Case Report

Accidental intradural injection during attempted epidural block
-A case report-

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Several cases of accidental subdural injection have been reported, but only few of them are known to be accidental intradural injection during epidural block. Therefore we would like to report our experience of accidental intradural injection. A 68-year-old female was referred to our pain clinic due to severe metastatic spinal pain. We performed a diagnostic epidural injection at T9/10 interspace under the C-arm guided X-ray view. Unlike the usual process of block, onset was delayed and sensory dermatomes were irregular range. We found out a dense collection of localized radio-opaque contrast media on the reviewed X-ray findings. These are characteristic of intradural injection and clearly different from the narrow wispy bands of contrast in the subdural space. (Korean J Anesthesiol 2011; 60: 205-208)

Key Words: Epidural block, Intradural, Subdural injection.

Subdural drug injections, which are often used during an epidural block, are not commonly reported, whereas little is known about intradural drug injection. Since an accidental subdural injection was reported by Dawkins [1] in 1969, typical 'rail-road track' spreading of contrast media in subdural injections has been reported [2,3]. In contrast, other cases have been reported in which the clinical pattern and contrast media spread pattern differed from those of previously known cases [4-6]. The latter cases suggest that there may be a second subdural space which is a part of the previously known subdural space but exists at a more superficial layer, essentially being an intradural space. Herein, we report our experience regarding a clinical procedure which appeared to be intradural drug injection during an epidural block. X-ray findings are also discussed.

Case Report

A 68-year-old female patient was hospitalized with the main complaint of spinal pain that had lasted for one month. The patient had undergone a rectal cancer operation two years earlier and, later on started undergoing anticancer treatment

continuously. However, metastasis in the lungs was found one year earlier. Lumbar MRI (magnetic resonance imaging) taken at the time of hospitalization showed evidence of metastatic cancer at the T9−L1 vertebral body, but the patient was transported to our department for pain management as the cancer was judged to be inoperable. The patient complained of 'collapsing' spinal pain on a VAS (visual analogue scale) 9 during an examination. The pain was tenderness from T9 to L1 along the mid-line. The pain became more severe when she changed position, stood up, or sat down, whereas it lessened in its severity to VAS 4 when she assumed a supine position. In a neurologic examination, the result of the straight leg raise test was normal, the deep tendon reflex was also normal, and no weakened muscle strength or hypoesthesia was found. The patient was not able to take oral analgesics due to nausea and vomiting. Although 25 μg/hr through a fentanyl patch was administered, pain relief was incomplete. When the patient complained of breakthrough pain, an intravenous injection of 30 mg of ketorolac or 25 mg of pethidine was carried out four or more times per day. This reduced the pain to VAS 2 for only one hour, marking the effective duration of the analgesic.

An explanation of the diagnostic epidural block was given to the patient and a dorsal spine epidural block was performed after obtaining her consent to the operation. With the patient in the prone position, the T9/10 interspace was checked under C-arm guidance and the puncture point was marked at the center line. After the skin around the puncture point was disinfected with a betadine solution, we carried out local anesthesia with 1% mepivacaine 3 ml and used an 18-gauge Tuohy needle to make the initial puncture. Applying the loss of resistance technique via imaging and normal saline, the epidural space was verified. After checking that there was no

regurgitation of cerebrospinal fluid or blood, 5 ml of contrast media was injected. Images were taken after verifying that the contrast media had not been injected into a blood vessel or the subarachnoid space through an anteroposterior view and an oblique view, and a mixture of 0.125% bupivacaine 6 ml and triamcinolone 20 mg was then injected. The patient's pain score did not change immediately after the drug injection, but after 30 minutes, the pain was reduced to VAS 2. The vital signs of the patient were continuously measured and no variation from the normal state was noted. Her consciousness was also normal. There was no abnormal finding, such as dizziness or respiratory distress. After one and half hour of hypoesthesia, the patient was recovered from sensory block and moved to the ward.

Although the pain score was reduced for a while, we reviewed the developed X-ray film in an effort to determine why the nerve block effect was so late in working and whether the blocked neuromeres were irregular. We found that the contrast media had collected at the central part of the spinal canal in an irregular pattern, as shown in the anteroposterior view (Fig. 1), and that it had not spread into the nerve root. An oblique view (Fig. 2) showed that the contrast media was collected in a bulging pattern at the rear side of the intrathecal space, which indicated that the injection was not a subarachnoid injection and that it differed from a common epidurogram result.

Subsequent pain control in the ward was carried out using a substitutive fentanyl patch (50 μg/hr) every third day and oral administration of the short-acting analgesic IR-codon at 5 mg a day. The patient stopped complaining of severe pain (VAS 2−3), and a continuous epidural block was therefore not utilized. In a follow-up after about 4 months, the pain was reported to be well controlled without an increase in the use of analgesics or specific complications.
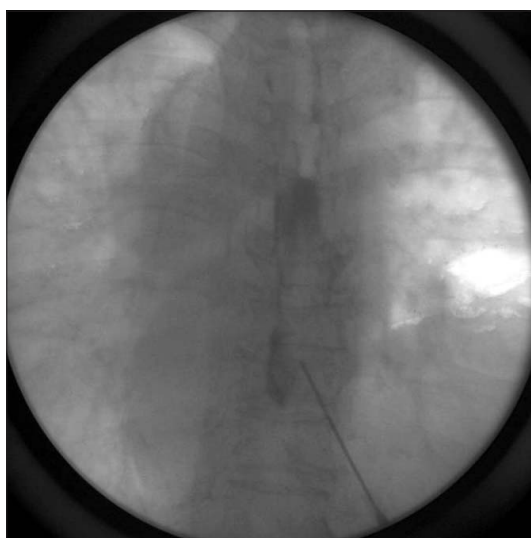

