

Case Report

MULTIPLE FIBRIN GLUE USE IN A COMPLICATED CASE OF POSTDURAL PUNCTURE HEADACHE FOLLOWING INTRATHECAL DRUG DELIVERY SYSTEM PLACEMENT: A CASE REPORT

Matthew Chung, MD^{1,2}, Neal A. Shah, MD², and Devang Padalia, MD²

A postdural puncture headache (PDPH) is a well-described complication after implantation of an intrathecal drug delivery system (IDDS). Treatment is typically with supportive management with the occasional need for an epidural blood patch. We describe a case of a patient with refractory muscle spasticity secondary to cerebral palsy that required a baclofen IDDS implantation and subsequently developed a PDPH. After failing conservative therapy as well as an epidural blood patch, the decision was made to attempt an epidural fibrin patch, which transiently improved her headache. Upon return of the patient's

symptoms, computed tomography myelogram demonstrated an extensive cerebrospinal fluid leak with ventral spread into the retroperitoneal space. Using a novel technique, a second epidural fibrin glue patch was administered just adjacent to the IDDS catheter insertion point, which was then successful in resolving her symptoms.

Key words: Intrathecal drug delivery system, postdural puncture headache, dural tear, cerebrospinal fluid (CSF) leak, fibrin glue, epidural blood patch

Intrathecal drug delivery systems (IDDS) have been commonly used as a therapeutic modality for the treatment of chronic pain and intractable muscle spasticity since they were first used in the 1980s (1,2). This modality has been more efficacious than its enteral and parenteral counterparts for the purposes of curtailing dose-related adverse effects and enhancing drug efficacy with the direct intrathecal introduction of medications (3,4). Despite these benefits, patients may experience complications and side effects associated with this invasive procedure. Although pharmacologic complications have been the most common problem reported with IDDS placement

(5), a cerebrospinal fluid (CSF) leak with associated development of postdural puncture headache (PDPH) can be a significant source of morbidity for the patient.

PDPH is a headache associated with a strong orthostatic component in the setting of a dural puncture; the symptoms of PDPH are usually self-limiting (6). Some risk factors for the development of PDPH include age, female gender, low body mass index (BMI), history of prior PDPH, and history of chronic headaches. In patients undergoing IDDS implantation, the sole risk factor cited has been age less than 60 years. In this population, the incidence has been reported to be as high as 23% (7). A majority of those who develop PDPH following IDDS placement improve after conservative medical treatment; however, up to 4.7% (7) occasionally require invasive procedures such as an epidural blood patch (EBP) and/or epidural fibrin glue patch (8-10). In rare cases, the patient will require a surgical intervention with dural repair (11), revision, or device explantation (10,11). Fibrin glue use has been regularly used intraoperatively for otologic and neurologic cases involving compromised

From : ¹Morsani College of Medicine, University of South Florida, Tampa, Florida; ²H. Lee Moffitt Cancer Center and Research Institute, Tampa, Florida

Author for correspondence: Matthew Chung, MD
Address: James A Haley Veterans Hospital, Attn: Matthew Chung, Neurology Department # 127, 13000 Bruce B. Downs Blvd, Tampa, FL 33612
E-mail: chung.matthew@gmail.com

dura by creating an impermeable seal; it has similarly been used postoperatively to secure dural defects (12,18). The current standard treatment for PDPH includes hydration, caffeine intake, bed rest, and when necessary, an EBP. In cases of a persistent CSF leak following IDDS placement, there are no strict guidelines; however, there are a limited number of reported cases involving the use of epidural fibrin glue (12,13). We present a case of refractory PDPH following IDDS implantation that was initially believed to be strictly a dorsal CSF leak, but extended ventrally into the retroperitoneal space as demonstrated on computed tomography myelogram (CTM). Further, we describe the successful treatment of this case by 2 successive fibrin glue injections with a technique not previously described in literature.

