Regional anesthesia for Cesarean section is a popular anesthetic method and a subarachnoid injection of local anesthetics provides rapid onset and a reliable block. Furthermore, it maintains airway reflexes and consciousness of the parturient and is associated with less neonatal depression. Complications related with spinal anesthesia are most often postdural puncture headache, back pain, hematoma, abscess, paresthesia or motor weakness and very rarely, myoclonus. Generalized seizures as a complication following epidural anesthesia with bupivacaine has been reported, but rarely following spinal anesthesia. We present a case of a parturient who was well antenatally, but presented with generalized tonic-clonic seizures following delivery. Although the possible etiologic factors of these transient seizures after spinal anesthesia are difficult to clarify, we emphasize that careful airway monitoring after regional anesthesia is important.

Key Words: Bupivacaine, Generalized tonic-clonic seizure, Spinal anesthesia.

Spinal anesthesia has many advantages for Cesarean section; it avoids the necessity of airway manipulation, lessens the risk of gastric aspiration, avoids the use of depressant anesthetic drugs, and allows the patients to remain awake during delivery. Compared with general anesthesia, there is less immediate neonatal depression after neuraxial techniques [1,2]. Complications that can develop from spinal anesthesia are most often postdural puncture headache, back pain, hematoma, abscess, paresthesia or motor weakness and, very rarely, myoclonus [3,4]. Myoclonus that develops after anesthesia is usually limited to the lower limbs and can involve both the upper and lower limbs on one side of the body and the respiratory function and consciousness are well maintained [5-7]. We report a case of a parturient in whom bupivacaine was used as a spinal anesthetic for cesarean section, and immediately after delivery, the patient developed respiratory depression and generalized tonic-clonic seizures. We discuss the possible etiologic factors for seizures after delivery or spinal anesthesia, and the importance of appropriate airway monitoring and management during regional anesthesia.

**CASE REPORT**

A 27-year-old primipara, gravida 3, para 0 with a height of 160 cm, weight of 77.5 kg, 37 weeks and 3 days pregnant visited our hospital in labor. The patient had a medical history of being a hepatitis B carrier, and she had no other specific past medical history or family history. The obstetrician decided to perform emergency cesarean section for delivery of the baby because the non stress test (NST) showed late decelerations. All laboratory data including coagulation status were within normal limits on admission. Preoperative chest X-ray and electrocardiogram were normal, and the physical examination showed nothing unusual.

The patient was not premedicated before anesthesia, and her vital signs after arrival in the operating room were as follows: blood pressure 120/90 mmHg, pulse rate 80 beats/min, and arterial oxygen saturation 98%. While providing oxygen at 6 L/min through an oxygen mask, the patient was positioned in the right lateral decubitus position for spinal anesthesia. Using a 25 G Quincke needle, the spinal anesthesia was performed between the L3-4 intervertebral space using the midline approach. At the first attempt, free flow of cerebrospinal fluid...
was obtained, hyperbaric 0.5% bupivacaine 8 mg (bupivacaine HCl®, Hana Pharm, Korea) and epinephrine 0.1 mg (epinephrine®, Daehan Pharm, Korea) were slowly injected. To prevent hypotension, 500 ml of Hartmann’s solution was administered. Five minutes after the intrathecal injection of bupivacaine, sensory block was checked upto the T4 segment using pin-prick. The patient complained of nausea, so blood pressure was measured again, and it had dropped to 90/60 mmHg. Five milligram of ephedrine was injected intravenously and blood pressure and pulse rate were stabilized at 110/80 mmHg and 70 beats/min respectively. Seven minutes after the start of surgery, a healthy baby was delivered. As the placenta was expelled, 500 ml of hydroxyethyl starch (Voluven®, Fresenius KABI Korea, Germany) mixed with oxytocin (Oxyton®, Yuhan yanghang, Korea) 20 IU was administered for 20 minutes, and 0.2 mg of methylergometrine maleate (Methylergonovine®, Jeil Pharm, Korea) was injected intramuscularly. On the monitor, the patient’s respiratory rate was maintained at 15 breaths per minute, arterial oxygen saturation was 100% and end tidal CO₂ (ETCO₂) of 33 mmHg was noted. During the operation, the patient was alert and was communicating with the anesthesiologist and her blood pressure and heart rate were within normal range. Three minutes after delivery, the patient suddenly complained of dyspnea, sudden convulsions in both arms lasting for 5 seconds, and it was followed by loss of consciousness and apnea. Because she did not respond to any stimuli, 120 mg of propofol and 50 mg of succinylcholine were administered, and endotracheal intubation was performed. Oxygen flow of 6 L/min was effectively applied by manual bagging until the end of surgery. Immediately after intubation, her blood pressure was 120/80 mmHg, pulse was 90 beats/min, arterial oxygen saturation was 100%, and blood glucose level was 80 mg/dl. Thirty minutes later, spontaneous respiration returned, and after checking for the restoration of consciousness, the patient was extubated and moved to the postanesthetic care unit. Her postoperative course was initially uneventful. The patient was alert, and sensory block had receded to the L1 segment. When questioned later, the patient remembered feeling nauseated and a sensation of difficulty in breathing, and then she suddenly blacked out. The results of a neurological consultation showed that the GCS (Glasgow Coma Scale) score was 15 points, and there were no abnormalities in her neurological examination, electroencephalogram and brain CT. On the 6th postoperative day, the patient was discharged without sequelae or complications, and no additional episodes of convulsions developed during post-clinic observation.

