

A Case of Acute Spinal Epidural Hematoma after Abdominal Aortic Aneurysm Operation

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A 76-year-old man who had an abdominal aortic aneurysm underwent vascular replacement, and an acute spinal epidural hematoma developed postoperatively despite the absence of abnormal preoperative laboratory data other than hypertension. General anesthesia was induced using nitrous oxide, oxygen, and sevoflurane (GOS), and epidural anesthesia was also performed at the intervertebral space between Th10 and Th11. At 5 days after operation, an emergency operation was carried out to remove the epidural hematoma, which was noted at the Th5-Th9 vertebral level. The patient's clinical course was relatively favorable, and he was eventually able to walk with a stick.

The cause of this acute hematoma remains unclear, but the following important factors might have been involved in its development: a transient bleeding tendency caused by intraoperative use of heparin as well as adverse effects to the epidural blood vessels due to an increased venous pressure following the surgical procedures.

Our patient, fortunately, had no significant sequelae. However, when performing epidural anesthesia, it is necessary to keep in mind that epidural hematoma, though observed very rarely, may develop, particularly in patients with a tendency for bleeding.

Key words: epidural hematoma, epidural anesthesia, abdominal aortic aneurysm

Epidural hematoma as a complication of epidural anesthesia is very rare, however, this condition is occasionally associated with serious clinical symptoms, especially noted in patients with a bleeding tendency [13]. We describe herein a case of acute spinal epidural hematoma developed after vascular graft surgery for repairing an abdominal aortic aneurysm.

CASE REPORT

The patient was a 76-year-old man with a height of 152 cm and a body weight of 45 kg. He had a medical history of hypertension, which was managed by oral treatment with amlodipine.

He was diagnosed with an abdominal aortic aneurysm 3 or 4 years ago, and had been followed up since the diagnosis. The patient was admitted to our hospital for the purpose of repairing his abdominal aortic aneurysm. Vascular replacement was performed using a Y graft. The aortic aneurysm was found to be peripheral to the renal artery, with a diameter of 6.5 cm based on the computed tomography data.

No abnormal laboratory data was obtained preoperatively, except a hemoglobin of 11.7 g/dl indicating mild anemia. Other laboratory values related to blood coagulation were a platelet count of $19.2 \times 10^4/\text{mm}^3$, a bleeding time of 4 minutes, and a prothrombin time of 12.7 seconds (84%), suggesting no bleeding tendency.

INTRAOPERATIVE COURSE

The patient was administered 150 mg of ranitidine hydrochloride and 5 mg of diazepam orally as preanes-

thetics one hour before being transported to the operating room. After entering the operating room, the patient was equipped with monitoring devices including an electrocardiograph, a blood pressure manometer, and a pulse oximeter, and a 19-Ga epidural catheter (Arrow Epidural Anesthesia Catheter Set, Arrow Japan, Ltd.) was inserted at the intervertebral space between Th10 and Th11 about 10 cm cephalad from the skin puncture site. The needle puncture was performed smoothly, and the catheter was also perfectly inserted into the epidural cavity without any problems such as hemorrhage.

Anesthesia was induced with 50 µg of fentanyl and 80 mg of propofol, and an endotracheal tube was inserted using 6 mg of vecuronium bromide. The anesthesia was maintained with oxygen 33%, nitrous oxide 66%, sevoflurane, fentanyl, and epidural anesthesia. Epidural anesthesia was induced by injecting 1% xylocaine hydrochloride as required via the catheter. During the course of the operation, dopamine and prostaglandin E₁ was infused intravenously as needed.

The activated clotting time (ACT) increased to 313 seconds after intravenous administration of 4 ml heparin prior to clamping the aorta, but the ACT returned to the normal range (127 seconds) by injecting 3 ml protamine after the completion of vascular anastomosis. No abnormal values were noted in blood pressure, arterial blood gas analysis, and electrolytes during the course of the operation.

