Inadvertent intrathecal injection of atracurium

Nahid Zirak, Ghasem Soltani, Naiere Ghomian, Mohamad Reza Hasanpour[1], Zahra Mashayekhi[2]

Department of Anesthesiology, [1]Anesthesiologist, [2]Obstetrics, Imam Reza Hospital, Faculty of Medicine, Mashhad University of Medical Sciences (MUMS), Mashhad, Iran

Address for correspondence:
Dr. Ghasem Soltani,
Department of Anesthesiology,
Imam Reza Hospital,
Mashhad University of Medical Sciences, Mashhad, Iran.
E-mail: telehealth.ir@gmail.com

ABSTRACT

This report relates how tracurium was given by mistake, intrathecally, during spinal anesthesia, to a 38-year-old woman, who was a candidate for abdominal hysterectomy. When no analgesia was observed, the mistake in giving the injection was understood. She was evaluated postoperatively by train of four ratio, measuring her breathing rate, eye opening, and protruding of tongue at one, two, twenty-four, and forty-eight hours, and then at one and two weeks, with the final evaluation the following month. The patient had normal timings during the operation and postoperation periods, and no abnormal findings were observed through the first month. This finding was contrary to several studies, which described adverse reactions due to accidental intrathecal injection of neuromuscular blocking drugs.

Key words: *Complication, spinal anesthesia, tracurium*

INTRODUCTION

Spinal anesthesia is common and used for many surgical procedures. Accidental administration of the wrong drug into the subarachnoid space may be associated with potential hazards.

The effects of neuromuscular blocking (NMB) agents in the cerebrospinal fluid (CSF) are unknown, although several observations have indicated that NMB drugs are not inert when injected into the CSF, resulting in adverse reactions like hemodynamic changes and muscular relaxation.[1,2]

With reference to Medline, and considering the incomplete information, we decided to report this case of an unintentional subarachnoid injection of tracurium, because there are no hemodynamic or neurological complications.

CASE REPORT

A 38-year-old woman (weighing 62 kg), with abnormal bleeding, was scheduled for an abdominal hysterectomy.

Access this article online	
Quick Response Code:	Website: www.saudija.org
	DOI: 10.4103/1658-354X.82811

Clinical history, physical examination, and biochemical tests showed normal values. We planned to use spinal anesthesia for her operation. After transferring her to the Operation Room, the intravenous (IV) line was accessed, with an 18 G angiocath, and 1.5 mg midazolam was injected intravenous and 500 ml of crystalloid fluid was administered. The electrocardiogram (ECG), noninvasive blood pressure (NIBP), heart rate (HR), and peripheral oxygen saturation (SpO_2) were measured with Saadat monitoring (Poyandegan). The Mean Arterial Pressure (MAP) and HR were 85 mmHg and 64 beat per minute, respectively. After explaining the procedure, the patient was laid down in the left lateral position. After aseptic preparation, local anesthesia was administered using 2 cc lidocaine 1%, and then a 25-gauge spinal needle was administrated in the subarachnoid space at the L3–L4 interspace, using a median approach. Appearance of CSF through the needle was confirmed by the subarachnoid position.

The drug ampoule, mistakenly containing 25 mg of tracurium (rather than a hyperbaric 0.5% bupivacaine solution, Marcaine-Spinal 0.5%; Astrazeneca AB. Sodertalje. Sweden) was drawn into the syringe and injected into the spinal space. This mistake was committed due to the similarity between the tracurium 25 mg ampoule (Glaxo Wellcome Company) and the bupivacaine solution. The active substance of the tracurium ampoule is atracurium besilate. The other ingredients are benzene sulfonic acid and water.

The patient was turned to the supine position, without a pillow under her head, and was observed for development of sensory and motor block. An assessment of the level of analgesia, through a pinprick test, was made five minutes later; at this time it was apparent there was no analgesia. After ten minutes, no sensory or motor block was yet seen, and at this point, we realized that the wrong ampoule had been injected, as the empty ampoule of tracurium (Glaxo Wellcome Company) was discovered.

At this stage, the patient was comfortable and without hemodynamic instability. MAP and HR were 80 mmHg and 78 beats per minute, respectively, and the patient was warmed with a blanket. Force, tonicity of peripheral extremity muscles, and reflex were evaluated, as well as upper and lower senses (with pinpricking and temperature tests); her spontaneous movements were normal, and the train of four (TOF) ratio was 60%. The patient's ability to breathe, to open her eyes, to protrude her tongue, and to swallow saliva was not affected. Intravenous crystalloid was infused as soon as possible. Monitoring was continued and the patient was observed for untoward signs and symptoms for 40 minutes and at that time the TOF ratio was at 75% and all clinical signs were normal. MAP and HR were normal, and the patient was comfortable. As the bleeding was modest, we decided to induce general anesthesia and operate on her once the TOF ratio reached more than 90% (at almost 50 minutes). Pre-induction MAP and HR were 75 mmHg and 74 beats per minute. Induction of anesthesia was done with thiopental Na 300 mg, fentanyl 150 µg, and tracurium 30 mg, and titrated with TOF monitoring, and when a TOF response was not seen, the patient was intubated. Anesthesia was maintained with propofol 100 µg/kg/minute, N_2O, and O_2 50%. Fentanyl 50 µg was administered every 25 – 30 minutes. The patient's muscular relaxation was monitored with a TOF with the Stimuplex HNS 11 nerve stimulator; a B-Braun Company device, every five minutes. During the operation, when the fourth TOF stimulus response appeared, we injected tracurium 10 mg. The intraoperative course was uneventful and the vital signs remained stable.