Fig. 1. AP view of T-spine X-ray after injection of radiopaque dye

Fig. 2. Oblique view of T-spine X-ray after injection of radiopaque dye

Discussion

The clinical characteristics of an accidental subdural injection include a situation in which a broad range of neuromeres are blocked despite the fact that only a tiny amount of the local anesthetic was injected, the onset of the anesthetic effect then being slower than that of an epidural injection. Hence, without sufficient attention to detail, assuming that a subarachnoid block is non-existent because there is no aspiration of cerebrospinal fluid, an embarrassing situation may arise as an unexpectedly high level of anesthesia may arise 15−35 minutes after the injection of the drug. Moreover, hypotension can occur due to the wide range of the sympathetic block, and respiratory distress or even unconsciousness or apnea may occur in the event of a respiratory muscle block. The recovery is rapid within 2 hours in general [4,7,8]. In the case where there is no evidence of a nerve block even after the expected onset time, it is reasonable to verify the subdural injection by the injection of contrast media through a catheter, when catheterization has been conducted, due to the probability of drug injection into the subdural space [9]. In particular, in the case of a cervical or thoracic epidural block, it is important to confirm the epidural injection by injection of contrast media, even when the single injection technique is performed, as the cervical space or thoracic epidural space is narrower than the lumbar region.

Since the findings of radioactivity in the subdural injections during epidural anesthesia in 1975 by Boys and Norman [2], there have been many reports of radioactivity in subdural injections. For a normal epidurogram, a pattern resembling a Christmas tree is found as the contrast media is discharged through the intervertebral foramen. In contrast, in the case of a subdural injection, the contrast media is widely distributed to many spinal segments up and down in a narrow pillar form, as characterized by the 'rail-road track' pattern in the anteroposterior view. The contrast media in the subdural space shows a pattern of very uniform density, with the boundary well distinguished. This is occasionally found in the anterior subdural space, but it is usually found at the rear side and along the post-external boundary, having a long shape. The nerve root is not distinguished even when the contrast media has spread widely in the subdural space [3].

There are other reports of contrast media imaging that differ from those associated with typical epidurograms or subdurograms. Collier [4] reviewed the epidurogram images of the 35 patients in an obstetrician department in which inappropriate epidural anesthesia was performed and found in four of the patients that the contrast media had collected locally around the injected segment rather than being widely spread, as in the case of a subdural injection. It was also reported that, in an epidural injection in the cervical spine, the contrast media had collected at the central part in the anteroposterior view, showing the boundary of a bulging shape at the rear side of the spinal canal from an oblique view [5]. Ajar et al. [6] also suggested there may be another space other than the subdural space with respect to images that are different from that of a typical subdural injection.

Reina et al. [10] reported, based on their electro microscopic observations, that the subdural space is the part that is formed by the splitting of the dural membrane-arachnoid membrane boundary surface by trauma. A drug is injected into the space formed by the splitting of the surface by mechanical force or by an air or liquid injection, and this space has been considered the subdural space. They termed another distinguishable space in the subdural space the secondary subdural space. The secondary subdural space is located closer to the superficial layer than the subdural space; it is located between twofold dural membranes. In the secondary subdural space, which is actually the intradural space, collagenous fibers, the main component of the dural membrane, are relatively rare when compared with other dural spaces. The images show that, when a drug is injected into this space, the thin layers of the dural membrane are separated and the drug is not widely spread but instead swells up, as a balloon would. When more of the drug is injected, some of the drug may be discharged into the epidural space. Alternatively, it can flow into the subdural space or subarachnoid space, damaging the anterior layer of the dural membrane or the arachnoid membrane.

Collier [11] examined via an epidurogram 10 patients who appeared to have undergone an intradural block. In radiographic images after the initial drug injection, all 10 patients showed a pattern of densely collected contrast media. Their clinical patterns were similar to that of a subdural injection in that the onset was 20−40 minutes slower, but it was characterized by limited drug spreading which was often unilateral, blocking a limited number of spinal segments. Some of the patients complained of dull back pain for a moment after catheterization or drug injection. When contrast media was injected, it flowed into the epidural space in 60% of the patients, into the subarachnoid space in 10% of the patients, and into the subdural space in the remaining 30% of the patients. An additional injection of a local anesthetic led to a satisfying block effect 15−30 minutes later in 8 of the patients, as if the onset of epidural injection had finally occurred. However, after one hour, a total spinal block and high subdural block took place in 2 of the patients, respectively, due to the wide segment block range.

Thus far, intradural blocks have been considered as one type of subdural block, as the concept has not been distinctively established. Thus, the prevalence rate of the use of an intradural injection remains unknown. It was reported that the

incidence of subdural anesthesia that took place during a spinal epidural anesthesia attempt was 0.82% [12]. It is assumed that an intradural block actually takes place at a rate higher than that of a subdural block because judgment regarding an intradural injection requires an injection of contrast media as well as verification through radiographs. When drug onset was slow during epidural anesthesia, the possibility of intradural anesthesia must have been neglected in many cases.

When the contrast media shows a pattern that suggests an intradural injection, judgment should be made considering various possibilities. As identification can be challenging with a modest amount of contrast media, an additional injection of it may be required to check the typical spread pattern to the epidural space if the case is not well confirmed. To do this, accurate knowledge and understanding of the contrast spread patterns of contrast media in epidural, subdural and subarachnoid spaces is necessary. In addition, preparation should be made against unexpected and/or severe symptoms. It should be seriously considered that additional drug injection may cause a total spinal block or high subdural anesthesia.

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