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REVIEW

Investigating the Effect of Magnesium in Preventing Tremors after Anesthesia: A Systematic Review

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Abstract

Background and Purpose: In addition, magnesium is prescribed intravenously, epidurally, or intraperitoneally, each of which may have different effects depending on the surgical procedure. In this review, we searched for randomized clinical trials that compared preoperative magnesium administration with controls and included studies that assessed chills as a primary and possible outcome. change. The main objective of this study was to evaluate the effect of preoperative magnesium in the prevention of postoperative chills. **Materials and methods:** This article is a systematic review that searched for all quality articles published in the Cochrane database until the end of 2020. References were checked, PubMed and Web of Science 55,555. **Results:** The initial search identified 3,294 publications. 64 articles were included in this study. The results showed that the frequency of colds in the group receiving intravenous, epidural and intraperitoneal magnesium was significantly reduced compared to the control group. **Conclusion:** Prophylactic use of magnesium can reduce the severity and number of post-anesthetic chills and other post-anesthetic symptoms.

Keywords: Magnesium- cooling- side effects- anesthesia

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Introduction

Tremor is a common complication in the postoperative period. This complication can increase the body's oxygen requirements and cause myocardial ischemia. Despite careful efforts to prevent hypothermia, many patients suffer from larceps after surgery. Young age, arthroplasty [1], low body temperature, and longer duration of surgery have been considered risk factors for postoperative tremor in previous studies [2, 3].

Medical intervention can reduce the frequency of tremors. Drugs such as dexmedetomidine, 5-hydroxytryptamine receptor antagonists, and meperidine have been shown to have anti-shake effects [4], but their cost is very high and safety poor [5, 6]. Magnesium may reduce the need for anesthetics, neuromuscular relaxants, and opioids during surgery. In a previous meta-analysis, 5 pooled data from 3 studies showed that magnesium reduced the severity of tremors. The results of other meta-analyses are inconsistent [7,8]. This may be because the meta-analysis included few studies that assessed primary outcomes. Many studies that assessed tremor as one of the secondary endpoints or side effects were not evaluated [9]. The quality of evidence in these data has not been assessed. Therefore, it is unclear how effective preoperative magnesium is in preventing postoperative chills [10, 11].

In addition, magnesium is administered intravenously, epidurally, or intraperitoneally, each of which can have different effects in different surgeries [12]. In this review, we searched for randomized clinical trials that compared preoperative magnesium to a control group and included trials that assessed tremor as a variable and primary outcome. The main goal of this study was to evaluate the effect of pre-operative magnesium in preventing shivering after surgery.

Method

This study is a systematic review with sequential

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analysis of randomized trial studies.

This study was based on the statement of 13 Meta-Analyses and the Cochrane Guidebook and was searched on the basis of the Cochrane Central Register of Tested, PubMed EMBASE, Controlled and Web of Science databases until the end of 2020 without time limit. The articles that met the inclusion criteria were evaluated separately by 2 authors and the differences were resolved by discussion. We sought randomized clinical trials that assessed the degree of shivering after magnesium administration compared with placebo or no medication in patients expected to have shivering after cardiac surgery. We excluded studies in which patients received cardiopulmonary bypass. We excluded studies that did not report tremors or that compared oral magnesium to placebo. We also excluded data from case reports, observational studies, letters to the editor, reviews, and animal studies.

Episodes pending

The primary endpoint was postoperative or intraoperative chills. In patients under general anesthesia, we only examined postoperative tremor because intraoperative tremor can be masked by neuromuscular blockers or other drugs. In patients who did not undergo general anesthesia, we assessed the degree of total tremor in the surgical and postoperative periods. If the number of people with tremors is recorded at multiple time points and the total number of tremor movements is not reported, we consider the tremor at the first time point.

We call tremors the first time after the operation chills. When chills were reported at different times during surgery, we used the last time during surgery. We did not limit the timing of tremor observation, since tremor is an important outcome throughout the postoperative period, in addition, it is uncomfortable for the patient and can cause cardiopulmonary disorders. Secondary outcomes included serum magnesium concentration before and after surgery, intubation time after surgery, length of stay in the post-anesthesia care unit (PACU), length of stay in the hospital, and side effects. Data collection A data collection sheet was created.