On completion of surgery, the patient was awake but with a slightly decreased level of consciousness. He



Fig. 1 Preoperative MRI (Sagittal Image)

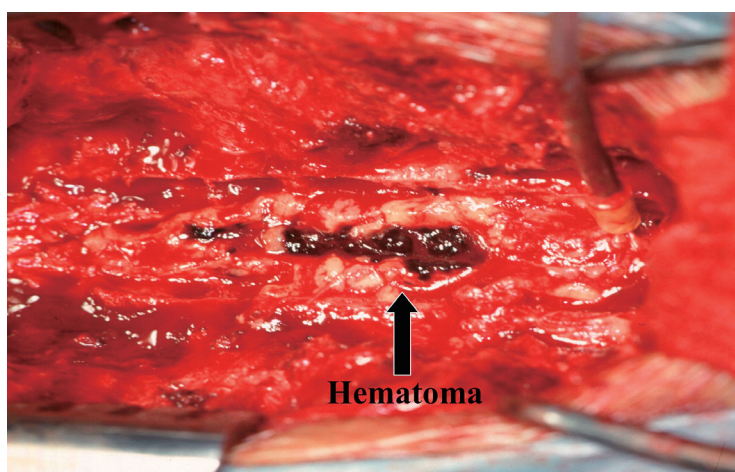


Fig. 2 Intraoperative views
Intra thoracic epidural hematoma (level from 5 to 9) presses the spinal cord. And there is no macroscopic abnormality of blood vessel system.

was able to answer the physician's call and also respond slowly to commands. As the patient's respiration was normal, the tracheal tube was removed. After removal of the tube, the patient's sensory perception did not appear to improve, but he could move his toes. No abnormalities were noted in respiratory or circulatory functions, and the patient was transferred to the intensive care unit. The duration of operation was 4 hours and 35 minutes, and that of anesthesia was 5 hours and 46 minutes. Postoperative pain was controlled using a mixture of 400 µg of fentanyl, 200 ml of 0.2% ropivacaine, and 32 ml of physiological saline (to be given over 48 hours) by epidural infusion at a rate of 5 ml/hr.

POSTOPERATIVE COURSE

On the morning of the day following surgery, the patient was conscious and could move his toes with no abnormal sense of touch, but the lower limbs remained unmovable, and the patient was unable to kneel. The epidural infusion was discontinued, and the patient's condition was monitored. As no symptomatic improvements were noted, the epidural catheter was removed

about 4 hours after the start of infusion. No abnormal clinical findings were found after removal of the catheter. At 2 days after operation, the patient seemed to have tactile sensation, though differing between the right and left feet. The left leg could barely be moved, and the right leg was weak. If so, we consulted neurologists about the symptoms of this patient, weakness of sensory and motor sensation in both of his lower extremities was pointed out. About bladder function was unknown. As the results of his conditions, the possibility of spinal ischemia that was associated with surgical procedure and influences of epidural anesthesia were suggested. Subsequently, the patient was followed up. The symptoms did not improve, and on the day 4th post operation, the orthopedist requested a magnetic resonance imaging of the chest, which revealed an epidural hematoma at the level of from Th4 to Th7 (Fig. 1). The hematoma, for which an orthopedic surgical intervention was indicated, was considered the causative factor of the patient's condition. On the following day, an emergency operation was carried out, consisting of Th5-Th9 laminectomy from the Th5 to Th9 vertebrae and removal of the epidural hematoma of the thoracic

Table 1 Values of Hemostatic Variables Allowing Institution of Central Nervous Blokade (Vandermeulen *et al.* 1994)

	Without Problem
PT	> 50% (INR < 1.5)
PTT	Upper limit of normal
Platelets	> 80000/ μ l-1
Bleeding time	< 8min

vertebrae.

During the surgery, a hematoma was noted in the epidural space at the Th5-9 level, compressing the spinal cord. However, macroscopically no abnormal vascular findings were observed (Fig. 2). And more, there were no abnormalities in microscopic findings. Also, the pathological examination performed later revealed no abnormality such as vascular deformity.

The postoperative course was uneventful. The patient was able to kneel on the day 30th post operation and to walk with a stick on the day 60th post operation. He was then discharged from the hospital.