CASE DESCRIPTION

A 26-year-old woman with congenital cerebral palsy and sensorineural hearing loss requiring cochlear implant presented to our clinic for severe-progressive spasticity and secondary spastic pain. She had failed management with an oral regimen of baclofen and dantrolene as well as scheduled oxycodone-acetaminophen and tramadol for breakthrough pain. The decision was made to attempt intrathecal baclofen therapy to improve her symptoms. After a successful intrathecal trial of baclofen, she was scheduled for implantation of an IDDS. The patient was placed in the lateral decubitus position and was prepared and draped in sterile fashion. Under fluoroscopic guidance, a 14-gauge Tuohy needle was used to access the L3-L4 intrathecal space via an interlaminar approach and the intrathecal catheter was advanced to the T10 level on the first attempt. After confirmed CSF backflow, the catheter was secured to the supraspinous ligament with an anchoring device. A pump pocket was then created using blunt and cautery dissection over the left lower abdomen. The catheter was then tunneled from the lumbar incision to the abdominal incision using a shunt tunneler. The catheter was connected to the pump, which was filled with a solution containing 40 mL of Baclofen (50 mcg/mL) and started at an initial rate of 150 mcg per day.

Within 2 days of the uncomplicated implantation, the patient reported a clear fluid draining from her lumbar incision site and upright positional headache.

After being seen in the clinic, a pressure dressing was applied to her incision site and she was told to drink caffeinated beverages and continue bed rest. After 2 days, the patient had no improvement in her symptoms and was admitted to the hospital. In an attempt to improve her condition, she underwent an EBP at the L4-L5 level under fluoroscopic guidance. Using a 17-gauge Tuohy needle, she was administered 18 mL of autologous blood and experienced immediate improvement of her symptoms. Several hours after the procedure, she reported a recurrence of her symptoms. The following day, and after reviewing the literature, a decision was made to attempt an epidural fibrin patch, which is composed of fibrinogen and thrombin. Using the standard loss-of-resistance technique, the epidural space at the L3-L4 level was accessed via an interlaminar approach. Care was taken to approach from the contralateral side of the catheter insertion site so as not to shear it. Contrast medium was injected via the needle to demonstrate good epidural flow with no intrathecal or intravascular uptake. Then 5 mL of Tisseel fibrin glue was injected epidurally in an incremental pattern. Postoperatively, the CSF leak from the posterior incision completely resolved; however, after transient improvement the patient continued to have PDPH symptoms. To further assess the patient, it was decided to perform a lumbar CTM. To avoid the risk of creating an additional puncture in the dura mater, the physician accessed the side port of the IDDS and injected 12 mL of contrast medium through the device catheter. Results of the CTM showed a L3-L4 dural defect along the dorsal thecal sac at the insertion point of the intrathecal catheter. Contrast media extravasation extended caudally into the L4-L5 level and then ventrally into the right foramen where it was visible in the retroperitoneum along the right psoas muscle (Fig. 1). Although CSF drainage from her posterior wound had stopped, her ongoing complaint of positional headache prompted the decision to pursue a repeat epidural fibrin injection. To assess the exact location of the intrathecal catheter and to inject precisely in the area of the leak, the physician used the side port of the IDDS to inject omnipaque contrast medium into the catheter. Once the catheter was visualized, a 17-gauge Tuohy needle was advanced under fluoroscopic guidance to within a few millimeters of the catheter insertion site in the epidural space (Fig. 2). Epidural placement at the L3-4 level was confirmed with contrast medium.



Fig. 1. Axial computed tomography (CT) myelogram view of the spine revealing anterior cerebral spinal fluid spread into the retroperitoneum surrounding the area of the psoas musculature.

At this point, a total of 4 cc of Tisseel fibrin glue was then injected. The patient tolerated the procedure well with marked improvement in her spasticity with complete resolution of her positional headache, nausea, vertigo, and photophobia over the next 12 hours. The patient was discharged the following day in stable condition. At clinical follow-ups over the next

8 months, there was continued relief of her spasticity with no reported sequelae from the PDPH or epidural fibrin injections.

