Magnesium sulfate

- An observational study on comparison of dexmedetomidine and magnesium sulphate as adjuvants to bupivacaine for adductor canal block for postoperative analgesia in total knee replacement patients
- Hydrogen inhalation and intrathecal magnesium sulfate ameliorate ischemia by suppressing cortical spreading depolarization in a rat subarachnoid hemorrhage model
- Comparative Evaluation of analgesic efficacy of ketamine and magnesium sulfate as adjuvants to bupivacaine for scalp block in supratentorial Craniotomy: A Randomized, Double-Blind clinical study
- Efficacy of Magnesium Sulphate as an Adjunct to Lignocaine in Inferior Alveolar Nerve Block for Extraction of Mandibular Third Molar-A Split-Mouth Double-Blinded Randomized Controlled Trial
- The Efficacy of Magnesium Sulfate in Perioperative Multimodal Analgesia
- A blended opioid-free anesthesia protocol and regional parietal blocks in laparoscopic abdominal surgery- a randomized controlled trial
- Effects of labetalol plus magnesium sulfate on brain symptoms and pregnancy outcomes in hypertensive disorders of pregnancy
- Effect of perioperative magnesium sulfate on neurological outcome in neurosurgical patients: a randomized double-blind controlled trial

Supplemental magnesium sulfate has a potential neuroprotective role in acute brain injury. It is safe, widely available, and inexpensive.

Randomized Controlled Trials

A prospective randomized double-blind controlled study evaluated the effect of perioperative intravenous administration of magnesium sulfate on brain injury caused by neurosurgery.

Fifty adult patients undergoing supratentorial neurosurgery (25 were assigned to magnesium sulfate group and 26 to the control group). On arrival to the operating room, the intervention group received intravenous magnesium sulfate, 4 g bolus in 100 mL of 0.9% saline solution lasting 20 min followed by 20 g in 1000 mL saline lasting 24 h. The control group received the same volume of saline. Serum S100B-protein levels 2 h after surgery was the primary outcome. Secondary outcomes were neuron-specific enolase, magnetic resonance imaging (MRI) parameters, neuropsychological testing, Glasgow Outcome Scale, and mortality, during hospital stay and at six and 12 months after surgery.

Statistically significant differences in the primary outcome were not found. At six months, MRI showed a mean surgical cavity volume of 10.0 cm3 (95% confidence interval [CI] 4.4-15.6) in the magnesium group vs. 26.9 cm3 (95% CI 13.8-39.9) in controls (P=0.02), gliosis/edema in 55% vs. 90.5% (P=0.014), and contrast enhancement around the cavity in 33.3% vs. 80% (P=0.041), respectively. Patients in the magnesium group showed better scores in some neuropsychological tests. There were no relevant adverse effects in magnesium group.

Neurosurgical patients treated with supplemental magnesium sulfate showed macroscopic improvement in some MRI parameters related to blood-brain barrier permeability and better performance in some focal cognitive domain [1)]

The study suggests that perioperative magnesium sulfate may improve MRI markers of neuroprotection and some cognitive domains but does not significantly impact acute biochemical markers of brain injury (S100B). Given the small sample size and mixed results, further multicenter trials with larger cohorts and longer follow-up periods are needed to validate these findings.

Future research should: ✔ Evaluate the optimal dosing and timing of magnesium sulfate administration. ✔ Assess its effects on delayed neuroinflammation and functional recovery beyond six months. ✔ Include larger multicenter trials with diverse patient populations to improve generalizability. ✔ Incorporate more comprehensive neuropsychological and functional outcome measures to correlate MRI findings with clinical recovery.

Final Verdict While the study presents intriguing evidence supporting magnesium sulfate's potential neuroprotective role in neurosurgery, its clinical significance remains inconclusive due to methodological limitations. More robust, large-scale studies are necessary before magnesium sulfate can be recommended as a standard perioperative neuroprotective agent.

Indications

Magnesium sulfate is the preferred drug for use in the treatment of acute symptomatic seizures (ASS) of eclampsia [2].

Lehoczky et al. evaluated if magnesium sulfate (MgSO4) titration following fetoscopic spina bifida closure is associated with fewer maternal complications than the Management of Myelomeningocele Study (MOMS) tocolytic regimen.

This prospective cohort study included 73 consecutive patients undergoing fetoscopic closure of spina bifida between 2015 and 2020. A policy of using the MgSO4 regimen per the MOMS trial was changed to a flexible one in which MgSO4 was titrated according to the frequency of the uterine contractions following surgery. The frequency of maternal pulmonary edema, low maternal oxygen saturation requiring oxygen supplementation, atelectasis, hypocalcemia and preterm delivery was compared before and after the policy was changed.

A higher proportion of women in the group that used the MOMS MgSO4 regimen had pulmonary edema compared to those in the flexible one [26.1% (6/23) vs. 6% (3/50); p= 0.024). Multivariate analysis showed that the MOMS tocolytic regimen was independently associated with a higher risk of pulmonary edema (aOR: 8.57; 95% CI: 1.54-47.7; p= 0.014) than a flexible one. There was no difference in the rate of preterm delivery.

Following fetoscopic closure of spina bifida, the MOMS MgSO4 regimen is associated with an increased risk of pulmonary edema than a more flexible regimen [3].

Subarachnoid hemorrhage

see Magnesium sulfate for subarachnoid hemorrhage.

Traumatic brain injury

Intravenous infusion of magnesium sulfate prevents seizures in patients with eclampsia and brain edema after traumatic brain injury. Neuroprotection is achieved by controlling cerebral blood flow (CBF), intracranial pressure, neuronal glutamate release, and aquaporin-4 (Aqp4) expression. These factors are also thought to be involved in the development of brain edema in acute liver failure [4].

Combined therapy with progesterone and magnesium sulfate significantly attenuated trauma-induced neuronal death, increased brain VEGF levels and improved spatial memory deficits that appear later in life of immature rats [5].

Magnesium sulfate shows a tendency to improve the Glasgow Outcome Scale and Glasgow Coma Scale scores, which is a promising result for traumatic brain injury therapy. Further effort is necessary to explore which subgroup of traumatic brain injury patients could benefit from magnesium sulfate [6].

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