CASE REPORT

Accidental intrathecal injection of magnesium sulfate for cesarean section

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ABSTRACT

Magnesium sulfate is used frequently in the operation room and risks of wrong injection should be considered. A woman with history of pseudocholinesterase enzyme deficiency in the previous surgery was referred for cesarean operation. Magnesium sulfate of 700 mg (3.5 ml of 20% solution) was accidentally administered in the subarachnoid space. First, the patient had warm sensation and cutaneous anesthesia, but due to deep tissue pain, general anesthesia was induced by thiopental and atracurium. After the surgery, muscle relaxation and lethargy remained. At 8-10 h later, muscle strength improved and train of four (TOF) reached over 0.85, and then the endotracheal tube was removed. The patient was evaluated during the hospital stay and on the anesthesia clinic. No neurological symptoms, headache or backache were reported. Due to availability of magnesium sulfate, we should be careful for inadvertent intravenous, spinal and epidural injection; therefore before injection must be double checked.

Key words: *Accidental, cesarean section, intrathecal, magnesium sulfate*

INTRODUCTION

One of the challenging problems in the operating room is accidental injection of drugs in epidural and subarachnoid spaces. It can be safe such as labetalol and atracurium[1,2] to even death following injection of vindesine or[3] bortezomib.[4]

Magnesium sulfate is among the drugs, which is used in obstetrics department for prematurity and preeclampsia. Furthermore, this drug is used as an analgesic adjutant along with opioids and local anesthetics in spinal cavity.[5-8] In the operation room, accessibility of magnesium sulfate has also caused certain problems. In this report, the complications caused by wrong intrathecal injection of magnesium sulfate were discussed.

CASE REPORT

The present case report is about the patient 26-year-old gravid 2 para 1 woman with a history of classic cesarean section (due to lack of the fetal head descent) and delayed emergence of anesthesia for pseudocholinesterase enzyme deficiency. She was transferred to the operation room at 3 am for emergency cesarean section. At first, the patient received 200 cc Ringer and then was placed in a sitting position. We decided to induce spinal anesthesia and for reducing neurologic complications, we used 3.5 ml of lidocaine 2%. Spinal anesthesia was done by a 25-gauge Whitacre needle in L4-L5 space; after confirmation of the subarachnoid space and cerebrospinal fluid, 3.5 ml of the lidocaine 2% was injected. The patient was immediately placed in the supine position. After 5 min with T5 block level by pinprick, the surgery was started. Skin incision was performed painless. However, the patient had complained of pain with deep incision. Then general anesthesia was induced by 4 mg/kg sodium thiopental and 0.5 mg/kg atracurium (instead of succinylcholine). Sellick maneuver was used and after about 2 min, the patient was intubated and ventilated mechanically and isoflurane was used for maintenance.

Cesarean operation was done and newborn was born with Apgar 8 in the 1st min and Apgar 10 in the 5th min. We administered 150 mg fentanyl and 30 units of oxytocin on serum. The surgery was performed with no special problem and lasted for 40 min. At the end of surgery, 0.04 mg/kg neostigmine and 0.02 mg/kg atropine were injected. Her shallow breathing and muscle movements confirmed that muscle relaxation was not adequately restored. Neostigmine

Access this article online	
Quick Response Code:	Website: www.saudija.org
	DOI: 10.4103/1658-354X.140906

and atropine (half of the initial administration) were again injected after 15 min. Meanwhile, a used magnesium sulfate 20% vial was found on the table beside lidocaine 2% (same color, size and volume) and a suspicion emerged about wrong injection of magnesium sulfate 20% instead of lidocaine 2%. Then 50 μg/kg/min propofol and 1 mg midazolam were infused. Spinal fluid on lateral position with Whitaker needle no = 27 in L3-L4 space was obtained and also blood tests were used to confirm the issue; magnesium was positive in spinal fluid and was reported as 5.5 mmol/L in blood. The patient was transferred to the intensive care unit (ICU). Her muscle relaxation was evaluated every half an hour using train of four (TOF). 6 and 8 h after intrathecal magnesium injection, 0.7 and 0.85 TOF were observed, respectively. At this moment, propofol injection was stopped and endotracheal tube was removed. Limbs movements were good but the patient was unable to speak yet. After about 10 h, the patient was in full consciousness, had good muscular strength with hand grip and biting test, then she started breast feeding. After 24 h, she was transferred to ward. During the hospital stay (72 h), the patient's motor and sensory evaluations showed no sign of neurological toxicity; she had no backache and she was discharged. The patient visited the anesthesia clinic twice in 2 week interval; she was evaluated and had no neuromuscular problems.