At the end of the surgery, at the appearance of the fourth response, the reverse of neuromuscular blockade (neostigmine 2.5 mg and atropine 1 mg) was administered. When an 80% TOF ratio was reached, the patient's trachea was extubated. In the recovery room the patient's ability to breathe, lift her head, and bend her knees was evaluated, and a tongue-depressor test was administered. When the TOF response was restored to >90%, the patient was transferred to the surgical ward and examined at one, two, twenty-four, and forty-eight hours, with all examinations reporting normal results. Sensory (pinpricking and temperature test), motor (spontaneous movement), and reflex maneuvers (upper and lower limbs) were evaluated at one week, two weeks, and one month.

DISCUSSION

Neuromuscular blocking drugs may activate or inhibit subtypes of nicotinic acetylcholine receptors in the central nervous system (CNS). The important difference between central and neuromuscular receptors is that the brain subtype of nicotinic acetylcholine receptors are seven times as permeable to calcium as neuromuscular junction receptors. Nondepolarizing NMB drugs are highly ionized. They are more lipophobic and rarely cross the blood-brain barrier.[1] Direct or accidental brain injections of NMB agents, such as gallamine or tubocurarine, have been associated with convulsions and neuronal damage.[2,3] The evidence showed that NMB causes excitement and seizures when administered into the CNS.[4]

There are several reports of accidental injection of NMB agents into the subarachnoid space. The accidental injection of small doses of gallamine or pancuronium into the CSF caused autonomic dysfunction and/or weakness in humans.[5,6] Our patient, however, showed no complications or adverse reactions. A metabolite of tracurium is laudanosine, which may contribute to seizure activity during an IV tracurium injection.[7] Our patient was generally comfortable, showed no agitation, and no seizures were observed.

Several studies have confirmed that NMB drugs in the CNS are pharmacologically active. Autonomic dysfunction, weakness, neuromuscular blockade, neuronal death, and seizures have been observed.[4,5,8] Salihoglu *et al.*, described generalized hypotonia, tachycardia, hypotension, diplopia, and general discomfort after an accidental subarachnoid injection of tracurium.[8] They thought that the hemodynamic changes were caused by direct histamine-releasing actions related to the intrathecal tracurium injection. The duration of the hemodynamic changes was short, and supported the idea of a histamine reaction from tracurium. However, in our patient we observed no short or long hemodynamic changes.

Peduto *et al.* recommended that the intrathecal injection of hyperbaric 1% bupivacaine solution, a few minutes after the accidental injection of an NMB into the subarachnoid space, could limit the diffusion of the NMB.[6] However, this injection (tracurium) could be harmful, due to the length of time an NMB may stay in the CSF, which might prolong the neural effects. Tracurium degraded through Hoffman elimination, and so pH and heat were very important. Therefore, prevention of hypothermia and warming with a blanket might be helpful in tracurium degradation. The

accidental spinal injection of tracurium in our patient was, fortunately, devoid of neurological sequelae.

CONCLUSION

In the present case, the accidental intrathecal injection of tracurium was safe, and no analgesia, sensory or motor block, hemodynamic changes or nerve disturbances were observed for one month.

REFERENCES

1. Szenohradszky J, Trevor AJ, Bickler P, Caldwell JE, Sharma ML, Rampil IJ, *et al.* Central nervous system effects of intrathecal muscle relaxants in rats. Anesth Analg 1993;76:1304-9.
2. Matteo RS, Pua EK, Khambatta HJ, Spector S. Cerebrospinal fluid levels of d-tubocurarine in man. Anesthesiology 1977;46:396-9.
3. Goonewardene TW, Sentheshanmuganathan S, Kamalanathan S, Kanagasunderam R. Accidental subarachnoid injection of gallamine. A case report. Br J Anaesth 1975;47:889-93.
4. Scheepstra GL, Vree TB, Crul JF, van de Pol F, Reekers-Ketting J. Convulsive effects and pharmacokinetics of laudanosine in the rat. Eur J Anaesthesiol 1986;3:371-83.
5. Mesry S, Baradaran J. Accidental intrathecal injection of gallamine triethiodide. Anaesthesia 1974;29:301-4.
6. Peduto VA, Gungui P, Di Martino MR, Napoleone M. Accidental subarachnoid injection of pancuronium. Anesth Analg 1989;69:516-7.
7. Cardone C, Szenohradszky J, Yost S, Bickler PE. Activation of brain acetylcholine receptors by neuromuscular blocking drugs. A possible mechanism of neurotoxicity. Anesthesiology 1994;80:1155-61.
8. Salihoglu Z, Demiroluk S, Kose Y. Accidental subarachnoid injection of atracurium: a case report. J Anesth 2002; 16:72-4.

How to cite this article: Zirak N, Soltani G, Ghomian N, Hasanpour MR, Mashayekhi Z. Inadvertent intrathecal injection of atracurium. Saudi J Anaesth 2011;5:223-5.

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