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Application of Epidural Blood Patch From to Thoracolumbar Region for Cerebrospinal Fluid Leakage in the Cervical Region: Is Trandelenburg Position Effective?

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Background: Background: Although intracranial hypotension is a relatively frequent problem after spinal taps, spontaneous intracranial hypotension is a rare disease. The most common cause is spontaneous spinal leak. Conservative treatment is usually the first option for these patients. If conservative measures fail, the treatment of choice is administration of an epidural blood patch (EBP).

Case Report: In our case a 44-year old female patient was admitted to the emergency department with the complaint of severe throbbing pain in the back of her neck that radiated to the frontal region. The transverse T2 space imaging scans at the cervical level showed flow void in the anterior side of the dura in the cross-section passing through the upper plateau of the cervical vertebra 7.

The patient was hospitalized with the diagnosis of intracranial hypotension. After one week of conservative treatment, her symptoms did not regress so an epidural blood patch was considered.

Nineteen mL of homologous blood was injected into the epidural space. She was kept in prone Trendelenburg position for 30 minutes. At post-operative hour 2, she told that her headache was relieved and the nausea stopped. She was headache free on her control examinations at week 1 and 1, 3, 6 month.

Conclusion: There are cases where EBP was applied primarily from the lumbar region for dural leakage in the cervical region, but then EBP was applied from the cervical region because the symptoms did not resolve. Our patient's symptoms have completely resolved. In this result, we think that keeping the patient in the Trandelenburg position for about half an hour after EBP is effective.

Key words: intracranial hypotension, epidural blood patch, Trandelenburg position

BACKGROUND

Although intracranial hypotension (IH) is a relatively frequent problem after spinal taps, spontaneous intracranial hypotension (SIH) is a rare disease with an incidence of 5 in 100,000 but an increasingly diagnosed cause of headache (1). The most common cause is spontaneous spinal leak. According to the International Headache Disorders Classification criteria, orthostatic headache increases when the patient stands up and decreases when they return to the supine position. Its classical characteristic is that it is an orthostatic headache. In addition to headache, symptoms such as neck pain, neck stiffness, nausea, vomiting, imbalance, or visual complaints may be present at varying levels of clinical severity.

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As SIH is rare, it may be underdiagnosed or misdiagnosed. Conservative treatment is usually the first option for these patients but it fails in many patients (2). If conservative measures fail, the treatment of choice is administration of an epidural blood patch (EBP). EBP can be performed with a blind technique, but the chance for success is low. Performing EBP under an imaging device like scopy or computerized tomography (CT) results in much better outcomes (3,4).

Several imaging methods have been proposed to detect the source of cerebrospinal fluid (CSF) leak. Magnetic resonance imaging (MRI), CT, MRI myelography, or cisternography can be used to investigate the possible causes of intracranial hypotension (4).

CASE

A 44-year-old female patient was admitted to the emergency department with the complaint of severe throbbing pain in the back of her neck that radiated to the frontal region. She had been suffering from headache for 3 days and reported that it had worsened. The headache increased upon standing up and waned as she returned to a supine position. Her pain did not respond to paracetamol and nonsteroidal anti-inflammatory drugs. She also complained about nausea and diplopia. She did not have a history of head and neck trauma or invasive procedure. She had no comorbidities and did not use any medication. Her neurological examination revealed restriction in lateral gaze to both sides suggestive of bilateral nervus abducens paralysis. Her orbital MRI revealed no abnormalities, but a MRI of the brain demonstrated subdural effusion of 5 mm at the deepest point in both cerebral convexities (Fig. 1a) and effacement of both perimesencephalic and prepontine cisterns (Fig. 1c).

