Journal of Research in Clinical Medicine

*J Res Clin Med*. 2026;14:35274
doi:10.34172/jrcm.026.35274
https://jrcm.tbzmed.ac.ir

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Review Article

# Propofol and magnesium sulfate for migraine management in emergency department: A systematic review

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**Article info**

**Article History:**
**Received:** February 24, 2024
**Revised:** August 30, 2025
**Accepted:** September 3, 2025
**ePublished:** May 9, 2026

**Keywords:**
Migraine, Magnesium sulfate, Propofol

**Abstract**

**Introduction:** Migraine is a prevalent condition that can affect 18% of the population. Propofol and magnesium sulfate can exert a therapeutic potential in pain management in patients with acute migraine attacks.

**Methods:** A semi-systematic review to investigate the efficacy of these two drugs was conducted. For the search strategy, PubMed, Embase, Google Scholar, and Cochrane Library were systematically searched. Finally, all randomized clinical trials were included.

**Results:** Eight studies met the criteria for inclusion in our review. Four investigated propofol, and four examined magnesium sulfate. No study compared these two drugs with each other.

**Conclusion:** Propofol demonstrated promising efficacy for pain control. Findings regarding magnesium sulfate were inconsistent. Overall, both agents appeared safe for administration in this patient population.

## Introduction

Migraine is a prevalent and debilitating neurological condition characterized by recurrent episodes of severe headache, often accompanied by various associated symptoms such as nausea, vomiting, and heightened sensitivity to light and sound (need reference). Affecting approximately 18% of the global population, migraines can significantly impair quality of life and daily functioning, making them a major public health concern. The disorder is classified into different types, primarily migraine without aura (MO) and migraine with aura (MA), each exhibiting distinct symptoms and characteristics, thereby necessitating tailored management approaches.[1,2]

Although the International Headache Society (HIS) has introduced NSAIDs and acetaminophen for mild and moderate attacks, wider groups of medications are needed for more severe attacks.[3] Besides selective receptor agonist 5-HT, steroids, and ergotamine, there are new options for pain control in migraine attacks. Propofol and magnesium sulfate are two of these options.[4-9] We reviewed the promising impact of these two drugs to assess their potential for migraine treatment in the emergency department.

## Methods

We conducted a systematic search of databases to find all available studies. We searched PubMed, Embase, WOS, and SCOPUS databases. A search question using PICO was designed as follows:

P: acute migraine patients
I: propofol OR magnesium sulfate
C: placebo
O: pain control

### *Search Strategy*

We employed the following keywords: migraine, propofol, magnesium sulfate, MgS, emergency department, emergency room, and emergency ward. All randomized clinical trials were eligible for inclusion. As the exclusion criteria, all non-English publications were excluded.

Study selection was conducted by screening titles, language, and study design. Two investigators independently assessed all eligible studies, and any disagreements were resolved by a third reviewer. Methodological quality was evaluated using the CONSORT checklist. The full search strategy is provided in Supplementary File 1.

## Results

We initially identified 987 records. After removing duplicates, 832 studies remained for screening. Based on title and abstract review, 824 studies were excluded, leaving eight for full critical appraisal. Four evaluated propofol and four assessed magnesium sulfate; none directly compared the two agents for the management of acute migraine. The propofol trials were published between 2012 and 2022, while the magnesium sulfate studies dated from 2001 to

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**Study Highlights**

***What is current knowledge?***

- the International Headache Society (HIS) has introduced NSAIDs and acetaminophen for mild and moderate attacks, wider groups of medications are needed for more severe attacks. Besides selective receptor agonist 5-HT, steroids, and ergotamine.

***What is new here?***

- Propofol demonstrates potential utility in managing migraine-related pain, whereas findings regarding magnesium sulfate are considerably conflicting. Nonetheless, both medications seem to be safe for use.

2005. Three studies originated in Iran, two in Türkiye, and one each in the United States, Brazil, and Australia. Across all included trials, 247 participants were enrolled in the magnesium sulfate studies and 269 in the propofol studies. One magnesium sulfate trial demonstrated clear selection bias, enrolling approximately 95 percent female participants. Figure 1 presents the PRISMA flow diagram summarizing the study selection process and initial search results."

***The Efficacy of Propofol Add-on Therapy in Migraine Management***

In the randomized, double-blinded study conducted by Moshtaghion et al., ninety cases were included in two groups. One group received 6mg subcutaneous sumatriptan, and the intervention group received 30 to 40 mg intravenous boluses, followed by 10 to 20 mg intermittent bolus doses to sedate the patients to a Ramsey score of 3 to 4. Pain intensity, need for antiemetic medication, and recurrence of symptoms were significantly lower in the propofol group. The authors concluded that propofol is equally effective as sumatriptan in controlling acute migraine attacks and has fewer side effects.[10] Another study by Soleimanpour et al. compared intravenous dexamethasone with intravenous propofol in 90 patients. In this prospective, randomized, double blind study, 10mg of propofol was administered every 5-10 minutes to a maximum dose of 80 mg. The results found propofol to be an effective and safe medication for migraine pain management.[1] In this line, a randomized controlled open-label study was also compared propofol to standard therapy in migraine attack management. Twenty-nine patients were analyzed in two groups. Patients in the propofol group had a lower time to discharge, and no safety concern was found in this subgroup of patients. However, the study did not have enough sample size and power to strongly indicate study safety parameters.[11] In addition, Farahmand Rad et al. conducted a triple-blind, randomized controlled trial to investigate the effectiveness of propofol/sumatriptan compared to sumatriptan/placebo in sixty patients. The results elegantly revealed that propofol add-on therapy with sumatriptan has the potential to increase the effectiveness of treatment.[12]