Including the number of patients in the study, age, physical condition of the American Society of Anesthesiology, type of anesthesia, anesthetic drugs used, type of surgery, route of magnesium administration, magnesium dose, continuous magnesium dose, time of magnesium administration, bolus

Estimating the duration of continuous injection, the number of cases with shivering, serum magnesium concentration, the time of removing the chip tube, the length of stay in PACU, the length of hospitalization and side effects. Two authors independently extracted the data from the studies using the existing form and reviewed the data. When the prevalence of shivering was not available in a study even if it was recorded, we tried to contact the corresponding author.

Heterogeneity was assessed using the 2I statistic. A 2I value between 30 and 60 indicates moderate heterogeneity, and a value above 60 indicates significant heterogeneity.

Results

The first search found 3294 articles. 64 clinical trials were included in this study. Since we were unable to obtain the full texts of some articles, we attempted to contact the editors of the journal. However, the full text of 11 articles was not available. Some studies showed that the number of tremor patients in both groups was. Intervention and control were the same, and other studies did not report the number of patients with tremor. Some authors indicated that tremor occurrences were reported, but then did not do so or only reported that tremor occurrences were similar. We tried to contact the authors of these articles to find out the number of patients with tremor and other relevant information. Two authors responded, the rest did not respond, so four clinical trials were excluded from the study because the authors did not respond. All submitted articles are in English, with the exception of six articles in Persian, Korean and Turkish.

The evaluated studies included data from 4303 people. 2300 of them magnesium (1114 by IV in 35 studies [6, 13-46]), by epidural in 12 studies [47-58], 638 by intraperitoneal injection in 16 studies [59-74] and 108 by Other routes received 4 interventions. All studies compared magnesium sulfate with placebo or no drug. Two studies compared several ways of magnesium administration. In relation to the magnesium sulfate drug manufacturing plant, it should be mentioned that the name of the used drug manufacturing plant was not mentioned in any of the articles published until 2014; In other articles that mention the manufacturing plant, all the drugs are supplied from the factory in the country of Mohaghegin and are not supplied from outside the country; For example, in Iranian studies, the magnesium sulfate of the Pasteur Institute of Iran, in the Egyptian study of the magnesium sulfate of Al-Sharki Company of Egypt, in the Chinese studies of the Chinese Infusion Pharmaceutical Company, etc.

Since there was a sufficient number of studies, a subgroup analysis was performed according to the ordering method. The frequency of tremor in the magnesium group was significantly increased by intravenous injection (hazard ratio 0.39, 95% CI, 0.299-0.054; 2 = 50%; n = 2124) and epidural injection (hazard ratio 24.95/0; CI). reduced. , 43.0-13.0; 2 = I 21%; n = 880) and intra-articular administration (risk ratio 64.0; 95% CI 43.0-96.0; 14 = 2% I; 1120 (n =) and intra-articular administration (risk ratio 01.1; 95% CI 19 ,2).-46.0;=2I%;81 (n=2I) Notably, 2I was assigned 0 percent for all 3 methods Adverse effects during extubation.

Approved in 4 studies (15, 19021-39), but there was no significant difference. ICU length of stay was shorter in the intravenous magnesium group compared to the placebo group (53 vs. 63 minutes; P = 0.04).

Serum Magnesium Concentration

This has been reported in 9 clinical trials in which magnesium was administered intravenously [13-18]. From a statistical point of view, there was no significant difference in the concentrations before the operation. Postoperative measurements were taken in the first

hour after surgery. One study was excluded from this review because the concentration reporting unit was not documented and the relevant author could not be contacted. In other cases, the concentration in the magnesium group was significantly higher and significant heterogeneity was observed. No studies reported serious side effects such as permanent nerve damage or fatal cardiac arrhythmias.

Nausea or vomiting

This has been reported in 54 clinical trials [15-68]. The incidence was lower in the intravenous magnesium group than in the control group, but there was no difference between the epidural or intraperitoneal groups.

Relaxation

Four cases of sedation were reported in 15 studies [25-39], and in 11 cases no sedation was observed in any group. Our study showed that there was no significant difference between groups (hazard ratio 54.1; 95% CI 81.0–95.2–81.0; 2.0% = 8 studies reported sedation rates for each group).

One study reported that the sedation score was higher in the magnesium group and another reported that it was higher in the control group. The remaining 6 studies reported no significant difference.

Pressure drop

Blood pressure reduction was performed in 36 studies [20-55]. The overall incidence was similar in all studies (hazard ratio 0.91, 95% CI 0.79-0.1.03; I=2(%)), with no differences observed by prescription schedule in the subgroup analysis. In 15 studies, no fall in blood pressure was reported, but blood pressure was recorded after study drug administration. In 10 studies, blood pressure was similar in all groups and in 5 cases blood pressure was lower in the magnesium group.

