Annals of Medical Research
DOI: 10.5455/annalsmedres.2019.05.245 2019;26(7):1330-2

Original Article

$MgSO_4$ prophylaxis for obstetric reasons: Traditional solutions vs ready-made solutions

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Abstract

Aim: Magnesium (Mg) is frequently used in obstetrics as an anticonvulsant and neuroprotection in daily practice. Although ready-made solutions are produced today, health care workers still prepare and use $MgSO_4$ via traditional methods. We planned this study to investigate the possible benefits of using ready-made solutions.

Material and Methods: The solution prepared by traditional methods was compared to a ready-made solution in terms of Mg amount, preparation duration and cost over time.

Results: Ready-made solutions resulted in a more homogeneous infusion (386.98±25.30 vs 402.65±21.68), lower cost (6.86 vs 5.56) and less labor loss (1258 (min: 900 – max: 1500) vs 0 sec).

Conclusions: This study, it does show that the use of a ready-made solution allows the patient to receive a more homogenous infusion of magnesium over time, and it is more financially profitable. The use of ready-made $MgSO_4$ solution also prevents the loss of time in the labor force that would have been spent preparing the solution.

Keywords: Magnesium; prophylaxis; traditional solutions; ready-made solutions.

INTRODUCTION

Magnesium (Mg) is the second most important cation in the intracellular area of the human body (1). Mg is also a cofactor of many enzymes and is involved in protein and nucleic acid synthesis for energy metabolism. It causes loosening due to the calcium antagonist effect and leads to neuromuscular blockage and loss of deep tendon reflexes when it reaches concentrations above physiological limits (2). In animal studies, Mg has been shown to heal central nervous system damage by advancing to the brain tissue (3) when it is applied to the peripheral area (4–7). Magnesium sulphate ($MgSO_4$) is used as a fetal neuroprotective agent and for suppression of uterine contractions in preterm births, as well as for seizure prophylaxis in preeclampsia patients (8,9). Due to these effects, Mg is widely used in obstetrics.

Traditionally, $MgSO_4$ solutions prepared in 5% dextrose or 0.9% sodium chloride (NaCl) are administered intravenously during 1–2 g/hr infusions. Mobilization of patients diagnosed with preeclampsia and preterm labor is restricted due to their conditions. In addition, continuous treatment of these patients in the form of infusions also contributes to immobility. In busy centers, a homogeneous preparation of the traditional $MgSO_4$ solution is not always possible. When prolonged immobility is added to this, the amount of Mg administered by the intravenous route may not be homogeneous. If the solution is not homogeneous, $MgSO_4$ prophylaxis may not work because of subtherapeutic levels, or there may be Mg toxicity if a preparation contains too much of the element.

In this study, a $MgSO_4$ solution prepared by the traditional method was compared with a ready-made $MgSO_4$ solution to determine infusion results and to analyze the cost difference between the two solutions.

MATERIAL and METHODS

This study was carried out in Adıyaman University Faculty of Medicine, Obstetrics and Gynecology Department. There was no need for ethics committee approval because it was an experimental study and not performed on any living beings.

Received: 07.05.2019 **Accepted:** 30.05.2019 **Available online:** 03.07.2019
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Service nurses who were not aware of the study were asked to routinely prepare an $MgSO_4$ solution. The preparation time to prepare a solution sufficient for ten patients was measured with a stopwatch without the nurses' knowledge. The mean of these ten measurements was considered as the preparation period.

After 266.66 mL was poured from a POLIFLEKS® 0.9% sodium chloride sterile field (SF) solution 1000 mL bottle (Polifarma Pharmaceutical Industry and Trade Inc., Istanbul, Turkey), $MgSO_4$ solution 266.66 mL was added (15% $MgSO_4$ 10 mL ampule, Galen Pharmaceutical Industry and Trade Inc., Turkey) for the study group (SG). Polifleks® 40 g ready-made magnesium sulfate solution 1000 mL was used for the control group (CG) (Polifarma Pharmaceutical Industry and Trade Inc., Istanbul, Turkey).

The two solutions were attached to standard serum hangers at a height of 170 cm and were attached to the serum set. With the help of a B-Flow Flow Regulator with IV Infusion Set (Bıçakcılar A.Ş., Istanbul, Turkey), infusion was started at 50 cc/hour. The solution was dropped into a container. The infusion was continued so that the two solutions were stationary. Samples of 2 mL were drawn from the end of the serum set every 30 minutes as of zero hours (T0) and coded. Coding was done so that the lab worker was blind. Measurements were performed with the Architect C8000 immunoassay analyzer (Abbott Diagnostics, Lake Forest, IL, USA).

In order to be within the measurement range of the device, measurements were made after dilution at the rate of 1/45 with a Mg value of 9 mg/dL. The results were recalculated according to the dilution rate.

