Magnesium Use for Paediatric Perioperative Analgesia: A Review of Current Evidence 2000-2020

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Introduction

Magnesium sulphate has been shown have efficacy in the management of post-operative pain in adults. [1] Results from research in adults cannot always be applied to paediatric practice due to differences to pharmacology, the types of surgical procedure undertaken, and the methods by which pain is measured and analgesic drugs are administered. No dosing studies have been carried out. [2] We wished to ascertain the breadth and depth of the current evidence base for magnesium use in the management of perioperative pain in children, results being used to inform current clinical practice.

Methods

A literature search carried out in December 2020 identified all articles relevant to the use of magnesium for the prevention and treatment of perioperative pain in children published between the years 2000 and 2020. Ovid Medline, PubMed, EMBASE and Cochrane Library were searched for the following terms; magnesium, children, paediatric, pediatric, anaesthesia, anesthesia, pain, analgesia.

Results 1: Type of Evidence

A total of 247 articles were returned once duplicates had been removed. Of these 37 were identified as being relevant. Articles that were excluded focused on the use of magnesium for other types of pain or other pathology (e.g. sickle cell crisis, asthma), or involved adult patients.

Table 1: Number of articles identified according to type of publication.

Type of Publication	Number
Original research	21
Systematic review or meta-analysis	5
Correspondence	2
Literature review	1
Conference abstract (original research)	1
Registered clinical trial with no associated publication	7
Total	**37**

Results 2: Operative Procedure

Table 2: Number of studies identified according to operative procedure.

Type of Procedure	Original Research	Systematic Review *
Tonsillectomy	10	3
Lower limb orthopaedic surgery	2	
Scoliosis surgery	3	
Lower abdominal/ inguinal	6	1
Strabismus surgery	1	

*Note: * the remaining systematic review included three studies, two looking at tonsillectomy and one looking at lower limb orthopaedic surgery, all of which are included in this literature review.*

References

1. Oliveira G, Castro-Alves L, Khan J, McCarthy R, Perioperative systemic magnesium to minimise postoperative pain, *Anesthesiology* 2013; 119(1): 178-190
2. Albrecht E, Kirkham K, Liu S, Brull R, Perioperative intravenous administration of magnesium sulphate and postoperative pain: a meta-analysis, *Anaesthesia* 2013; 68: 79-90

Results 3: Routes of Administration, Drug doses, Serum Levels

Table 3: Number of research studies according to the route of administration of magnesium; the dose ranges given; and the number of studies in which serum magnesium levels were measured.

Route of administration	Number of studies	Dose range	Number of studies in which plasma levels recorded
Intravenous	11	30-50 mg/kg bolus 10-15 mg/kg/hr infusion	4
Caudal	7	50 mg (total dose) with Ropivacaine or Bupivacaine	0
Local infiltration	3	2-5 mg/kg with Levobupivacaine or Ropivacaine	0
Local application (magnesium soaked gauze)	1	2 mg/kg applied for 3 minutes	0

Results 4: Outcome measures and Study Conclusions

Studies compared Magnesium administration with placebo or an alternative analgesic adjunct (Dexmedetomidine, Ketamine). Outcome measures for the studies included pain scores, analgesic duration, and post-operative analgesic requirements (time to first request, need for rescue analgesia, total postoperative analgesic consumption). 7 of 18 studies found magnesium to have a significant effect on postoperative pain scores. 14 of 22 studies found magnesium to have a significant effect on postoperative opioid consumption. No studies found any significant complications or adverse outcomes.

Figure 1: Study conclusions on efficacy of magnesium on reducing pain scores according to route of administration.

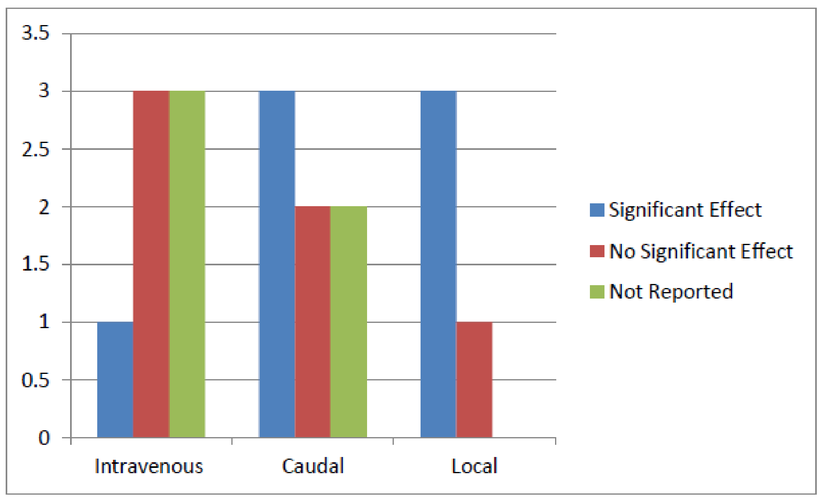
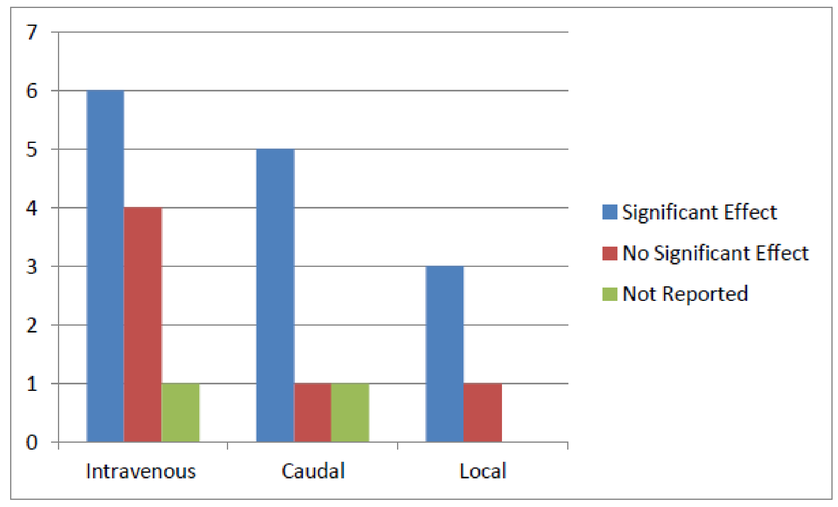


Figure 2: Study conclusions on efficacy of magnesium on reducing post-operative analgesic requirements (or duration of caudal block) according to route of administration.



Conclusions

There is currently a lack of specific evidence to support the routine use of magnesium in the treatment of perioperative pain in children. The published material focuses on just a few procedures which do not represent the full breadth of paediatric surgical practice. The exact role of magnesium in this context therefore remains unclear.