RESEARCH ARTICLE

Assessment of magnesium sulphate usage in pre-eclamptic and eclamptic women in Omdurman Maternity Hospital, 2017: A cross-sectional study [version 1; peer review: 1 approved, 1 not approved]

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Abstract

Background: Eclampsia, the end phenomena of the preeclampsia spectrum, appears as new onset grand mal seizures in women with preeclampsia. Recently, the World Health Organization has recommended magnesium sulphate (MgSO₄) as the main drug of choice to treat/prevent eclampsia. However, in Sudan no real assessment data about MgSO₄ efficacy, benefits and risks in pre-eclamptic and eclamptic women has been reported.

Methods: A cross-sectional hospital-based study was conducted between January and April 2017 at Omdurman Maternity Hospital using a checklist. Data was collected from the medical records of 130 pre-eclamptic/eclamptic pregnant women, including: age, blood pressure, protein urea appearance, admission diagnosis, reason for using MgSO₄, policy of MgSO₄ administration, outcomes after using MgSO₄, side effects of using MgSO₄, and MgSO₄ toxicity recording. After data collection, IBM SPSS (version 21) was used to analyze the data.

Results: Out of 130 recruited women, 78% were diagnosed with preeclampsia and 22% were diagnosed with eclampsia. Magnesium sulphate was indicated as a prophylactic in 88 patients and as treatment in 42 patients. Interestingly, only 9 patients had uncontrolled- recurrent seizures after using magnesium sulphate and only one patient developed drug related toxicity.

Conclusion: After MgSO₄ administration, the majority of patients (121; 93.1%) had controlled seizures and only one patient developed MgSO₄ toxicity (respiratory paralysis). Therefore, MgSO₄ represents an effective and safe drug of choice used to treat/prevent eclampsia in Sudan.

Open Peer Review

Approval Status

	1	2
version 1		
11 Apr 2019	view	view

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 Cloudnine Hospital, Shivajinagar, Pune, India
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Any reports and responses or comments on the article can be found at the end of the article.

Keywords

Pre-eclampsia, eclampsia, pregnancy, Magnesium Sulphate

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Introduction

Preeclampsia/eclampsia is a pregnancy-specific disease with multisystem physiological disorder, which may lead to increased risk of maternal and perinatal mortality and morbidity¹. Regarding etiology, no clear cause has been defined, but some reports indicate that oxidative stress and placental defects during early pregnancy may represent the main causes². Preeclampsia is defined as pregnancy-related systemic disorder, which is associated with incidence new onset of hypertension as well as proteinuria³. Eclampsia is described as the beginning of grand mal seizure symptoms in preeclamptic women⁴. Epidemiologically, around 50,000–60,000 pregnant women die due to preeclampsia/eclampsia each year, which represents around one-quarter of maternal deaths in Latin America, and approximately one-tenth of maternal deaths in Africa and Asia^{5,6}.

Magnesium sulphate (MgSO_4) is one of the main interventions used to decrease the morbidity and mortality from preeclampsia/eclampsia. In 2011, MgSO_4 was been strongly suggested by the World Health Organization (WHO) to be the drug of choice for both treatment and prevention of eclampsia⁷. Currently, the WHO and other international organizations recommend two MgSO_4 prophylactic protocols for eclampsia. The first one is the Pritchard regimen, in which MgSO_4 is administered intramuscularly, while it is injected intravenously in the second protocol named as Zuspan regimen⁸. MgSO_4 might be toxic in some conditions, and the toxicity depends on the serum magnesium levels, for example: loss of the knee jerk may develop at 3.5–5 mmol/l; respiratory paralysis may occur at 5–6.5 mmol/l, cardiac conduction is altered at higher than 7.5 mmol/l⁹. Meanwhile, it can lead to death if the serum magnesium exceeds 12.5 mmol due to cardiac arrest⁹.