**DISCUSSION**

Complications that can develop due to spinal anesthetic techniques are local anesthetic toxicity, neural injury or failure. Postdural puncture headache most often occurs in parturients and back pain, hematoma, abscess, paresthesia or motor weakness, and very rarely myoclonus may also occur [3,4]. Myoclonus that develops after spinal anesthesia is usually limited to the lower limbs and can involve both the upper and lower limbs unilaterally. There are no convulsions or change in consciousness, and patients generally recover without complications [3-7]. Systemic toxic reaction to local anesthetics occurs more commonly as a result of accidental intravascular injection and much less frequently following the injection of an excessive quantity of local anesthetics. Convulsions induced by local anesthetics have been reported twice in cases of epidural anesthesia using 0.75% bupivacaine, but whole-body convulsions after bupivacaine injection for spinal anesthesia are very rare [4]. Lee et al. [5] have reported a case of a patient with a history of epilepsy and who developed generalized status epilepticus, which seems to have been caused by psychological factors after spinal anesthesia using tetracaine. Song et al. [6] have reported continuous myoclonic seizures which developed after spinal anesthesia using tetracaine. However, tetracaine is an ester local anesthetic that is hydrolyzed in plasma by cholinesterase, which is not present in cerebrospinal fluid. This reaction causes tetracaine to remain for a long time in the cerebrospinal fluid causing the convulsions. However, bupivacaine is an amide, which is metabolized in the liver, and until now there have only been two reported cases of convulsions limited to the lower or upper limbs after spinal anesthesia using bupivacaine [7,8].

We experienced a case of a patient who developed perioperative respiratory depression and unconsciousness accompanying generalized tonic-clonic seizures after spinal anesthesia for cesarean section. We could consider that the local anesthetics directly affected the cerebral cortex thereby triggering the convulsion. Dyes injected into the subarachnoid space of the lumbar region travel slowly towards the head and find their way into the intracranial space, so if any medication administered into the subarachnoid space is retained in the body due to any reason, it can travel in the cerebrospinal fluid and reach the cerebral cortex [9]. Systemic toxicity induced by
local anesthesia is directly related to the plasma concentration of the medication, and this is decided by the amount administered, absorptivity, tissue distribution rate, and metabolism and excretion rates, and can also be influenced by the patient’s age, cardiovascular status and liver function. Symptoms of central nervous system toxicity associated with local anesthetics are dizziness and lightheadedness, difficulty focusing, tinnitus, drowsiness, disorientation, shivering, muscle twitches, and tremors originating in the face and limbs. If it progresses, it can lead to unconsciousness and generalized seizures accompanied by respiratory arrest. But the amount of the local anesthetic in spinal anesthesia is too small to cause systemic toxicity, and we have taken into consideration all the physiological circumstances during delivery and pregnancy.

First, gravidas have regions of higher sensory block than non-gravidas even with small amounts of spinal anesthesia. This is because the abdomen at full-term blocks the venous outlets and so there is a phenomenon of venous congestion in the veins of the epidural and subarachnoid space, and this causes a decrease in the subarachnoid space as well as in the amount of cerebrospinal fluid. In addition, lordosis in gravidas contributes to the spread of the anesthetic. Gravidas also have decreased number of proteins, albumin, and gamma globulin in the blood plasma, and these results in a decrease of the local anesthetic in the binding form and an increase in its free form, which allows a quicker and excessive movement of the drug from the cerebrospinal fluid into the blood [9]. However in this case, the level of sensory block after anesthesia was up to the T4 segment and was up to the L1 segment in the recovery room, so we can rule out respiratory depression due to a higher level of sensory block.

