The Use of Intraoperative Intravenous Magnesium Sulfate To Reduce Postoperative Pain

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EVIDENCE-BASED PRACTICE

ABSTRACT

The use of non-opioid perioperative analgesic drugs such as intravenous magnesium sulfate has been advocated to reduce postoperative pain. It was unclear if intraoperative intravenous magnesium sulfate decreases postoperative opioid consumption and pain. The purpose of this work is to describe the evidence on the effectiveness of intraoperative intravenous magnesium sulfate in improving patient analgesia postoperatively. Six randomized controlled trials evaluating the effectiveness of intraoperative intravenous magnesium sulfate administration in decreasing postoperative opioid use and pain scores were critically appraised. The results of these studies consistently found patients who received intraoperative intravenous magnesium sulfate had lower pain scores and required less opioids postoperatively. Based on this evidence, a plan to implement a change in practice is described.

PICOT QUESTION

Do adult patients undergoing surgery (**P**) who receive intravenous magnesium sulfate intraoperatively (**I**) compared to patients who do not receive intravenous magnesium sulfate intraoperatively (**C**) have less pain and use fewer opioids (**O**) in the postoperative period (**T**)?

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EVIDENCE TABLE

Title Author Year	Study Type	Conclusions
Antinociceptive Effects of Magnesium Sulfate for Monitored Anesthesia Care during Hysteroscopy: A Randomized Controlled Study. Gao, P., Lin, J., Wang, S., Zhang, Y., Wang, G., Xu, Q., & Guo, X. (2020).	A randomized control trial	**50mg/kg in 100mL** Total dose of fentanyl given to patients in group magnesium was less than the one administered to group C (control group) [100 (75-150) vs 145 (75-175) ug, median (range); P<0.001]. In addition, patients receiving magnesium displayed lower VNRS scores at 15 min, 30 min, 1 hour, and 4 hours postoperatively.
Implementation of magnesium sulphate as an adjunct to multimodal analgesic approach for perioperative pain control in lumbar laminectomy surgery: A randomized placebo-controlled clinical trial. Tsaousi, G., Nikopoulou, A., Pezikoglou, I., Birba, V., & Grosomanidis, V. (2020).	A randomized placebo-controlled trial	**20mg/kg** Postoperative analgesics consumption in morphine iv equivalents (mean difference −9.24 [95 % CI −13.31, −5.17] mg; p = 0.001) and VAS scores at all-time points of assessment were lower in magnesium group; this effect peaked at 4 h (mean difference −2.15 [95 %CI −3.21,−1.09; p = 0.001]. Magnesium reduced intraoperative remifentanil consumption and prolonged the time-interval to first rescue analgesia (p < 0.01).
Magnesium sulfate for postoperative analgesia after surgery under spinal anesthesia. Shah, P. N., & Dhengle, Y. (2016).	A randomized controlled trial	**250mg bolus followed by infusion of 500 mg** The VAS score ranges were 0–3, 4–6 and 7–10. In the immediate postoperative period, no patient had a VAS score more than 6. One patient in the magnesium group and seven in the control group had a VAS score of 4–6, which was statistically significant ($p = 0.006$). Whereas at the 4-hour interval, seven patients in the magnesium group and 17 patients in the control group, had a VAS score of 4–6, which was also statistically significant ($p = 0.001$). A total of 18 patients in the magnesium group required rescue analgesia, amounting to 33.3% of the group. In the control group, 29 patients required rescue analgesia, amounting to 53.7% of the group. The lower number of patients in the magnesium group requiring rescue analgesia was also a statistically significant difference ($p = 0.033$). The control group required rescue analgesia earlier than the magnesium group. The magnesium group required rescue analgesia at 7.89 ± 4.31 hours, whereas the control group required it earlier at 4.59 ± 4.01 hours in the postoperative period ($p = 0.009$).
Magnesium sulfate improves postoperative analgesia in laparoscopic gynecologic surgeries: A double-blind randomized controlled trial. Sousa, A. M., Rosado, G. M., De Souza Brandão Neto, J., Guimarães, G. M. N., & Ashmawi, H. A. (2016).	A double blinded randomized control trial	**Bolus of 20 mg/kg over 20 min followed by 2 mg/kg/hr.** Patients that received magnesium had significantly lower morphine consumption compared with patients who received saline solution. Patients in group M (magnesium sulfate) consumed 3.38 and 5.7 mg of morphine; and group S (saline solution) consumed 5.7 and 12 mg of morphine after 60 minutes and 24 hours, respectively. In group M, morphine consumption was significantly lower than in group S. Time to first dose of morphine rescue in groups M, and S were 10, 5, and 5 minutes, respectively.
Magnesium and bladder discomfort after transurethral resection of bladder tumor. Park, J., Hong, J. S., Kim, D. H., Yu, J., Hwang, J., & Kim, Y. (2020).	A randomized control trial	**Bolus of 50 mg/kg, followed by an infusion of 15 mg/kg/hr.** The incidence of catheter-related bladder discomfort above a moderate grade at 0 h postoperatively was significantly lower in the magnesium group than in the control group (13 [22%] *vs*. 46 [77%]; $P < 0.001$; relative risk = 0.283; 95% CI, 0.171 to 0.467; absolute risk reduction = 0.55; number needed to treat = 2); similar results were observed for catheter-related bladder discomfort above a moderate grade at 1 and 2 h postoperatively (5 [8%] *vs*. 17 [28%]; $P = 0.005$; relative risk = 0.294; 95% CI, 0.116 to 0.746; and 1 [2%] *vs*. 14 [23%]; $P < 0.001$; relative risk = 0.071; 95% CI, 0.010 to 0.526, respectively). Patient satisfaction on a scale from 1 to 7 was significantly higher in the magnesium group than in the control group (5.1 ± 0.8 *vs*. 3.5 ± 1.0; $P < 0.001$; 95% CI, 1.281 to 1.919). Magnesium-related adverse effects were not significantly different between groups.
Effect of intraoperative magnesium infusion on perioperative analgesia in open cholecystectomy. Bhatia, A., Kashyap, L., Pawar, D. K., & Trikha, A. (2004).	A randomized control trial	**Bolus of 50 mg/kg, followed by an infusion of 15 mg/kg/hr.** The amount of morphine needed during the operation was statistically comparable, slightly less in the magnesium group. The VAS scores were comparable between the two groups. The magnesium group had significantly decreased pain levels on coughing at 0 and 1 hours following the procedure.

Evidence from 6 RCTs of surgical patients consistently found that receiving an intraoperative intravenous magnesium sulfate bolus followed by a magnesium sulfate infusion postoperatively decreased pain scores (immediately postoperative) and decreased total amount of opioid medication administration in 24h.

PRACTICE CHANGE

- CRNAs in a level II trauma center in Florida, were educated via a PowerPoint presentation on the evidence of intraoperative magnesium sulfate 2- 4 g to reduce postoperative pain and opioid use.
- Education was supplemented with a Q&A session and laminated flyers in the OR's.
- Post education, providers verbalized a strong interest in incorporating magnesium sulfate into their anesthetic plan of care.
- Additional practice change includes relocation of magnesium sulfate bags from remote areas to Omnicell in each OR to facilitate ease of administration.
- Data pending includes number of magnesium sulfate bags used 2 months prior to implementation and 2 months post implementation.

REFERENCES

WEBSITE