In Sudan, preeclampsia/eclampsia is considered as one of the main factors leading to an increase in morbidity and mortality among pregnant women². There is not enough assessment data reported about MgSO_4 efficacy, benefits and risks in preeclamptic and eclamptic women in this setting. Thus, the present study was carried out to assess MgSO_4 usage in preeclamptic and eclamptic women in Khartoum, Sudan.

Methods

Study site and participants

A cross-sectional pilot hospital-based study was conducted between January and April 2017 at Omdurman Maternity Hospital (Khartoum, Sudan) using a checklist, which was completed by the researcher. Data was collected from patient medical records.

Eligibility criterion was as follows: women who were pregnant and had preeclampsia/eclampsia. The total number of preeclamptic/eclamptic patients admitted during the time period was 130 patients. Therefore, the data records of 130 preeclamptic/eclamptic pregnant women were included in this study.

Data collection

The checklist (Extended data¹⁰) collected the following data variables from records: age; blood pressure; protein urea appearance; admission diagnosis (eclampsia/preeclampsia);

reason of using MgSO_4 (prophylactic in pre-eclampsia or treatment in eclampsia); MgSO_4 administration policy (loading dose and maintenance dose); outcomes after MgSO_4 therapy; monitoring of MgSO_4 side effects (BP, pulse rate, respiratory rate, pulse oximeter, urine output, deep tendon patellar reflexes); MgSO_4 toxicity recording.

Source of bias

Misdiagnosis of admitted patients might be a source of bias. This was addressed as follows.

As per hospital policy, any patient who was admitted with blood BP $\geq 140/90$ and protein urea the following criteria were measured and only patients who have one or more of the following criteria were diagnosed and admitted as pre-eclamptic patients: refractory oliguria (<500 cc over 24 h), renal function compromise (minimal criterion would be a rise in serum creatinine of 1 mg/dl above baseline), persistent right upper quadrant or epigastric pain or both, persistent headache, scotomata or blurred vision, shortness of breath with reduced oxygen saturation or pulmonary edema, thrombocytopenia (platelets $<100,000/\text{cu.mm}$), hemolysis (based on peripheral smear analysis or increased bilirubin), impaired liver function of unclear etiology, and estimated fetal weight below 5th percentile for gestational age are important parameters to be noted.

Patients who were admitted with blood BP $\geq 140/90$, protein urea and grand mal seizures were diagnosed as eclamptic patients.

Data analysis

After data collection, IBM SPSS Statistics software (version 21) was used to descriptively analyze the data.

Ethical clearance

Ethical clearance (FPEC-06-2018) was obtained from the Ethical Committee of the University of Khartoum, Faculty of Pharmacy. Official agreement from the general manager and the medical directors of the hospital preceded the conduction of this study. After records were as being eligible for the study, the patients were contacted for their consent to use the records in this study. Since the majority of the patients were illiterate, oral informed consent was preferred to written informed consent.

Results

As shown in Figure 1A, 62 participants were 25–34 years (~48%). About 34% of participants were 15–24 years and only 18% were 35–45 years old. Regarding admitting diagnosis, the majority (78%) were diagnosed with preeclampsia, while 22% were diagnosed with eclampsia (Figure 1B).

Every patient recruited to the study was followed up while they received MgSO_4 therapy. During follow-up some of the preeclamptic women developed eclampsia; therefore, the ratio of preeclampsia:eclampsia became 88:42 instead of 101:29.

MgSO_4 was used as a prophylactic agent in 88 preeclamptic women and as treatment for 42 eclamptic women, as shown in Figure 1C. Moreover, magnesium sulphate was administered as a loading dose in 51 (39.2%) patients, while most treated

Figure 1. Participant characteristics. Graphs showing the distribution of the study population according to (A) age; (B) admitting diagnosis; (C) MgSO₄ indication; (D) administration of loading dose of MgSO₄; (E) administration of maintenance dose of MgSO₄

patients (98.5%) were administered a maintenance dose of MgSO₄ (Figure 1D and E).

