm was found (P= <0.05).

We saw that after 1 hour of injection magnesium sulphate 16.4%,after 2 hour 23% and after 4 hour 31.1 % developed poor variability i.e. <5 which was statistically

significant (p value <0.001). Studies of Wright et al showed 8.3% patients developed decreased variability after 4 hour of injection magnesium sulphate.[7] Lin et al, reported decreased variability in 40% cases after injection $MgSO_4$.[8] Duffy et al found increased risk of absent or minimal variability and Hallak et al, found lower variability at 3 hour in $MgSO_4$ group compared to control group.[9,10] Stewart et al, found minimal or absent variability during bolus infusion but corrected during steady state.[4]

We observed absence of acceleration in statically significant women after 1 hr of $MgSO_4$ bolus injection. Peaceman et al, reported 50% non- reactive NST tracing after injection $MgSO_4$.[11] Guzman et al, reported reduced reactivity (accelerations of 15 bpm over 20 minutes).[12] Stewart et al, Hallak et al, reported no significant difference in number of acceleration.[4,10]

It is observed in our study that late deceleration appeared in only few patients which was not in significant number. Stewart et al, Hallak et al, found no significant difference in deceleration.[4,10] Duffy et al reported few prolonged decelerations.[9]

All 122 patients were discharged under satisfactory condition. 87.7% neonates were healthy and bedside, 12.3% required NICU admission. 4.1% neonates were admitted in NICU and expired.

CONCLUSION

Maternal exposure to magnesium in severe preeclampsia and eclampsia is associated with persistent decrease in basal fetal heart rate by approximately 9-11 bpm but it is within the accepted normal range (110 bpm-160bpm). Statistically significant patients developed decreased beat to beat variability <5 after 1 hr of injection $MgSO_4$. Statistically significant patients developed absence of acceleration .Few patients developed late decelerations but it was not significant. Stewart et al, Hallak et al, found no significant difference in deceleration. Duffy et al, reported few prolonged decelerations.

So Magnesium Sulphate is the best anticonvulsant drug for eclampsia and prevention of convulsion in severe preeclampsia having minimal or no effect on maternal and fetal outcome.

Funding: No funding sources
Conflict of interest: None declared
Ethical approval: The study was approved by the Institutional Ethics Committee

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Cite this article as: Singh R, Rai N, Sharma NR, Mohan R, Srivastava R, Tiwari HC. Assessment of the effect of injection magnesium sulphate on fetal heart rate pattern in patients of eclampsia and preeclampsia. Int J Reprod Contracept Obstet Gynecol 2016;5:3667-70.