Traumatic anterior cervical pseudomeningocele causing intracranial hypotension successfully treated with blood patch: case report

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Cervical pseudomeningocele is a rare complication of trauma. It develops when an extradural collection of cerebrospinal fluid (CSF) develops after a dural breach. The authors present the unusual case of a 33-year-old man with progressive headache, neck pain, mental status changes, and cardiopulmonary instability after polytrauma sustained from a motorcycle-versus-deer collision, without improvement during a 5-day hospitalization. Magnetic resonance imaging revealed a collection of CSF anterior to the cervical thecal sac compatible with an anterior cervical pseudomeningocele. A nontargeted epidural blood patch was performed with subsequent resolution of the patient's symptoms. Anterior cervical pseudomeningoceles are usually asymptomatic; however, these lesions can cause orthostatic headaches, neck pain, and cardiopulmonary compromise, as it did in the featured patient. Pseudomeningoceles should be included in the differential diagnosis for posttrauma patients with progressive neurological decline or postural headache, and blood patch may be an effective minimally invasive treatment.

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KEY WORDS blood patch; cervical; MRI; pseudomeningocele; trauma; technique

PSEUDOMENINGOCELES are extradural collections of cerebrospinal fluid (CSF) that result from a dural breach.^{1,2} These lesions are typically iatrogenic, a complication from spinal surgery.^{2,4} They can also be congenital, usually occurring in the thoracic or thoracolumbar area, and are associated with diseases such as Marfan syndrome or neurofibromatosis.⁵ In addition, idiopathic pseudomeningoceles have been described, usually in association with a spontaneous CSF leak around a spinal meningeal diverticulum.^{6–9} Treatment in these cases often involves bed rest, blood patch, subarachnoid drainage, or surgical repair. In more rare cases, pseudomeningoceles can be caused by trauma.^{2,5,6,11,12} We present the case of a relatively uncommon posttraumatic anterior cervical pseudomeningocele, with symptoms of intracranial hypotension, successfully treated with a blood patch.

Case Report

History and Examination

This 33-year-old man sustained polytrauma following a motorcycle collision with a deer. He was not wearing a

helmet. He was stabilized at an outside center and transferred to our emergency department. Cervical spine CT revealed an isolated C-6 spinous process fracture (Fig. 1A). Other injuries included a right distal fibular ankle fracture dislocation and bilateral pulmonary contusions. There was no evidence of intracranial pathology. The spinous process fracture was treated with immobilization in a rigid Miami J cervical collar.

Approximately 24 hours postinjury, the patient complained of extreme neck pain and headache when nursing staff attempted to have him sit up. His pain was mostly postural and improved with flat bed rest. He also exhibited progressively worsening episodes of bradycardia, oxygen desaturation, and mental status changes on elevating his head. In an evaluation for a cardiac or embolic cause, an electrocardiogram, an echocardiogram, and a pulmonary CT angiogram were negative. After 5 days of hospitalization without clinical improvement and given the posterior head and neck pain that was out of proportion to his known injuries, MRI of the cervical spine was performed for persistent symptoms. Imaging studies revealed an extradural fluid collection ventral to the thecal sac and extending

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FIG. 1. **A:** Reformatted sagittal cervical spine CT demonstrates a normal cervical spine, except for a slightly displaced fracture through the spinous process of C-6 (arrow). **B:** Axial T2-weighted sequence from cervical spine MRI demonstrates a hyperintense ventral extradural fluid collection similar to CSF, slightly flattening the ventral cord (arrow). **C:** Sagittal T2 image (magnified field of view) shows the ventral extradural fluid collection (arrowhead), the fracture of the C-6 spinous process (curved arrow), and the displaced ventral dural reflection along the superior and inferior cervical spine (arrow). **D:** Axial T2-weighted sequence (magnified field of view) shows a focal dural disruption ventrally at the level of C-2 (arrow). Findings are compatible with an anterior cervical pseudomeningocele.

from C-2 to the T2–3 interspace, which demonstrated a signal similar to that for CSF (Fig. 1B and C). In addition, a small defect was identified in the ventral dura at the level of C-2 (Fig. 1D). Findings were compatible with a traumatic anterior cervical pseudomeningocele.