To avoid practitioner-related errors, patients' vital signs and parameters must be monitored frequently during MgSO₄ administration¹¹. In this study, only vital signs (Pulse Rate, Blood Pressure, Respiratory Rate, and Pulse Oximeter) were checked ten minutes after starting loading dose (LD). At the end of LD, 4 hourly checks were performed during maintenance dose (Figure 2A). Other important parameters, such as urine output and deep tendon patellar reflexes, were checked in 42% and 25% of patients, respectively.

Regarding outcomes after administration of MgSO₄, the majority of patients (121; 93.1%) had controlled seizures (Figure 2B). Only one patient developed MgSO₄ toxicity (respiratory paralysis).

Discussion

Being pregnant at age 35 or more is one of the highest risks of developing preeclampsia/eclampsia¹², however, in the present study the 25–34 year age group was the largest age group of women with preeclampsia/eclampsia. MgSO₄ is considered as the golden choice for treatment and prevention of eclampsia, as endorsed by the WHO⁷. Therefore, it is no wonder that MgSO₄ has been used to control every admitted eclamptic/preeclamptic case included in the present study.

Regarding the administration protocol, MgSO₄ must be given by either Pritchard or Zuspan regimen. In Pritchard regimen, a

loading dose of 4 g is injected intravenously, then a maintenance dose will be started immediately by intramuscular injections of 10 g followed by 5 g 6 times/day. In Zuspan regimen, 4 g dose is given a loading dose, then maintenance dose by using 1 to 2 g/h controlled infusion pump¹³. In present study, poor practice is observed as 61% of admitted patients didn't receive loading doses and two patients didn't receive maintenance dose.

Some reports indicate that the rate of eclamptic seizures was recorded as being lower than 35% of all recruited cases after using MgSO₄, while in present study the rate of uncontrolled-recurrent seizures was only 7% after using MgSO₄¹⁴. In this study, no patient died as a result of using MgSO₄ whereas some literature indicates that "if MgSO₄ was universally prescribed for all pre-eclamptic pregnant women, the death from magnesium toxicity may be more than that from seizures"¹⁴. On the other hand, the prevalence of MgSO₄ toxicity is very mild and only one toxicity case had been reported worldwide to date¹⁵.

Conclusion

Although practitioners in the present study did not properly adhere to MgSO₄ protocol, the successful output of its usage as a treatment for eclampsia and prophylaxis for pre-eclampsia was shown by the majority of patients (93.1%) only having controlled seizures, with only one patient developing toxicity.

Practitioners' adherence to MgSO₄ protocol should be assured in the future to increase the percentage of the well-controlled patients.

A Parameters monitoring after MgSO₄ administration

B Outcome after administration of MgSO₄

Figure 2. Outcomes of patients after magnesium sulphate administration for preeclampsia/eclampsia. (A) Parameters monitored after MgSO₄ administration; (B) distribution of study population according to seizure outcome after administration of MgSO₄.

Data availability

Underlying data

Open Science Framework: Assessment of Magnesium Sulphate Usage in Pre-eclampsic and Eclampsic Women in Omdurman Maternity Hospital, 2017, <https://doi.org/10.17605/OSF.IO/YV76K>¹⁰.

Extended data

Checklist used in the present study: <https://doi.org/10.17605/OSF.IO/YV76K>¹⁰.

Data are available under the terms of the [Creative Commons Zero “No rights reserved” data waiver](#) (CC0 1.0 Public domain dedication).

Grant information

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Melania Maria Ramos Amorim

Maternal and Child Healthcare, Instituto de Medicina Integral Prof. Fernando Figueira, Recife, Brazil

Although the use of magnesium sulfate in preeclampsia and eclampsia is indeed a very important issue, the study is very small, it was conducted in a single center, the objectives are not clearly defined, the sample size has not been calculated, the data collection was performed for only 4 months and the study fails to add any new finding to the current state of the art. If we consider for example the outcome "seizure recurrence", which occurred at 7% of patients, considering a confidence level of 95% and an absolute precision of 2%, a sample size of 625 patients would be required.