Her cervical MRI revealed a fluid intensity that sur-

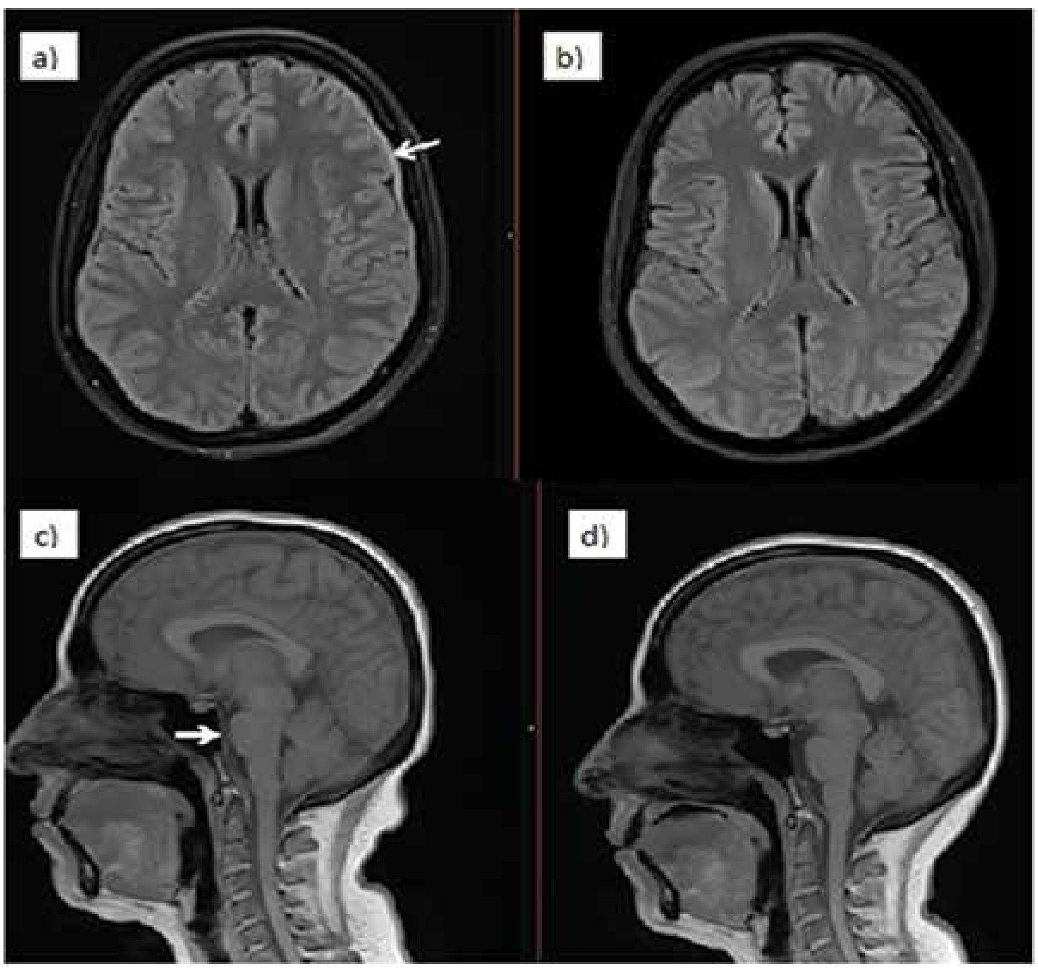

Fig. 1. a) Subdural effusion before EBP; b) Regression of subdural effusion after EBP (transverse cross-section); c) Effacement of prepontine cisterns before EBP; d) Opening of the prepontin cisterns after EBP (saggital cross-section).

rounded the dural sack starting from skull base to thoracic level 8.

The transverse T2 space imaging scans at the cervical level showed flow void in the anterior side of the dura in the cross-section passing through the upper plateau of the cervical vertebra 7 (Fig. 2).

During her stay in the inpatient clinic, the patient was given strict bed rest and received oral fluids and and also infusions of 2000 mL per day of intravenous (IV) saline solution. In addition to oral intake of increased coffee consumption, she was also given 500 mg paracetamol, 30 mg caffeine, and 10 mg codeine twice a day for the pain. After one week of conservative treatment, her symptoms did not regress, so an epidural blood patch was considered. The patient was placed on the operating table in prone position and a cushion was placed under her abdomen in order to correct for lumbar lordosis. Then she was prepped and draped under sterile conditions. The endplates of the verterbrae at the entry level were adjusted to be parallel and straight. The plan was to enter the epidural region from the intervertebral space between T12 and L1. After the entry point was determined, local anesthetic was administered at the entry point. An 18-gauge Tuohy needle was guided to the target space in a paramedian direction. The needle was advanced slightly when the fluoroscopy was in the anteroposterior (AP) position. Then the scopy was adjusted to the lateral imaging position to check its depth. The epidural space was entered with the loss-of-resistance method. The contrast medium was injected to check if the needle tip was inside the epidural space.