Second, the possible cause of unconsciousness was considered to be hypoglycemia, but the blood sugar level measured directly after the convulsive episode was 86 mg/dl, and the patient did not have underlying disease such as gestational diabetes.

Third, we could assume that the patient might be very frightened not only about anesthesia and delivery, but may also be feeling isolated in an unfamiliar surrounding. While awakening in the operating room, she could have faced many auditory and visual stimuli. These psychological factors may also interact with many other causes of seizures.

Fourth, we could consider that the patient hyperventilated during spinal anesthesia for cesarean section due to nervousness, which led to decrease in carbon dioxide and cerebral blood flow leading to convulsions [9]. Although ETCO₂ does not directly reflect the PaCO₂, ETCO₂ monitoring has been proven to be an acceptable alternative to arterial blood gas PCO₂ in many clinical circumstances. In this case, respiratory rate and ETCO₂ of the patient were maintained at almost within the normal range.

Fifth, convulsions caused by drop in blood flow can occur due to supine hypotensive syndrome and low blood pressure post-spinal anesthesia is frequently seen in gravidas, but stable blood pressure was maintained throughout the surgery in this case.

Sixth, we could suspect several types of brain damage that can cause convulsions such as cerebral hemorrhage. Kim et al. [10] experienced intracerebral hemorrhage after vesicolitholapaxy under spinal anesthesia, and Yildirim et al. [11] reported a case where subdural hemorrhage presented with headaches, high blood pressure and generalized seizures after spinal anesthesia in a gravida. However, in our case, there were no abnormalities on the brain CT taken postoperatively, so the cerebral causes can be excluded.

Seventh, Abouleish et al. [12] reported a case of a gravida developing hypertension and seizures after delivery following IV injection of oxytocin 10 IU and 0.2 mg of methylergometrine maleate. However, even if the methylergometrine maleate was injected slowly over a minute while monitoring the blood pressure, this is an unsafe procedure which only delays the hypertensive response for about three minutes, so it should always be injected intramuscularly. In our case, methylergometrine maleate was injected intramuscularly, and there were no specific changes in blood pressure after injection, so the medications used for uterine muscle contractions can be excluded as the cause for convulsions.

Treatment for seizures involves stopping the convulsion and rectifying the respiratory depression and metabolic acidosis that can develop in minutes. For this, benzodiazepine is administered and the airway is maintained, and oxygen should be provided through suitable ventilatory support. Muscle relaxants such as succinylcholine can restrain the convulsions by relaxing the muscles. Thiopental (1–2 mg/kg) stops the convulsions immediately, and diazepam increases the activity of gamma amino butyric acid (GABA), which increases the seizure threshold, and so it is effective in suppressing the convulsions. Propofol was used in our case, and Bansinath et al. [13] have reported that propofol adjusts the activity of GABA, glycine, and glutamate receptors thereby demonstrating an anticonvulsant effect, and Samra et al. [14] have also reported on the powerful anticonvulsant effect of propofol.
A healthy 27-year-old gravida developed sudden generalized tonic-clonic seizure episode, unconsciousness and respiratory depression after spinal anesthesia using bupivacaine 8 mg for cesarean section, and the convulsions stopped after immediate IV injection of propofol, succinylcholine followed by intubation and ventilatory support. Postoperatively, the patient recovered without any sequelae or complications; consequently, she was discharged six days later, and during further clinical observations, there were no additional convulsive episodes.

In our case, the factors which caused the convulsions could not be identified precisely, but it can be considered that the physiological and anatomical changes due to pregnancy increased the level of the anesthetic, while at the same time, increased blood absorptivity of the anesthetic, direct effect of the local anesthetic on the cerebral cortex, and anxiety or fear during the perioperative period were all responsible for the convulsive episode.

There is a general tendency to ‘drop one’s guard’ when dealing with conscious patients and this is referred to as ‘vigilance decrement’. Monitoring requirements for regional anesthesia should be just as stringent as those for general anesthesia. ETCO2 monitoring is usually not used in conscious patients, however, it is important to monitor the respiration of all patients undergoing operation.

In Conclusion, parturients can develop rare complications such as generalized tonic-clonic seizures accompanied by respiratory depression and unconsciousness after spinal anesthesia. Thus, it is critical to monitor the respiration and consciousness after spinal anesthesia, and emotionally stabilize the patient to prevent development of psychological factors such as fear and panic using both verbal sedation and nonverbal methods like music.

REFERENCES

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