The effectiveness of magnesium sulfate for seizure prevention and control in patients with preeclampsia and eclampsia has already been demonstrated in solid randomized controlled trials and systematic reviews available from the Cochrane Library, so an observational study would have to provide important additional information to be considered valid. With unclear objectives and inconsistent methods, without adequate presentation of the analysis variables, this is an important concern.

I also question a fact that seems very strange to me, only 39% of the patients had the loading dose of magnesium sulfate administered. How is this possible? A maintenance dose can only be done without an loading dose. If this was a prospective study it is a very serious and ethically unjustified mistake because this problem being identified the authors would have to warn the clinical staff and provide the patient with the best available treatment.

The study also does not follow STROBE recommendations.

Therefore, I do not recommend its indexing.

Is the work clearly and accurately presented and does it cite the current literature?

No

Is the study design appropriate and is the work technically sound?

No

Are sufficient details of methods and analysis provided to allow replication by others?

No

If applicable, is the statistical analysis and its interpretation appropriate?

Partly

Are all the source data underlying the results available to ensure full reproducibility?

Yes

Are the conclusions drawn adequately supported by the results?

No

Competing Interests: No competing interests were disclosed.

Reviewer Expertise: Obstetrics and Gynecology; High-risk pregnancy, Hypertension in Pregnancy, Evidence-based Medicine, Prenatal, Childbirth and Postpartum Care, Maternal Mortality, Abortion, Reproductive Rights

I confirm that I have read this submission and believe that I have an appropriate level of expertise to state that I do not consider it to be of an acceptable scientific standard, for reasons outlined above.

Reviewer Report 25 June 2019

<https://doi.org/10.5256/f1000research.19299.r49423>

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Girija N. Wagh

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The study is a genuine and ethical presentation of the practices in the Omdurman Maternity Hospital in Sudan and has proved the efficacy of the magnesium sulfate in the treatment of preeclampsia and eclampsia. Magnesium sulfate is a valuable therapy in the management and prevention of eclampsia¹. But many parts of the world obstetricians continue to have reservations of using magnesium sulfate due to the fear of apparent toxicity. As the evidence is coming up and the experience of the use of the drug is increasing, magnesium sulfate is proving to be an effective therapy for seizure prevention and control with the added advantage of fetal

neuroprotection and pain alleviation. The fear among the physicians is a result of inadequate knowledge, and infrastructure and lack of organization and this are beautifully depicted in a recent study in Brazil².

The current publication in Sudan has scientifically designed and conducted the study and has come up with valuable information on the magnesium level and the significant advantages of using magnesium sulfate. This study is important as the blood levels of magnesium have been studied and correlated. In practice actually, it is not essential to determine the blood levels of magnesium. Clinical signs if studied well and closely monitored are enough to ensure the correct delivery of the drug at the right dose. Also, it is important to keep the calcium gluconate³ injection handy as an antidote to excessive levels of magnesium sulfate. Magnesium sulfate especially is of benefit during labor management to prevent eclampsia⁴.

I would also suggest the center to take up the universal and optimum delivery of magnesium sulfate as a quality improvement parameter and this would go a long way in reducing the perinatal adverse outcomes in the association of gestosis (preeclampsia).

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Is the work clearly and accurately presented and does it cite the current literature?

Yes

Is the study design appropriate and is the work technically sound?

Yes

Are sufficient details of methods and analysis provided to allow replication by others?

Yes

If applicable, is the statistical analysis and its interpretation appropriate?

Yes

Are all the source data underlying the results available to ensure full reproducibility?

Yes

Are the conclusions drawn adequately supported by the results?

Yes

Competing Interests: No competing interests were disclosed.

Reviewer Expertise: Maternal medicine and high-risk obstetrics, infertility and laparoscopic

surgery

I confirm that I have read this submission and believe that I have an appropriate level of expertise to confirm that it is of an acceptable scientific standard.

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