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Spinal epidural pressure as a less-invasive monitoring of intracranial pressure: report of two cases of encephalitis

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Introduction

We often experience an increase in intracranial pressure (ICP) in patients with encephalitis. For ICP monitoring in patients with head trauma and following neurosurgery, cerebrospinal fluid pressure of the ventricle or cerebral epidural pressure is often measured. These invasive methods are not suitable for patients with encephalitis. Previous studies have demonstrated that the ICP is reflected in the spinal epidural pressure [1,2]. We monitored spinal epidural pressure through an epidural catheter at the cervical level in two patients with encephalitis, and compared it with cerebrospinal fluid pressure measured with a conventional lumbar puncture method.

Case report

The spinal epidural pressure was measured in two patients with viral encephalitis. Epidural puncture was performed at C7-Th1 using an 18G Touhy needle with the bevel pointing cephalad. A catheter was inserted 5 cm, filled with sterile normal saline, and connected to a pressure transducer with a flushing device. Reference level was set at the midaxillary line. Before measuring epidural pressure, the catheter was flushed with 1 ml of sterile saline, and the zero balance was ajusted. The patients were supine during the period of monitoring spinal epidural pressure.

For diagnostic purposes lumbar puncture was performed several times at L3–4 sinal level with the patient in the right lateral recumbent position. Cerebrospinal fluid pressure was measured using a conventional lumbar puncture manometer.

The study protocol was approved by the ethical commitees of our hospital, and informed consent was obtained from the patients' families.

Case 1. An 18-year-old woman was admitted due to disturbance of consciousness, convulsion, and a high fever. There was no abnormality in cerebral computed tomography (CT). Herpes simplex encephalitis was suspected from clinical signs, EEG, and laboratory data. Thiamylal was administered continuously to control convulsions. On admission, cerebrospinal fluid pressure and epidural pressure were 14.0 and 9.5 cmH_2O, respectively. Epidural pressure showed a tendency to increase. On the 6th hospital day, cardiac arrest occurred following sudden bradycardia 4 h after discontinuation of thiamylal. Spontaneous circulation was restored by precordial thump and bood pressure increased immediately to 120/70 mmHg, the prearrest level. Cardiac arrest was presumed to be related to increased ICP. Infusion of thiamylal was resumed and glycerol was instituted. One hour later, epidural pressure was 16.3 cmH_2O. Cerebral CT 5 h after the arrest was normal. Brain edema was not present. Seven hours after infusion of thiamylal and glycerol, epidural pressure had decreased to 13.6 cmH_2O. On the 9th day, spinal epidural pressure and cerebrospinal fluid pressure was 9.5 and 13.0 cmH_2O, respectively, and did not change in the subsequent week. The patient recovered without any sequelae.

Case 2. A 52-year-old man was admitted with disturbance of consciousness, high fever, and petechial rash.

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Viral encephalitis was suspected. The spinal epidural pressure and cerbrospinal fluid pressure were 25.8 and 19.0 cmH_2O, respectively. On the following day, the level of consciousness worsened and epidural pressure increased. On the 4th day, cerebral CT revealed cerebral edema. Thiamylal was not infused because of unstable hemodynamics. Epidural pressure was controlled by administration of glycerol. On the 11th day, both epidural pressure and cerebrospinal fluid pressure decreased to 19.0 and 16.5 cmH_2O, respectively. Cerebral CT was normal. Clinical signs gradually improved. No complications due to the use of spinal epidural pressure monitoring were observed.

Discussion

Many methods have been devised for monitoring ICP [3,4], and several studies have shown that intracranial epidural pressure is useful for monitoring ICP [5–7]. In our cases there was a good correlation between spinal epidural pressure and cerebrospinal fluid pressure. Epidural pressure was reduced by infusion of drugs that decrease intracranial pressure. However, the relationship between spinal epidural pressure and ICP has not been sufficiently investigated. Previous studies in dogs and human indicate that spinal epidural pressure reflects cerebrospinal fluid pressure at the lumbar level [8,9], and it is suggested that measurement of spinal epidural pressure is useful for monitoring ICP.

Only a few reports, however, have measured the two pressures simultaneously. Asano et al. [1] placed catheters in the lumbar epidural space and cisterna magna in dogs. Epidural injection of saline resulted in increases in lumbar epidural pressure and cerebrospinal fluid pressure. Subarachnoid injection also caused an elevation of both pressures. Fujioka et al. [2] measured lumbar epidural pressure and intracranial epidural pressure simultaneously in seven neurosurgical patients. Lumbar epidural pressure was measured with a catheter-tip pressure transducer through a 12 G Touhy needle in the lumbar epidural space. In five of seven patients, lumbar epidural pressure was consistently 70% to 100% of the value of the intracranial epidural pressure. The pressures changed in parallel under various conditions, such as neck compression and administration of mannitol. However, it is also reported that this correlation is low in patients with a blockage of the subarachnoid space at the region of the aqueduct [10].

We measured epidural pressure at the cervical level, because this site seems to reflect the ICP more precisely than at the lumbar level. But our later study revealed that epidural pressure at the cervical and lumbar level in anesthetized patients without spinal subarachnoid blockage were identical. Continuous monitoring of ICP is also possible with the device. We did not continuously record the spinal epidural pressure in Case 1. If it had been done, cardiac arrest might have been avoided.

We conclude that spinal epidural pressure can be measured with safety by our simple method. It is a valuable alternative to more invasive ICP monitoring techniques in patients suffering from encephalitis, provided a blockage of the spinal canal is not present.

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