Statistical analysis was performed using the Statistical Package for Statistical Analysis (SPSS) version 21.0 (IBM Corp., Armonk, NY). Both groups were compared with descriptive statistics.

RESULTS

While pouring 266.66 ml of SF solution and adding $MgSO_4$ in the study group lasted 1258 seconds, the control group did not experience this time loss. In the traditionally prepared solution, the mean Mg level was found to be 386.98 ± 25.30 mg/dL (min: 333.9, max: 421.8) in the SG; the Mg level was 402.65 ± 21.68 mg/dL (min: 343.7, max: 421.8) in the CG group (p = 0.037) (Table 1).

Table 1. Comparison results in both groups

	Traditional $MgSO_4$	Ready-made $MgSO_4$	
Magnesium (mg/dl) (mean ± SD)	386.98±25.30	402.65±21.68	p=0.037
Preparation Time (second) (min-max)	1258 (900-1500)	0	Gain: 1258
Unit price $	6.86	5.56	Gain: 1.3

*Independent Samples Test

In each group, the distribution of the measured values of Mg levels by time is shown in the figure 1.

The cost of both solutions was calculated using the Turkish Pharmaceutical Guide website (10), and prices were converted to US currency. While the cost of the ready-made solution was $5.56, the cost of preparing the same solution traditionally was calculated to be $6.86 ($1 = 5.39 TL).

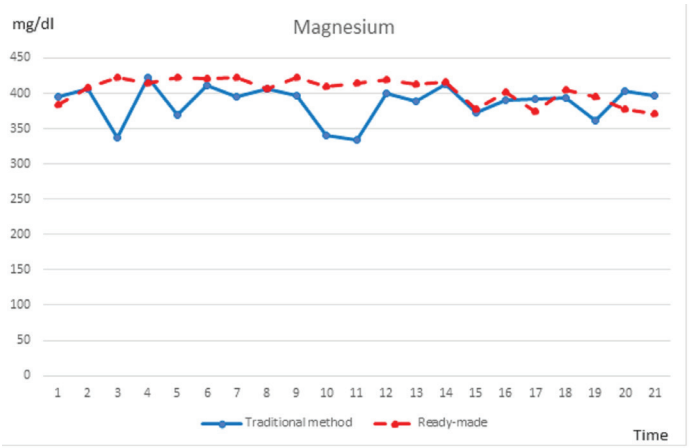

Figure 1. Magnesium measurement values of time in both groups

DISCUSSION

It has been reported that a small but significant Mg increase is detected in the cerebrospinal fluid of patients with preeclampsia treated with intravenous $MgSO_4$ (11–13). This increase is very important for magnesium's anticonvulsant and neuroprotective effect. It is very important that the hourly amount of Mg given to the patient be homogenous because incomplete Mg infusion may cause insufficient eclampsia prophylaxis and neuroprotective effect, and we also believe excessive amounts may be toxic. This study reveals that the amount of Mg in the samples taken from both groups differs with time. It can be said that the higher the standard deviation, especially in the study group, the greater the change in the amount of Mg given over time. This may be due to the fact that the solution is not completely mixed during preparation. It is estimated that the content is more homogeneous in the ready-made solutions. In our study, more homogenous Mg levels were detected in the ready-made solution.

It is known that there are problems in supplying inexpensive drugs in many undeveloped countries (14). It is known that other anti-epileptic drugs are used instead of $MgSO_4$ in the treatment of eclampsia since $MgSO_4$ could not be reliably provided until recently (15,16). However, the supply of these drugs is very important for both cost and patient safety. The hospital information management system revealed that an average of 500 units of $MgSO_4$ solution is used per year in our hospital. This amount of the solution, prepared by the traditional method, represents approximately 1000 minutes of lost time and a cost of $650.

CONCLUSION

The dilution of the samples and the small number of samples were the disadvantages of this study. Despite the size of the study, it does show that the use of a ready-made solution allows the patient to receive a more homogenous infusion of magnesium over time, and it is more financially profitable. The use of ready-made $MgSO_4$ solution also prevents the loss of time in the labor force that would have been spent preparing the solution.

Acknowledgement
We want to thank to Nurse Elif Cengiz, who spent her time to prepare the solution under heavy working conditions; the medical faculty students Ertugrul Ozturk and Ayse Ruken Kurt, who took and labeled the samples every 30 minutes in the study; Biochemistry Specialist Dr. Serpil Firat Gocer, who analyzed the samples; laboratory workers Fatma Kaya and Muyesse Ozdemir; and, finally, Dr. Elif Mutlu who organized the study from the beginning.

Competing interests: The authors declare that they have no competing interest.
Financial Disclosure: There are no financial supports
Ethical approval: There was no need for ethics committee approval because it was an experimental study and not performed on any living beings.

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