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Fluoroscopy-Guided Prophylactic Epidural Blood Patch After Lumbar Puncture in a Patient With a History of Post-Dural Puncture Headache: A Case Report

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Background: Epidural blood patch (EBP) is a known gold standard in the treatment of post-dural puncture headache (PDPH). However, there are no known reports in the literature to date that discuss a fluoroscopy-guided single-shot approach of EBP administration immediately following a lumbar puncture (LP).

Case Report: The patient is a 71-year-old man with progressive multifocal leukoencephalopathy that presented with a history of debilitating PDPH following recurrent LPs that were required for lab monitoring. The patient underwent a single-shot LP followed by an EBP via the same needle prior to removal from the skin. The patient was free of any PDPH symptoms immediately postprocedure and on follow-up.

Conclusions: A single-shot fluoroscopy-guided approach of administering an EBP immediately after an LP, but prior to needle removal from the skin, may be a safe and efficient approach for preventing PDPH in applicable patient populations.

Key words: Post-dural puncture headache, epidural blood patch, fluoroscopy, lumbar puncture, case report

BACKGROUND

Post-dural puncture headache (PDPH) is an adverse iatrogenic complication that involves puncture of the dura and can occur during a diagnostic lumbar puncture (LP), spinal anesthesia, and epidural placement. The occurrence of PDPH is increased with patient risk factors, such as women, age below 50, pregnancy status, prior headache, low cerebrospinal fluid (CSF) opening pressure, and low body mass index (BMI) (4). The headache is often positional and, although the exact mechanism is unclear, the majority of the literature supports a proposed mechanism of intracranial hypotension resulting from decreased CSF volumes and pressures. It is believed this decrease in CSF cushioning to the brain results in a mechanical traction on the dura which shifts the brain caudally, thus placing pressure on pain-sensitive structures, such as the meninges, cranial nerves, and sinuses (1,3). This mechanism offers an explanation for the worsening of symptoms that occurs with upright positioning in many patients with PDPH. This mechanism is also supported by a recent randomized control trial (2) where prophylactic intrathecal injection of normal saline provided a clinical benefit in the prevention PDPH for at least 48 hours. Additionally, there is evidence of cerebral blood vessel dilation in PDPH via magnetic resonance findings of engorgement of venous sinuses, enhancement of meningeal layers, and enlargement of

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the vascular pituitary gland, as a compensatory mechanism for the decreased CSF volume (3).

Although spontaneous resolution of PDPH may occur without treatment, the headache can be debilitating for some patients and resolution may not occur for a one-week period or longer. Additionally symptoms of PDPH include nausea, dizziness, neck pain, visual changes, hearing changes, and even death from hematomas caused by venous shearing from traction (3). Conservative treatments include bed rest, limitation of upright positioning, oral hydration, caffeine, and oral analgesics, such as acetaminophen and nonsteroidal anti-inflammatory drugs; however, they provide only temporary or limited relief in moderate-to-severe cases of PDPH (4). The gold standard for the treatment of PDPH is an epidural blood patch (EBP), shown extensively in the literature as the most effective treatment in relieving PDPH pain and in shortening the duration of symptoms in patients with mild-to-severe PDPH with response rates of 61% to 98% of cases (1).

There are many documented cases of prophylactic blood patches within the literature; however, none to date describe the specific technique with fluoroscopy of performing a prophylactic single-shot EBP immediately before the very needle, which was utilized for an LP, is removed from the skin site.

Thus, we present the first known case where a cancer patient that required repeated LPs, with a known history of multiple previous debilitating PDPHs following an LP, received a prophylactic blood patch simultaneously during completion of the LP procedure itself. The patient's fluoroscopic imaging is de-identified and the patient consented to present this case report.

CASE

The patient is a 71-year-old man with a medical history notable for idiopathic pulmonary fibrosis status-post lung transplant on immunosuppressants. He was found to have progressive multifocal leukoencephalopathy, and thus required recurrent LPs every 3 weeks for JC polyomavirus lab monitoring. The patient had received 3 LPs prior to his initial visit at the MD Anderson Pain Clinic. He stated that after each LP, which was done through interventional radiology, he had resulting headaches that he described as debilitating and lasting for many days. Given the patient's risk for repeat PDPHs, the pain medicine team was consulted by interventional radiology for an EBP procedure that would follow after their completion of an LP. At this point, it was suggested that the pain team could do both the LP and a prophylactic blood patch under fluoroscopic guidance in a single shot. This single-shot approach would decrease the patient's radiation exposure, decrease needle insertions, and facilitate care for the patient as he would not require coordinating 2 separate provider appointments across a large hospital. The interventional radiology team agreed with the benefits of this approach and the patient was thus sent to the pain clinic for the procedure.

