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Anaesthetic Implications Of Magnesium Sulphate With General Anaesthesia In Management Of Hemithyroidectomy

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Abstract

Magnesium sulphate is a versatile drug which has been used previously in preeclampsia patients, asthma, arrhythmias and acute respiratory failure. Recent attention has been drawn to its intraoperative effects in patients undergoing general anaesthesia. Benefits include potentiation of analgesia with sparing of muscle relaxant and inhalational anaesthetic. The role of magnesium in reducing analgesic requirements during the postoperative period has been demonstrated previously.2 Magnesium administration also leads to a significant reduction in analgesic consumption during the intra-operative period3. In this case report, we studied the interaction between magnesium sulphate and anaesthetic agents propofol, atracurium and isoflurane.

Keywords: Magnesium sulphate, Analgesia, Magnesium

Introduction

Magnesium is the fourth most abundant cation in the body[1] and second most abundant intracellular cation.[2] It plays a major role in various physiological processes in our body. It activates many of the enzymes involved in energy metabolism and acts as a natural calcium antagonist, regulating calcium access into the cell. [3]Among its other roles, the blockade of N-methyl-D-aspartate (NMDA) receptor and calcium channel is important from anaesthesia point of view. Although magnesium is not a primary analgesic in itself, it enhances the analgesic actions of more established analgesics as an adjuvant agent. Magnesium sulphate has been reported to be effective in perioperative pain treatment and in blunting somatic, autonomic and endocrine reflexes provoked by noxious stimuli.[4,5]

Case Report: A 48 year old female, weighing 58kg, presented in MGM Hospital, Kamothe OPD with a neck swelling in the left submandibular region. The swelling was insidious in onset, progressive in nature, not associated with dyspnoea or dysphagia. She was studied in an outside hospital where USG neck showed a large 3.6 * 3.4 * 2.7 cm, well defined cystic lesion in the left lobe of thyroid, causing mild deviation of trachea and IJV laterally. Fine needle aspiration was performed suggestive of colloid goitre with cystic degeneration. After a detailed history, clinical examination and physical evaluation, this patient was electively posted for left hemithyroidectomy.

Pre-anaesthetic check-up revealed a pulse rate of 90/min, blood pressure of 110/70mmHg and SPO2 of 98% on room air. Airway examination revealed an adequate mouth opening, intact dentition, Mallampati score I with air entry bilaterally equal on auscultation. Patient was a known case of diabetes mellitus, taking oral hypoglycaemic medication with blood glucose level within normal range. There was no history of any other comorbidity. Blood investigations and thyroid profile were within normal limits. Preoperative magnesium level was within normal range. ECG and chest X-ray were normal as

well. X-ray neck was done, showing a well-maintained tracheal air space and a soft tissue bulge over lower 1/3rd portion of neck anteriorly. Indirect laryngoscopy showed normal vocal cord movements. Patient was accepted as ASA II.

Patient was kept in a fasting state for 8 hours prior to surgery. It was decided that patient will be induced under general anaesthesia with infusion magnesium sulphate as an adjunct. Difficult airway trolley was kept on standby. In the preoperative room, monitors were attached to the patient and vitals recorded. Loading dose of magnesium sulphate was then administered (50mg/kg over 20 minutes). Hemodynamic stability was maintained throughout. Patient was taken inside the operating room, monitors were attached and vitals again recorded. Premedication was done with inj Glycopyrrolate 0.2mg, inj Midazolam 1mg and inj Fentanyl (2mcg/kg). Patient was then induced with inj Propofol (2mg/kg) and inj Atracurium(1mg/kg). Nasal intubation was done with flexometallic ETT no 7.0 for ease of access to surgical site and to avoid kinking of the tube. Patient was then maintained on O_2/air/Isoflurane and IV fluids.

After induction of general anaesthesia, infusion of magnesium sulphate (4000mg/50ml NS) was started at 15 mg/cc/h; according to body weight.

Intraoperatively, patient was maintained on isoflurane at 0.6% and a repeat dose of inj atracurium(1mg) was given only once. The anaesthetic course was uneventful, evidenced by very little variation in the haemodynamic status. Hemithyroidectomy required over 3 hours. Infusion magnesium sulphate was stopped at the time of skin closure.

The patient was reversed from anaesthesia with Inj Neostigmine (0.05mg/kg) and inj Glycopyrrolate (0.008mg/kg). Following satisfactory assessment of ventilatory and neuromuscular parameters , trachea was extubated smoothly. Patient was shifted to PACU for observation , where his ECG , urine output and Magnesium levels were assessed. All parameters were within normal limits. Patient was then shifted to general ward.

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Discussion

Balanced anaesthesia has four components: unconsciousness, muscle relaxation, analgesia and amnesia. In this case, a significant decrease was seen in the requirement of atracurium (duration of action = 30-35min) and isoflurane (MAC = 1.1) during general anaesthesia in the presence of a magnesium sulphate infusion. Magnesium administration led to a significant reduction in analgesic consumption during the intra-operative period[3] . No haemodynamic instability was seen associated with magnesium administration.

Magnesium sulphate has been proposed as a general anaesthetic [6,7] . Although magnesium was regarded as a central nervous system depressant, its anaesthetic effect was shown to result from cerebral hypoxia following progressive respiratory and cardiac depression, whereas on maintaining respiratory support no central nervous system depression was seen even at a very high serum concentration of magnesium[8].

Magnesium decreases the amount of acetylcholine released from the motor nerve terminal, leading to diminished excitability of the muscle fibre itself and reduction in the amplitude of the end plate potential. It therefore potentiates the neuromuscular blockade produced by non-depolarising neuromuscular blocking agents[9]. It decreases catecholamine release from the adrenal medulla and adrenergic nerve endings. It also reduces postoperative shivering and obtunds the pressor response to laryngoscopy and intubation by decreasing catecholamine release[1].

Magnesium sulphate is safe to use. Toxicity begins at serum concentration of 2.5–5 mmol litre^{-1},[10] Cardiac arrest occurs at 12.5 mmol litre^{-1}.[10] It also has a high therapeutic index and cost-effectiveness.

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