

Inadvertent intrathecal injection of large dose magnesium sulfate

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ABSTRACT

The case is a 35-year-old man who underwent spinal anesthesia for emergency strangulated inguinal hernia repair. About five minutes after 3 ml intrathecal drug injection, the patient suffered respiratory distress, bradycardia, hypotension and loss of consciousness. The patient was rapidly intubated and crystalloid infusion and epinephrine drip were established. Thereafter, he was admitted in intensive care unit. Search for the cause revealed us that 3 ml of magnesium sulfate (50%) was injected mistakenly for spinal anesthesia. Two days later, he was extubated and on the fifth day, he was discharged from the hospital without an obvious evidence of complication.

Key words: *Inadvertent intrathecal injection, magnesium sulfate, neurotoxicity, spinal anesthesia*

INTRODUCTION

Intrathecal administration of magnesium sulfate was used for preparing anesthesia in seven operations about a century ago.^[1] However, because of facing some complications, it had been abandoned. In recent years, magnesium sulfate was used as an intravenous drug in medicine or an adjuvant drug in spinal anesthesia.^[2,3] In a rat model, intrathecal injection of magnesium sulfate in an iso-osmolar concentration of 6.3% produced a state of spinal anesthesia and general sedation without any evidence of neurotoxicity.^[4] Mg²⁺ blocks the calcium channel in the N-methyl-d-aspartate (NMDA) receptor. It is a non-competitive blocker that blocks ion channels in a voltage-dependent fashion.^[5,6] The current case report focuses on a mistakenly subarachnoid large dose magnesium sulfate injection which progresses to a total spinal block.

CASE REPORT

The case was a 35-year-old man whom presented with

a strangulated inguinal hernia. He had been brought to the operating room at 3 AM in an emergent situation when the operating room personnel were tired and sleepy because of a previous busy night. Anesthesiologist chose spinal anesthesia in a sitting position with 3 ml of bupivacaine (0.5%). Immediately after drug injection, the patient laid himself down on a supine position. The anesthesiologist tilted his body about 10-15 degrees to a head-down position to reach a sensory block level up to T4-6. About five minutes later, the patient suffered respiratory distress, bradycardia, hypotension and loss of consciousness. He was intubated and simultaneously 1 mg intravenous atropine was injected. In spite of atropine injection, hypotension and bradycardia continued, which resulted in rapid infusion of normal saline and bolus injection of 100 µg epinephrine. Subsequently, IV epinephrine infusion (20-30 µg/min) was established because of unstable cardiovascular status. Searching for the source of problem revealed that 3 ml of magnesium sulfate 50% (1.5 g) was injected mistakenly instead of bupivacaine.

This mistake occurred because of two reasons: First, the similarity of the shape of drug containers and its labels [Figure 1] and second, the anesthesiologist was sleepy and careless.

After about one hour, his hemodynamic status became more stable while epinephrine drip at a lower infusion rate was continuing. However, he was totally paralyzed and unconscious; hence, the surgeon performed the

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Figure 1: Picture of bupivacaine (B/Braun) and magnesium sulfate (Shahid Ghazi) vials. Pay attention to similar color and graphics of the labels

herniorrhaphy, and epinephrine drip gradually was tapered and stopped up to the end of operation. At the end of the surgery, in spite of stable hemodynamic status, because of continuing unconsciousness and muscle paralysis, the intubated patient was transferred to intensive care unit (ICU). Hemodynamic monitoring and respiratory support at the ICU went on and morphine–midazolam infusion (1-2 mg/h) was established for preparing an acceptable sedation. After 24 h, he became fully conscious but because of residual muscle paresis, the patient couldn't be weaned from mechanical ventilation. Thus, he remained intubated and sedative drug infusion was continued up the next morning.

In the third day, the muscle power became better and finally the patient was successfully extubated. Thereafter, a lower limb physiotherapy was performed for about two days and he was able to walk on day 4. After taking an MRI of spinal cord which was normal, the patient was discharged on the fifth day. Three weeks later, an electromyography and a nerve conducting velocity study were performed that showed a normal result. The patient followed up for 6 months and fortunately he didn't show any obvious complication during that period. Permission for publication was obtained from the patient.

DISCUSSION

This is the first report of total spinal anesthesia due to inadvertent intrathecal injection of large dose magnesium sulfate. Lejuste MJ reported the first case of inadvertent subarachnoid injection of magnesium sulfate in a parturient woman. In that report, the patient complained of intense backache combined with leg paralysis after inadvertent injection of 2 ml magnesium sulfate (50%).

She was conscious with intact sensorium and no sign of sympathetic dysfunction was detected.^[7] The main differences between the current case and the previous one are the occurrence of severe sympathetic dysfunction and unconsciousness in the present case. Focusing on the two case scenarios reveals us the reasons of this difference: 1) Larger volume of magnesium was injected in the present case (3 ml vs. 2 ml); 2) The position of patient was tilted to a head-down position to achieve higher sensory block level in the present case; 3) The present case was anesthetized emergently, so a faster drug injection could be assumed; 4) In the present case, strangulated hernia may cause anorexia and relative dehydration, and subsequently a smaller volume of cerebrospinal fluid may lead to a rapid drug spread. 5) A raised intra-abdominal pressure due to intestinal obstruction may be another contributor to the rapid spread of the drug. Additionally, magnesium sulfate (50%) is a hypertonic solution and its spread is more dependent on gravity which is the case in a head-down tilt.^[8] Besides, it was found that intrathecal spread of hyperbaric solutions may be associated with an increased incidence of cardiorespiratory side-effects.^[9]

All above-mentioned facts can be regarded as the cause of such a rapid spread of the magnesium sulfate.^[10] It is noteworthy that duration of muscle weakness induced by magnesium sulfate lasted for a long time. This finding is in accordance with the study of Dayioglu *et al.* They found that addition of magnesium sulfate to local anesthetics during spinal anesthesia (because of residual muscle weakness) prolonged the time to ambulation.^[11]

CONCLUSION

We must emphasize on two factors which were the reasons for drug misadministration: (1) Personnel fatigue and (2) Similar shape of different drug containers. Thus, it is suggested that countermeasures (elimination of long work shifts, crosscheck and double-check technique, loudly reading of every drug label, placement of every drug in a particular shelf, etc.) must be meticulously considered in the operating room to prevent occurrence of such a disastrous event.

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