DISCUSSION

Epidural hematoma is associated with epidural anesthesia, with a rare incidence of one per 150,000 [8] or 190,000 [13] epidurally anesthetized patients. This complication is reportedly observed more frequently in patients with a bleeding tendency [13], including those with coagulation disorders [3], thrombocytopenia, preoperative low-molecular heparin, and chronic renal failure [1]. Additional risk factors such as difficult catheter insertion and spinal canal lesions have also been reported [13], and a study has described the association between epidural hematoma and high-dose corticosteroids [7]. Vandermeulen *et al.* [11] assessed 46 patients with epidural hematoma observed between 1906 and 1994 from different perspectives, especially in terms of the relationship with anticoagulant therapy. Of these 46 patients, 10 (approximately 22%) were found to have no coagulation abnormalities requiring anticoagulation therapy.

As the incidence of epidural hematoma is lower in patients with no abnormalities in the blood coagulation system, laboratory reference ranges related to blood coagulation has been provided for epidural or spinal anesthesia (Table 1) [11]. Generally, an epidural puncture may be performed with no problem in patients who have laboratory values within these reference ranges. One study showed that intra- or post-operative heparin therapy has not caused epidural hematoma due to spinal and epidural anesthesia if such a therapy is given in patients whose ACT is no greater than twice the reference ranges [9]. However, these ranges do not seem to be absolute criteria, because a case report described a patient in whom epidural hematoma developed following subcutaneous heparin given after surgery for gastric cancer [10].

In the present case, no abnormal preoperative laboratory values related to blood coagulation were obtained, and the epidural catheter was inserted smoothly. However, a causal relationship between the

hematoma and the epidural catheter inserted at the intervertebral space between Th10 and Th11 cannot be ruled out, because the hematoma existed from the Th5 to Th9 level. However, the hematoma is unlikely to develop due to insertion of the epidural catheter, because magnetic resonance imaging data and intraoperative findings suggested that the hematoma might have spread downward from the upper thoracic vertebral level. The frequency of vascular damage due to insertion of an epidural catheter has been reported to be approximately 3 to 18 [5, 12].

Epidural hematoma may also develop at the time of removal of an epidural catheter [2, 4]. Even once the tissue injured at the time of catheter insertion has healed, it may be damaged again at the time of catheter removal, possibly resulting in hematoma formation. In the present patient, hemorrhage was unlikely to occur at the time of removal of the catheter because symptoms suggesting muscular weakness had already developed prior to catheter removal, but the possibility of hemorrhage cannot be ruled out. The patient had no complaint of pain at the onset of the epidural hematoma, whereas a very intense pain or back pain reportedly occurs at the onset of such a hematoma.

In view of these findings, we investigated the possibility of non-traumatic epidural hematoma in the present case. Non-traumatic epidural hematoma is a rare disorder, and to date it has been reported in only about 30 patients [6]. A causal relationship has been clarified in 60% of these patients; the most common cause has been described as an increase in bleeding time due to anticoagulant therapy, impairment of hepatic function, or antirheumatic drugs, but only a few of these causes have been histologically verified. The mechanism of hemorrhage has been considered as follows: the epidural venous plexus may damage due to elevation in venous pressure consequent on increased abdominal pressure, thereby leading further to mechanical extension and an eventual laceration of the epidural bridging artery.

In the present case, there is the possibility the blood vessels might be damaged in the epidural cavity due to elevation in venous pressure associated with the operative procedures and in addition, intraoperative heparin infusion might contribute to the development of hematoma. Furthermore, it cannot be ruled out that the catheter placed in the epidural cavity was possibly involved in the above process. In other words, the acute epidural hematoma occurred in the context of the following situations: the patient temporarily had a bleeding tendency due to intraoperative heparin infusion, the blood vessels were more vulnerable to injury in the

epidural cavity, and the catheter was placed in the epidural cavity. Therefore, careful consideration is necessary when an epidural catheter is used during surgical procedures using a drug that may cause a hemorrhagic tendency. In addition, it should be kept in mind that a hematoma may occur at the time of catheter removal.

As described above, an epidural hematoma developed postoperatively in the present case following thoracic epidural block even when no abnormalities had been observed in preoperative laboratory values related to blood coagulation. It is important to recognize the potential risk of an epidural hematoma if a transient bleeding tendency occurs due to intraoperative heparin use with a concurrent risk of vascular damage associated with operative procedures.

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