DISCUSSION

The management of refractory PDPH following IDDS



Fig. 2. Anteroposterior fluoroscopic view of the spine with fibrin being administered in area of suspected dural tear with close proximity to indwelling catheter that is outlined with contrast medium.

placement can be extremely difficult when conservative measures have failed. There are limited options and no protocols for treatment once an EBP has failed. Given the debilitating nature of PDPH and the potential complications including pseudomeningocele, arachnoiditis, meningitis, epidural abscess, seizure, subdural hematoma, and cerebral venous sinus thrombosis (15), alternative options must be considered in cases refractory to EBP. The definitive treatment of a CSF leak would be removal of the IDDS and suture of the dural opening (14); however, this is not always a tenable option for patients and carries the risk of a major surgical procedure.

Fibrin glue is commonly used in neurosurgical and otologic procedures to ensure intraoperative dural closure and prevention of CSF leakage. This has spurred interest in its postoperative use (12,18) for the treatment of dural defects and PDPH. The fibrin seal compound is a preparation composed of fibrinogen and thrombin that, when combined and applied to tissue, generates a fibrin clot that has both hemostatic and adhesive properties (16-18). The total volume of fibrin used is smaller than that

used in an EBP; although there is no consensus as to the precise volume required, at least 20 mL of blood is used in an EBP (15,22) while a range of 3 to 7 mL of fibrin has previously been reported (12,20). This is due to its rapid coagulation properties, instantaneous fibrin cross-linking, adherence properties, and decreased potential for spread (19,20). Due to these properties of fibrin, the administration of injectate should be as close to the dural puncture site as possible (12). Adverse effects associated with the use of fibrin glue are few and infrequently reported, making this an excellent option as adjunct therapy for postoperative complications from a dural defect. Anaphylaxis, aseptic meningitis, air embolism, and epidural drain obstruction have been reported from fibrin glue; however, determination of direct causality has been difficult in these cases (16).

Several studies demonstrate that a single application of fibrin glue is a viable option in cases of IDDS implantation complicated by PDPH. Freeman et al described 3 cases of IDDS placement for spasticity that were complicated by CSF leak with refractory headaches (12). Gerritse et al described 3 cases of IDDS implantation for cancer pain that involved persistent CSF leaks. Following a failed EBP, these patients responded favorably to a fibrin glue patch (17). Based on a literature search including the treatment of complications from IDDS placement, the repeated use of fibrin glue after failed

conventional therapy (including EBP) has not previously been reported in the literature.

Additionally, this case illustrates a novel methodology for the most effective placement of the epidural fibrin patch that has not been previously cited in the literature. The Medtronic Synchromed II (Medtronic, Minneapolis, MN) intrathecal drug delivery pump that was used has a side port that connects directly to the intrathecal catheter. This port is used to assess the integrity of the catheter and the associated connection to the pump via contrast medium injection. In this case, contrast medium was injected through the side port as a means of outlining the catheter as a visual aid. This allowed for optimal placement of the fibrin

injectate adjacent to the site of the dural defect (as shown in Fig. 2).

By presenting the methodology in this case and discussing the thought process, it is the hope of the authors that physicians will consider a trial of multiple fibrin glue injections and use contrast medium to visualize the intrathecal catheter for similar complicated IDDS cases with PDPH. This would give patients the best chance of recovery and prevent the need for more invasive surgery or removal of the IDDS.

Conflicts of Interest

The authors do not have any conflict of interest pertaining to this case.