Bradycardia

Bradycardia was reported in 32 studies [31-62]. The overall incidence did not change (hazard ratio 0.85, 95% CI 0.08–0.66; I = 2%, no difference observed in subgroup analysis by route of administration).

Bradycardia was not reported in 12 studies, but the incidence heart rate (HR) was reported between groups, with 9 of them showing no significant difference in heart rate. In the remaining three cases, heart rate was reported to be lower in the magnesium group at some point after study drug administration.

Discuss

Our study showed that intravenous magnesium was effective in reducing tremors, although epidural and intraperitoneal methods were also effective. Postoperative magnesium supplementation did not increase the incidence of side effects. Intravenous magnesium was effective in preventing the tremors; In addition, a quality check of the articles revealed that 2I is zero, indicating slight heterogeneity. No further research is needed to show that intravenous magnesium is effective in preventing tremors [75-77]. In the previous review studies on this topic, only a few studies were included, and in our opinion, the quality of the evidence was not evaluated, and in our study, their weak points were eliminated [78].

This study of ours can be considered as an update of the previous systematic review by Chang et al., but some aspects were different between the studies. First, the word “shivering” was not used to search for texts in their analysis, while we reviewed all randomized control trials comparing magnesium and control. In addition, our search was without time limit [79].

While they limited the publications to the last ten years. Therefore, our search not only included the latest publications, but its scope was wider [75, 80, 81].

The cost of prescribing magnesium is low and our study showed that intravenous magnesium was not associated with an increase in adverse outcomes. Therefore, magnesium should be considered in patients at risk of chills, such as young patients or those who have undergone prolonged surgery [82], to prevent uncomfortable chills. In addition, patients with impaired cardiac reserve and heart failure due to chills benefit from active warm-up and pharmacological prophylaxis of chills. This should be taken into account in the patient’s hemodynamics. The mechanism by which magnesium exerts its anti-distortion effect is unclear. During general or neuraxial anesthesia, body temperature tends to drop due to dilation of blood vessels. Vasoconstriction and chills are automatic temperature regulation mechanisms that prevent hyperthermia. Tremors cause increased oxygen consumption and carbon dioxide production, require muscle oxygenation, and result in blood vessel dilation that counteracts vasoconstriction [83,84]. It may not be as effective in preventing hypothermia, but it can still be harmful in patients with limited cardiac reserve. General and spinal anesthesia have been reported to lower patients’ tremor threshold [85, 86].

The relationship between the effect of a dose of magnesium on the prevention of chills is unclear. A subgroup analysis by intravenous dose showed that less than 60 mg/kg magnesium sulfate would not increase tremor severity, but we were unable to determine the optimal dose from the results 8. Lowest intravenous dose among included studies 2 This was millimoles (300 mg magnesium sulfate) and although there was no statistical difference, the degree of shivering was lower in the magnesium group. Of note, only 12 studies comparing magnesium with intravenous magnesium showed a significant reduction in tremor frequency. We cannot conclude that intravenous magnesium sulfate up to 300 mg is effective in reducing chills [87].

The frequency of side effects did not increase with the administration of magnesium. Magnesium has been reported to have a sedative effect, but in our study postoperative magnesium administration did not result in sedation. Although magnesium has been shown to prolong the action of neuromuscular blockers [88], extubation time was not significantly increased in patients treated with magnesium. Magnesium has been associated with nausea and/or vomiting in some patient groups [89], but

this association has not been observed in the postoperative period. This may be due to savings in opioid use [90].

Some studies have shown that blood pressure or heart rate are significantly reduced after taking magnesium. Neither the previous nor our meta-analysis considered all studies evaluating the effectiveness of pruritus prevention. It might be worth investigating further in the future [91, 92].

In conclusion, as a result, a systematic review and a consistent analysis of previous studies have shown that intravenous magnesium significantly reduces chills in surgical patients.

A meta-analysis of studies did not show that epidural or intrathecal magnesium was effective in reducing tremor. And to determine the outcome, studies with a low risk of bias evaluating the anti-tremor effect of epidural and intracranial magnesium are needed.

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Since ethical approval from universities is not required for meta-analyses and systematic reviews, there is no code of ethics for this study. At this point, we are extremely grateful for the cooperation of Mr. Mojtaba Ismailpour, one of the most efficient people in collecting articles on this topic, who helped us a lot in preparing this article.

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