After obtaining informed written consent, the patient was placed in the lateral position and routine monitors were applied. An anteroposterior view of the spine (Fig. 1) was utilized to visualize the L3-L4 interspace and the skin overlying the space was marked under fluoroscopy. The skin overlying the lumber region was prepped with Betadine and sterilely draped. Local anesthesia was obtained with 2 mL of 1% lidocaine. A 20G, 3.5 inch spinal

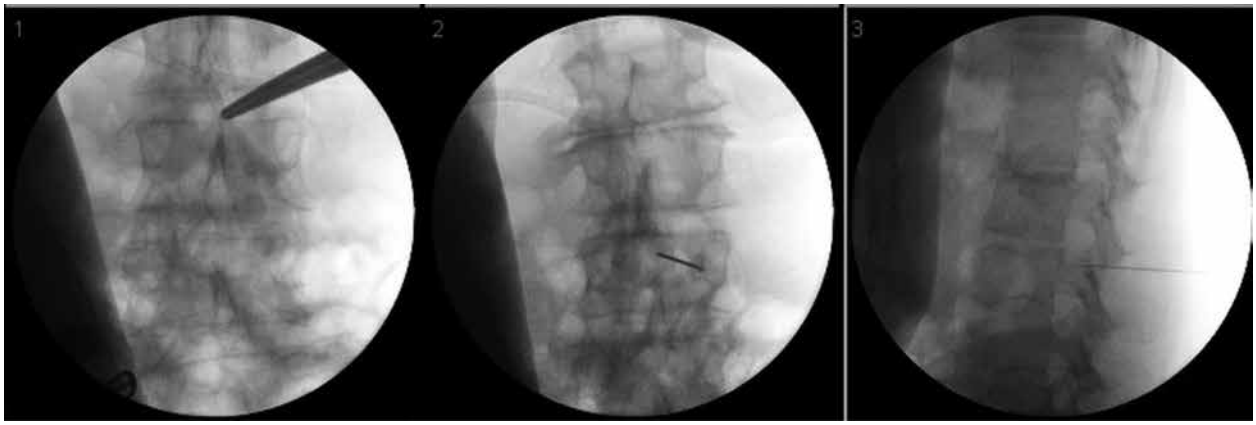

Fig. 1. These photos display the LP portion of the procedure. 1) Identifying the L3/L4 interspace. 2) Advancing the needle into the interspace. 3) Lateral view of the needle in the subarachnoid space.

needle was advanced under fluoroscopic guidance until CSF was obtained at one pass. Approximately 25 mL of CSF total was drained and allocated into the respective vials needed for the patient's lab testing. The spinal needle was then slowly removed until the CSF flow on aspiration stopped and images were taken (Fig. 2). Contrast dye was injected at this point to confirm the epidural space (Fig. 3) and 15 mL of sterile blood, which was drawn from the left antecubital region, was slowly injected. The needle was then removed and both procedures were completed without any adverse events or complications.

The patient was observed in the postprocedure recovery room for approximately 45 minutes following the procedure. During this time, the patient reported no headache, no weakness, no nausea, no back pain, and no visual changes, and was discharged home from the pain clinic. On telephone follow-up, in the days after this procedure, the patient continued to deny any symptoms and expressed relief and gratitude with the benefit provided with our treatment approach given that he would continue to require repeat LPs.

DISCUSSION

It is well known that PDPH can result from dural puncture with procedures, such as an LP or during neuraxial anesthesia. A recent Cochrane review identified the incidence of PDPH to be estimated at 36% after an LP, > 50% after unintentional dural puncture in obstetric patients, and < 10% after spinal anesthesia (5,6). Notable modifiable procedural risk factors include needle diameter size, needle type (use of a cutting-bevel needle associated with increased risk over a pencil-point needle), bevel orientation, number of attempts with an LP, and inexperience with the procedure (1,3,5).