REFERENCES

- Albright AL, Gilmartin R, Swift D, Krach LE, Ivanhoe CV, McLaughlin JF. Longterm intrathecal baclofen therapy for severe spasticity of cerebral origin. *J Neurosurg* 2003; 98:291-295.
- Albright AL, Barron WB, Fasick MP, Polinko P, Janosky J. Continuous intrathecal baclofen infusion for spasticity of cerebral origin. *JAMA* 1993; 270:2475-2477.
- Blackshear PJ, Rohde TD, Prosl F, Buchwald H. The implantable infusion pump: A new concept in drug delivery. *Med Prog Technol* 1979; 30:146-149.
- Botros M, Christo P. Current perspectives on intrathecal drug delivery. *J Pain Res* 2014; 7:615-626.
- Kamran S, Wright BD. Complications of intrathecal drug delivery systems. *Neuromodulation* 2001; 4:111-115.
- Bezov D, Lipton RB, Ashina S. Post-dural puncture headache: Part I diagnosis, epidemiology, etiology, and pathophysiology. *Headache* 2010; 50:1144-1152.
- Neuman SA, Eldrige JS, Qu W, Freeman ED, Hoelzer BC. Post dural puncture headache following intrathecal drug delivery system placement. *Pain Physician* 2013; 16:101-107.
- Follett KA, Naumann CP. A prospective study of catheter-related complications of intrathecal drug delivery systems. *J Pain Symptom Manage* 2000; 19:209-215.
- Kolaski K, Logan LR. A review of the complications of intrathecal baclofen in patients with cerebral palsy. *NeuroRehabilitation* 2007; 22:383-395.
- Motta F, Antonello CE. Analysis of complications in 430 consecutive pediatric patients treated with intrathecal baclofen therapy: 14-year experience. *J Neurosurg Pediatr* 2014; 13:301-306.
- Bezov D, Lipton RB, Ashina S. Post-dural puncture headache: Part II – prevention, management, and prognosis. *Headache* 2010; 50:1482-1498.
- Freeman E, Holzer B, Eldrige J, Moeschler SM. Fibrin glue to treat spinal fluid leaks associated with intrathecal drug systems. *Pain Pract* 2014; 14:570-576.
- Gerritse BM, van Dongen RT, Crul BJ. Epidural fibrin glue injection stops persistent cerebrospinal fluid leak during long-term intrathecal catheterization. *Anesth Analg* 1997; 84:1140-1141.
- Singh PK, Jain R, Mishra S, Kumar S, Bhatnagar S, Deo S. Management of pericatheter cerebrospinal fluid leak after intrathecal implantation of a drug delivery system. *Am J Hosp Palliat Care* 2008; 25:237-239.
- Turnbull DK, Shepherd DB. Post-dural puncture headache: Pathogenesis prevention and treatment. *Br J Anaesth* 2003; 91:718-729.
- Esposito F, Angileri FF, Kruse P, Cavallo LM, Solari, Esposito V, Tomasello F, Cappabianca P. Fibrin sealants in dura sealing: A systematic literature review. *PLoS ONE* 2016; 11:e0151533.
- Gerritse BM, Von Dongen RT, Crul BJ. Epidural fibrin glue injection stops persistent cerebrospinal fluid leak during long-term intrathecal catheterization. *Anesth Analg* 1997; 84:1140-1141.
- Nissen AJ, Johnson AJ, Perkins RR, Welsh JE. Fibrin glue in otology and neurotology. *Am J Otol* 1993; 14:147-50.
- Wong K, Monroe B. Successful treatment of postdural puncture headache using epidural fibrin glue patch after persistent failure of epidural blood patches. *Pain Pract* 2017; 17:956-960.
- Crul BJ, Gerritse BM, van Dongen RT, Schoonderwaldt HC. Epidural fibrin glue injection stops persistent postdural puncture headache. *Anesthesiology* 1999; 91:576-577.
- International Headache Society. Post-dural puncture headache. International Headache Society Classification (ICHD-3) Web site. www.ichd-3.org/7-headache-attributed-to-non-vascular-intracranial-disorder/7-2-headache-attributed-to-low-cerebrospinal-fluid-pressure/7-2-1-post-dural-puncture-headache/. Date Published 01/31/2018. Date Accessed 07/11/2018.
- Gaiser R. Postdural puncture headache. *Curr Opin Anaesthesiol* 2006; 19:249-253.