***The Potential of Magnesium Sulfate Add-on Therapy in Migraine Management***

In a single-blind, placebo-controlled randomized trial involving 30 participants, administration of 1 g of magnesium sulfate resulted in a favorable therapeutic response, in which 86% of patients experienced a complete analgesic effect, and in 14% subsided significantly. All patients tolerated treatment with no side effects. Therefore, it could be concluded that magnesium sulphate is a safe and effective candidate for pain control in acute migraine.[13] Another double-blind, randomized, placebo-controlled trial divided 44 patients into two groups. Group 1 received metoclopramide + magnesium sulphate, while group 2 received metoclopramide and a placebo. Unexpectedly, patients in group 1 showed a lower efficacy in pain reduction due to the contraindicated effect of magnesium on the effectiveness of metoclopramide.[14] For comparing magnesium sulfate, metoclopramide, and placebo, in a clinical study, patients received magnesium sulfate, metoclopramide, or placebo in three groups. The results indicated that patients in the magnesium and metoclopramide groups did not show a superior effect on pain control when compared with placebo.[15] However, a significant reduction in symptoms has been found following magnesium sulfate administration in migraine patients with aura.[5]

**Discussion**

Various studies have been conducted on migraine pain and pain control so far.[16,17,18] In this semi-systematic review article, we explored the potential of propofol and magnesium sulfate in pain management in patients with acute migraine attacks. Eight eligible studies were included in our study. All studies were randomized clinical trials with small sample sizes.

Propofol showed a promising therapeutic effect in this issue, and four studies showed its effectiveness and safety. All four studies found a significant difference between propofol add-on therapy in comparison with placebo or standard treatments.

Results for magnesium sulfate were inconclusive, and one study even indicated a negative effect. In this regard, Corbo et al. found that adding magnesium sulfate to metoclopramide reduced pain improvement. Notably, the study was limited by a small sample and substantial selection bias, with women comprising 95 percent of the participants.[4] While Demirkaya et al. reported that magnesium sulfate was effective for migraine management, Cete et al. found no significant difference between magnesium sulfate and placebo, and Bigal et al. observed benefit only among patients experiencing migraine with aura.[5, 13, 15] Overall, it can be concluded that both propofol and magnesium sulfate were safe to be

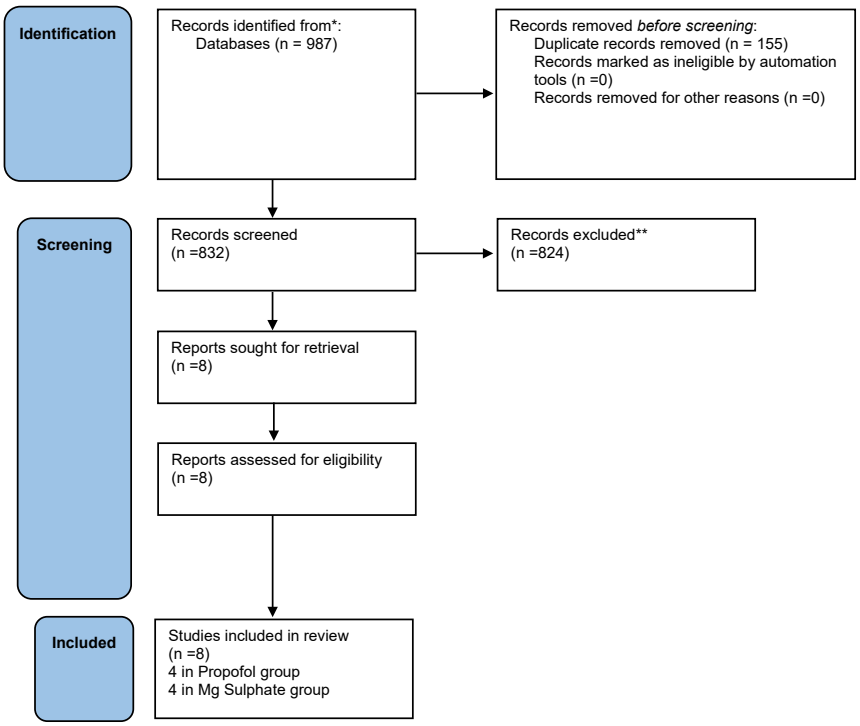


**Figure 1.** PRISMA flow diagram

administered in these eight studies.

## Limitations

No trials were found that evaluated these two medications head-to-head. The included studies were limited by small sample sizes, and the evidence on magnesium sulfate was notably outdated, with the latest study published over twenty years ago.

## Conclusion

Propofol demonstrates potential utility in managing migraine-related pain, whereas findings regarding magnesium sulfate are considerably conflicting. Nonetheless, both medications seem to be safe for use.

### Acknowledgments

The authors would like to appreciate the Clinical Research Development Unit, Imam Reza General Hospital, Tabriz, Iran, for their cooperation in conducting this research.

### Authors' Contribution

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### Competing Interests

There is no conflict of interest.

### Ethical Approval

This study was reviewed and approved by the Research Ethics Committee of Tabriz University of Medical Sciences (IR.TBZMED.VCR.REC.1403.151).

### Funding

Not applicable.

### Supplementary File

Search strategy.

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