After it was ensured that the needle tip was inside the epidural space, the blood drawn from the patient was injected. During the procedure, communication was maintained with the patient. She was asked to report when she felt fullness in the head and neck area, neck stiffness, radicular pain, and nausea. The injection was stopped when she reported that she felt fullness in her head and neck. Nineteen mL of homologous blood was injected into the epidural space. She was kept in the prone Trendelenburg position for 30 minutes. Then she was transferred back to the inpatient clinic. At postoperative hour 2, she reported that her headache was relieved and that the nausea had stopped, but diplopia still persisted. On postoperative day one, her headache and neck pain were resolved completely, but diplopia persisted. Her brain MRI performed one week following the procedure was compared with the preoperative brain MRI and showed that the bilateral subdural effusion seen on the previous scan was resolved markedly (Fig. 1b) and that the prepontine and premesencephalic cisterns were open (Fig. 1d). Her postprocedural spinal

Fig. 2. Flow void in the anterior side of the dura in the cross-section passing through the upper plateau of the cervical vertebra 7. a) Saggital cross-section; b) Transverse cross-section.

MRI revealed that the previous epidural CSF intensities had disappeared almost completely and that there was only some intensity suspected to be effusion left in the anterior epidural space at thoracic levels 7-8-9 (Fig. 3).

Her diplopia persisted on her control examinations at week one and one month, but she was headache-free. The diplopia started to resolve on month 3 after the procedure. The diplopia resolved totally on month 6 after the procedure.

DISCUSSION AND CONCLUSIONS

IH is a rare disease but an increasingly diagnosed cause of headache. IH may develop due to spontaneous, iatrogenic, or traumatic causes. There are a limited number of studies regarding the incidence of traumatic and iatrogenic cases. As SIH cases cannot be recognized most of the time, it is difficult to measure its incidence and prevalence. A study conduced in an emergency setting reported the annual incidence of spontaneous cases to be 5 in 100,000. This study also reported that women were affected more than men and it peaked at age 40 (1,5).

Spontaneous spinal CSF leaks may be caused by a great variety of etiologies including minor traumas like cough, falls, or sports activities; connective tissue disorders like Marfan's syndrome and Ehler Danlos syndrome; dural defects; or meningeal diverticula (3). Moreover, CSF leaks in the ventral dura may develop when a calcified microspur cuts the dura like a blade (6). The case we are presenting here did not have any history of trauma or procedures, and no etiology could be found.

Apart from headache, IH has been reported to be associated with symptoms such as nausea, vomiting, dizziness, meningismus, cranial nerve palsies, and even coma. The symptoms are thought to be caused by the decrease in CSF volume, which may lead to the dilation of the veins in the brain and epidural space, descend of the brain, traction of the cranial nerves, and compression of diencephalic structures.

Tension of the abducens nerve may cause diplopia; tension of the trigeminal nerve may cause hypoesthesia; and tension of the vestibulocochlear nerve may cause auditory and balance problems. Auditory and balance problems may develop due to perilymphatic pressure changes as well. In addition, they may lead to tensile ruptures in the cerebral bridging veins, resulting in subdural hematomas.

Conservative treatment is the first-line treatment option recommended for IH. Bed rest, intake of fluids, analgesics, and caffeine are recommended. If conservative

Fig. 3. a) A fluid intensity of 2 to 3 mm at the deepest point that surrounded the dural sac at thoracic level 4 and around both lateral and posterior sides from thoracic 4 to 8 starting from the skull base down to the thoracic level 4 in the epidural area (before EBP); b) Disappearing epidural CSF intensities almost completely (one week after EBP) (saggital cross-section).

treatment fails, EBP can be performed (7). Application of EBP in a patient who had headache due to CSF leak that developed after dural tear in the lumbar nerve root was first reported in 1955 (8). In a Cochrane review, EBP was found to be superior to the conservative treatment for postdural puncture headache (9).