Treatment

The following day, the patient underwent a nontargeted, large-volume epidural blood patch at L1–2 in an attempt to treat his postural symptoms.

Posttreatment Course

He experienced almost immediate relief of his postural headache and neck pain. His heart rate and oxygen saturation also normalized. At the 2-week, 3-month, and 1-year follow-up visits, he remained asymptomatic.

Discussion

Traumatic anterior cervical pseudomeningoceles are extremely rare. To the best of our knowledge, only 3 other

cases have been reported.⁶ While the targeted epidural blood patch procedure has been described for the treatment of spontaneous and postsurgical pseudomeningoceles that cause intracranial hypotensive symptoms, this is the first report of a successful nontargeted blood patch in the traumatic setting.

The way in which the injection of autologous blood stops CSF leakage is not fully understood. Some propose that the blood patch increases extradural tissue pressure relative to subarachnoid pressure through mass effect, which decreases the gradient for CSF efflux.^{1,3,10} This may explain why patients experience immediate symptomatic relief after the patch injection and may also provide a reason for the efficacy of the nontargeted approach; the mass effect of the blood patch would pressurize the entirety of the dural tube. Clot formation over the dural defect is another possible explanation for the efficacy of the blood patch and may account for the latent effect of the procedure. In this theory, a dural plug, created by the viscous clot, blocks the CSF leak and restores CSF pressure.^{1,3,10} The variability of symptom relief among patients suggests that the mechanism by which the epidural blood patch works is probably multifactorial, and in our case the large volume of blood injected into the patient certainly could have had both effects. Given the limited experience with traumatic pseudomeningoceles, the success rate and long-term symptomatic benefit of this procedure remain uncertain.

Trauma is the least common cause of pseudomeningoceles.^{4,7,11} When these lesions develop after trauma, they often involve nerve roots of the brachial and lumbosacral plexuses. These nerves are anchored between 2 mobile parts, and any forceful distraction can result in nerve root avulsion and pseudomeningocele formation. In these cases, the pseudomeningocele usually organizes in the posterior spinal region.⁴

In our patient, the pseudomeningocele was not identified at the time of presentation, since it was not apparent on the trauma cervical spine CT. Pseudomeningoceles are most often asymptomatic.^{5,8} Patients may present with a variety of symptoms due to compressive mechanisms, including headache, nausea, vomiting, and significant neurological compromise.^{5,7}

The preferred modality for investigating pseudomeningoceles is MRI, which reveals a region of low signal intensity on T1-weighted images and high signal intensity on T2-weighted images, similar to CSF.^{5,8} Computed tomography myelography and fluoroscopic myelography may also demonstrate pseudomeningoceles. Myelography combined with CT may be superior to MRI for identifying CSF outflow tracts, and delayed CT myelography may detect a slow-filling pseudomeningocele.⁵ Fluoroscopic myelographic studies can show filling of the pseudomeningocele as well as demonstrate flattening of the thecal sac margin, absence of the nerve sheath, and pulsatile leakage of contrast into the extraarachnoid sacs.⁵

Conclusions

In summary, anterior cervical pseudomeningocele is a rare complication of spinal trauma. Although usu-

ally asymptomatic, these lesions can cause orthostatic headache and neck pain, mental status changes, and cardiopulmonary compromise, as occurred in our patient. Therefore, pseudomeningocele should be included in the differential diagnosis for posttraumatic patients with these symptoms. Magnetic resonance imaging is the preferred modality to evaluate for these lesions. Our case demonstrates that a nontargeted epidural blood patch can be an effective option for treating patients with symptoms due to anterior cervical pseudomeningoceles.

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Author Contributions

Conception and design: Eckel, Takahashi. Acquisition of data: Eckel, Takahashi. Analysis and interpretation of data: Eckel, Takahashi. Drafting the article: Eckel, Takahashi. Critically revising the article: Eckel, Takahashi, Diehn, Schwartz, Hunt. Reviewed submitted version of manuscript: all authors. Approved the final version of the manuscript on behalf of all authors: Eckel. Study supervision: Daniels.

Supplemental Information

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