Although the exact mechanism in which an EBP relieves PDPH is not completely understood, there are many hypothesized mechanisms mentioned in the literature. One possible mechanism is that an EBP may serve as a plug for the dural leak, and thus facilitate healing of the puncture site. Additionally, there may be a role that the EBP plays in regards to increasing CSF pressure and volume intracranially via a mass effect within the epidural space. This increase in CSF volume and pressure addresses the mechanical traction on pain-sensitive areas that occurred with the initial loss of CSF volume and pressure (1). In the context of EBP volume, a randomized, multinational, and blinded trial (7) of 120 patients found that EBP injections of 15 mL, 20 mL, and 30 mL resulted in 61%, 73%, and 67% partial or permanent relief of headache, respectively.

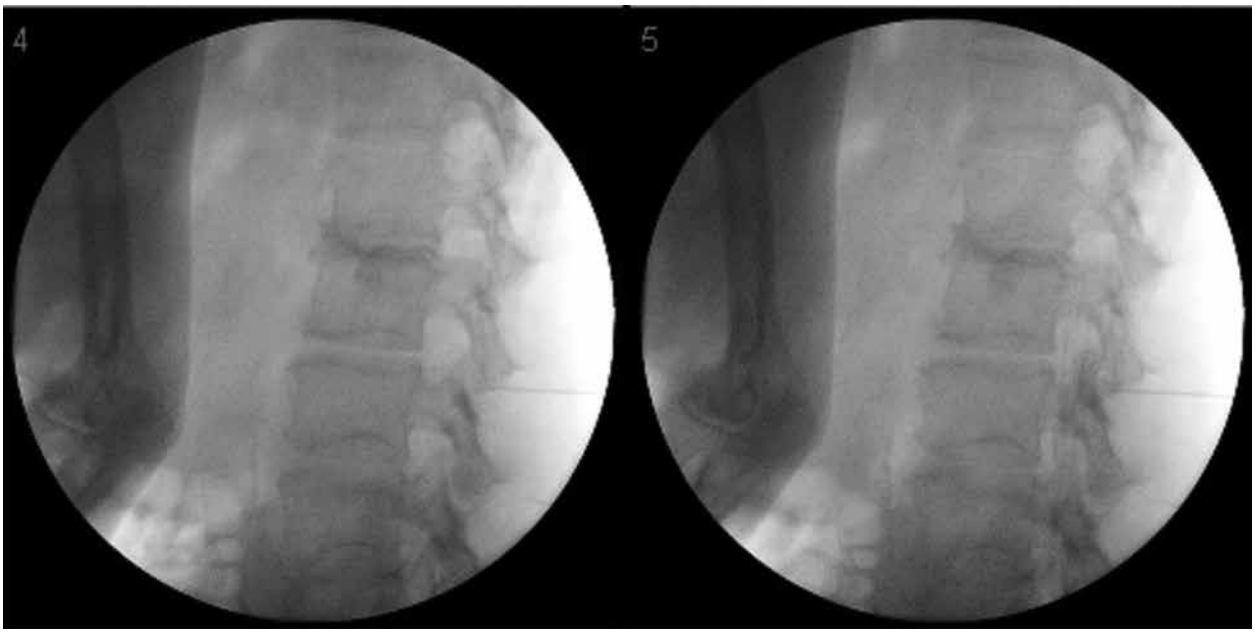

Fig. 2. These photos display the retraction of the needle from the subarachnoid space to the epidural space under fluoroscopic guidance.

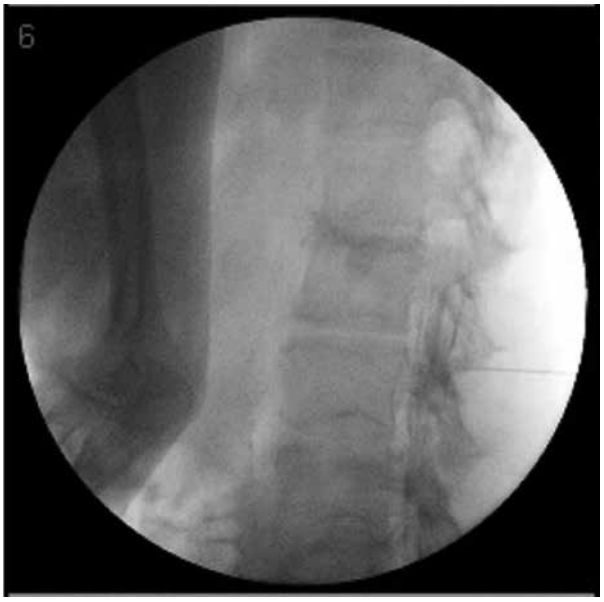

Fig. 3. This photo displays the epidural spread of the contrast dye within the epidural space. This image was taken prior to injection of the EBP.