There are several hypotheses explaining the mode of action of EBP. Increased hydrostatic pressure caused by EBP may create an acute compression effect on the dura, or the injected blood may coagulate on the dural tear, functioning as a tamponade. Increased hydrostatic pressure around the dura after EBP may relieve headache transiently, but headache may recur unless a permanent patch is formed. In a study, it was demonstrated that lumbar EBP in cases with cervical CSF leak could only relieve headache transiently most of the time by increasing the hydrostatic pressure around the dura, while cervical EBP was more helpful for a longer time as it directly created a tamponade. EBP's mode of action includes the formation of a dural tamponade covering the tear where there is CSF leakage and changing dural resistance and stiffness (7). Our patient, however, did not have recurrent headache on month 3 of the follow-up.

Dural tears are usually observed at the cervicothoracic or thoracolumbar junction. But most EBPs are performed at the lumbar level. Cervical EBP applications carry a higher risk as the cervical epidural space is narrower. Severe complications may be observed postoperatively, such as transient bradicardia, seizures, cranial nerve palsies, acute neurological deterioration, subdural hematoma, compression of nerve roots, or chemical meningitis. Spinal cord compression is one of the most feared complications of cervical EBPs, but there is no systematic study that has been conducted to determine the incidence of these complications; there are mainly case reports available (7,10,11). Cervical EBPs are usually performed when a lumbar EBP fails or only provides transient relief (4,12). Therefore, we performed EBP by entering from the T12-L1 level to avoid possible complications in our patient who had a CSF leak at the level of C7. Cases like ours, in which a lumbar EBP was performed for a cervical CSF leak, are rare in the literature (4,11).

There are cases in which EBP was applied primarily from the lumbar region for dural leakage in the cervical region, but then EBP was applied from the cervical region because the symptoms did not resolve (12). Our patient's symptoms have completely resolved. We have achieved a successful result in our application. Based on our result, we think that keeping the patient in the Trandelenburg position for about half an hour after EBP is effective. In this way, the epidural blood can reach the cervical levels.

The volume of blood injected varied across the EBPs applied in different regions. One study reported higher success rates with higher injected blood volume and recommended that the highest possible volume of blood is injected to make sure that the blood injected into the epidural space also spreads to other levels and increases the chance of success (13,14).

In another study, the success of the first blood patch applied was connected with the amount of the blood volume injected, anterior epidural CSF collection length, and midbrain-pons angle. The success rate was found to be higher in patients who were injected with more than 22.5 mL of blood during EBP. The success rate was found to be lower when the anterior epidural CSF collection length was greater than 8 segments. In that study, the first injection was 80% successful in patients injected with more than 22.5 mL of blood and in whom anterior epidural CSF collection was lower than 8 segments (15). We injected the blood while talking to the patient during the procedure. We asked the patient to report when she felt fullness in the head and neck area, neck stiffness, radicular pain, and nausea. The injection was stopped when she reported that she felt fullness in her head and neck. Nineteen mL of blood was injected into the epidural space. Although the epidural CSF collection length in our patient was greater than 8 segments and the blood injected was less than 22.5 mL, the first blood patch was successful. There was no need for a second procedure.

The efficacy of EBP for the treatment of patients who do not respond to conservative treatments has been demonstrated mainly in case reports and reviews including limited numbers of patients. One study reported 61% of patients who received EBP had recovered completely or partially (13). In another study, the EBP response rate was found to be 58.7% (15). Our case report is consistent with the fact that EBP is a fast, safe, and effective treatment for orthostatic headache caused by SIH. The volume of blood injected during EBP and the levels of application vary. In the treatment of dural tears in the cervical region, we think that the application of EBP from the lumbar epidural region and keeping the patient in the Trandelenburg position for a while can be effective. In this way, the possibility of serious complications related to EBP applied from the cervical region can be avoided. There is a need for further study on this matter.

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