DISCUSSION

Administration of magnesium sulfate as a supplement for local anesthetic medications and opioids in intrathecal space has been studied in recent years. Numerous articles have used 50-100 mg of magnesium sulfate in combination with morphine and bupivacaine 0.05% in lower limb surgery,[5] cesarean,[6] hysterectomy[7] and thoracotomy.[8]

Magnesium increases muscle relaxation performance and also prolongs clinical effects of succinylcholine and non-depolarizing muscle relaxants. It accelerates local anesthetics and is the non-competitive antagonist of N-methyl-D-aspartate (NMDA) receptors. It reduces central, peripheral and cardiac nerve conduction. It causes peripheral vasodilatation, mild tachycardia and bronchial dilatation.

Hypermagnesemia is usually induced due to iatrogenic reasons. Symptoms associated with increased magnesium depend on its blood levels. QRS complex widening, prolonged PR and QT are observed at 2-4 mmol/L levels. Hypoventilation, decreased tendon reflex and muscular weakness are seen at levels of 8-12 mmol/L. Hypotension, bradycardia and vasodilatation are also observed at level of 10-20 mmol/L and coma and apnea at 20-30 mmol/L levels.

Epidural injection of 500 mg of magnesium sulfate with morphine and bupivacaine in Sun *et al.* study had better and long-lasting post-operative pain relief after cesarean section, reduced post-operative analgesics and improved patient satisfaction within 24 h in comparison to bupivacaine alone or morphine with bupivacaine.[9]

A systematic review in 2013 by Morrison *et al.* evaluated intrathecal magnesium sulfate in 15 clinical trials. Longer duration of anesthesia was observed in non-pregnant patients with no evident difference between pregnant and non-pregnant groups in prevalence of hypotension and pruritus.[10] Another qualitative review by Albrecht *et al.* in the year 2013 reported earlier onset time in intrathecal and epidural magnesium sulfate groups with only one case of headache out of 140 patients.[11]

So far there are no clear reports for neurological effects and no reports of high dose of intrthecal magnesium sulfate in humans. In the rats, was compared between single dose of 3 mg magnesium sulfate and seven consecutive daily doses of 3 mg magnesium sulfate in spinal cavity. Pathological studies reported effects of nerve damage (neurodegeneration) in both groups.[12] Furthermore Saeki *et al.* showed that magnesium sulfate had no protective effects and increased risk of neural toxicity in rabbits.[13] In contrast, in another study on rabbits, subarachnoid magnesium sulfate decreased and delayed ischemia-induced complications and had protective effects on the spinal cord due to reduction in acute neuronal degeneration.[14]

Goodman *et al.* in their study have reported two cases of inadvertent epidural administration of magnesium sulfate as much as about 9 g with intervals of several hours that was used to control pain in pregnant women. None of the patients showed any sign of local neurological toxicity. One patient complained about weakness and mild consciousness disorder with increased serum level. The second patient reported mild backache and mild non-postural headache on the 2nd day after surgery which was improved on the 3rd day.[15]

Initial thermal changes and numbness of the skin followed by intrathecal magnesium sulfate may be due to local semi-anesthetic or NMDA effects; but, deep tissue had no proper analgesic effects for surgery. Systemic effects of magnesium sulfate are because of its vascular adsorption which is induced with delay. Complications of increased blood levels of magnesium sulfate on central and peripheral nerves and also facilitation of muscular relaxation effects of atracurium are among the reasons mentioned for prolonged muscular relaxation.

Due to availability of magnesium sulfate in the operation room, risks of wrong injection of medications should be

considered. According to the instructions, the medication should be always checked twice before injection. In the reported patient, accidental intrathecal injection of 700 mg magnesium sulfate was accompanied by muscular relaxation for about 8-10 h, which was maintained by mechanical ventilation, patient transfer to ICU, intravenous sedation injection and supportive measures with no long-lasting adverse neurological or mobility disorders.

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How to cite this article: Gilani MT, Zirak N, Razavi M. Accidental intrathecal injection of magnesium sulfate for cesarean section. Saudi J Anaesth 2014;8:562-4.

Source of Support: Nil. **Conflict of Interest:** None declared.