Less clear in the literature is the impact of timing from dural puncture with EBP on symptom relief. Although there have been a studies (8-11) that have suggested decreased response with EBP when administered within 24-96 hours of dural puncture, the data is not free of confounding variables. These studies, of note, were observational, nonrandomized, included both obstetric and nonobstetric patients, variable needle sizes, and variable need types. Although these studies focused on the relationship of EBP timing on symptom relief, one cannot ignore the possibility that patients with severe post-dural puncture symptoms are both less likely to have complete relief compared to patients with minimal-to-moderate symptoms and more likely to receive an EBP within a shorter time period (8). Indeed, in order to clarify the relationship of EBP timing on PDPH treatment response, a randomized single-blinded study would need to be designed that focuses on patients with symptoms severe enough to warrant an EBP that are then randomly assigned within defined time frames to receive a standardized approach for the procedure. Such a study would be challenging however due to the limited inclusion criteria and ethical concerns with delaying EBP timing in patients with severe symptoms.

Of relevance to our case report is the role of fluoroscopy with our single-shot prophylactic nontraumatic EBP technique. When compared to the blind technique for EBP, the current literature suggests that the use of fluoroscopy-guided EBP (FGEBP) provides the benefits of improved needle guidance, fewer attempts, increased response rates (12). A study performed by Wahab (13) found that there was a 95% response rate in EBPs performed under fluoroscopy vs 60% response rate under the traditional methods. Their study found that the use of fluoroscopy resulted in statistically significant fewer attempts, lower volume of blood required for therapeutic effect, lower incidence of back pain 2 hours after the procedure, and decrease requirement of rescue analgesics. Additionally they found that the fluoroscopy group had a significantly decreased back pain postprocedure and no complications; whereas, the conventional group had 3 and 2 patients that experienced nerve root irritation and hematoma, respectively. A known disadvantage to the use of fluoroscopy for EBP would be radiation exposure; however, a recent study in which 66 FGEBP procedures were completed reported a mean fluoroscopy time of 39 seconds. The authors thus discussed how the benefits of FGEBP, listed above, arguably outweigh the risks of such brief radiation exposure time (13). It can even be said that the use of fluoroscopy, unless there is a documented contraindication or unavailability for its use, would be the standard of care in the United States.

It is important to note that although the novel use of fluoroscopy for prophylactic blood patches can be a safe and effective treatment option for the appropriate patient, it like all procedures does not come without risks. A recent update on EBP (14) discusses the common adverse effects of this procedure which can include headache, backache, neck pain, radicular irritation by blood by-products, and a mild pyretic reaction. Specific to backache, reports indicate an incidence of approximately 80% with resolution by 4 weeks. A rebound intracranial hypertension (RIH), caused by an increase in CSF pressure by closure of the CSF leak by the EBP, can also occur and present with headache that is worse in the supine position. If RIH were to occur, the associated headache is often transient and can be treated with acetazolamide or topiramate (14). It is for these reasons why it behooves pain physicians to include in their discussion with patients when obtaining written informed consent for an EBP, a discussion on the risks, benefits, common complications, and alternative treatments in regards to PDPH prevention and treatment.

Indeed, the utilization of fluoroscopy and administration of contrast in real time is a standard of care for

EBP in the United States, unless there is a documented reason that it could not be used, as it ensures localization of the epidural space, confirms needle tip location, provides objective data for prediction of EBP locational spread, and thus minimizes complications for this procedure. When performed by an experienced pain physician, the utilization of fluoroscopy for a prophylactic EBP in the appropriate patient at risk for PDPH can be considered as a safe and effective treatment option for this common clinical scenario.

CONCLUSIONS

The utilization of fluoroscopic guidance via a single-shot approach of simultaneously administering an EBP immediately after the LP procedure, but prior to needle removal from the skin, may be a safe and efficient approach for preventing PDPH in patients with a history of PDPH after an LP and in patients that require serial LPs but also have an elevated risk of experiencing PDPH.

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