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CT-guided epidural blood patch for treatment of CSF leak and pseudomeningocele following tethered cord release in a 3-year-old☆

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ABSTRACT

An epidural blood patch (EBP) has become standard of care for management of postdural puncture headache, and in recent years, attempts have been made to expand its applicability. Its utility in the management of postsurgical pseudomeningocele remains poorly defined, and few reports describe its use in children. In this case, we report the successful management of lumbar pseudomeningocele via EBP in a 3-year-old after tethered cord release, thereby obviating the need for surgical repair and its potential morbidity.

1. Introduction

First described by Gormley in 1960, the epidural blood patch (EBP) has become standard of care for management of postdural puncture headache. In recent years, attempts have been made to expand its applicability, with its use being explored for management of such diverse applications as incidental surgical durotomy, spontaneous intracranial hypotension, and traumatic subarachnoid-pleural fistula [1–3]. Its utility in the management of postsurgical pseudomeningocele has also been suggested but remains less well defined. Additionally, performance of EBP in pediatric patients is not frequently reported and, to the authors' knowledge, has never been described in the management of pseudomeningocele in patients younger than adolescents. We present the case of a 3-year-old female with tethered cord who underwent a surgical tethered cord release and subsequently developed headache, nausea, and emesis with imaging findings consistent with intracranial hypotension and lumbar pseudomeningocele. She underwent EBP placement with immediate and durable resolution of symptoms.

EBP is a procedure in which autologous blood is injected into the epidural space adjacent to the site of a suspected dural leak in an attempt to relieve symptoms resulting from low CSF volume. Symptoms of intracranial hypotension are generally not life threatening but may nonetheless be debilitating, including orthostatic headache, nausea, vomiting, double vision, and difficulty concentrating. The procedure is postulated to be beneficial by two mechanisms: immediately postinjection via dural tamponade and delayed via sealing of the dural hole through inflammation and clot formation [4]. Adverse effects from placement are uncommon but include back pain, leg paresthesias, fever, infection, and hemorrhage. Though EBP is generally considered safe and effective for treatment of postdural puncture headache when conservative measures fail, its role in the treatment of other conditions leading to low intracranial pressure, such as pseudomeningocele, is less well-defined [5–7].

A pseudomeningocele is an extradural collection of CSF that results from a dural breach and subsequent CSF leakage [8]. It may be iatrogenic (after intradural surgery or incidental durotomy during extradural surgery), traumatic, congenital, or idiopathic. Though the incidence varies with the cause, the greatest number of cases appears to result from incidental durotomy after extradural lumbar spine surgery [8,9]. The true incidence in intradural spinal surgery is not known but is likely to be much higher; Zide et al. report an incidence of 43% following tethered cord release [10]. Treatment options for pseudomeningocele include noninvasive measures such as compression dressings, percutaneous aspiration, and direct surgical exploration and drainage. CT-guided percutaneous treatment with either fibrin glue or EBP has also been advocated [2,11–15].

Few pediatric cases of pseudomeningocele treated with EBP have been reported. Fridley et al. described EBP for treatment of

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pseudomeningocele in two females aged 16 and 17 years. Sanders et al. reported EBP for postoperative CSF leak in a 3-year-old, though no pseudomeningocele was documented [15,16]. Of note, though CSF leak and pseudomeningocele are related processes, Mihlon et al. suggested with their case series that the presence of pseudomeningocele was an independent predictor of EBP failure in treatment of postsurgical incidental durotomy [2]. In the present case, we describe the successful management of lumbar pseudomeningocele via EBP in a 3-year-old after tethered cord release, thereby obviating the need for surgical repair and its potential morbidity.

2. Case report

This is a 3-year-old female born at 37 weeks gestation with double vessel cord and a medical history notable for scoliosis, tethered cord with terminal lipoma, eczema, asthma, ventricular septal defect (VSD), and bilateral myringotomy tube placement at 2 years of age for recurrent ear infections. The patient was initially diagnosed with tethered cord after undergoing scoliosis screening at her 3-year-old well-child visit. Spinal radiographs showed a Cobb angle of 46°. A spinal MRI demonstrated a tethered cord with terminal lipoma and multilevel vertebral anomalies including an L2 hemivertebra, sacral dysgenesis with right-sided fusion of the S2/S3 and S4/S5 segments, and coccygeal agenesis. A screening renal ultrasound was unremarkable and a screening echocardiogram demonstrated a tiny muscular VSD for which no treatment or precautions were needed. The patient was asymptomatic and had no abnormal neurologic findings on examination.

The patient subsequently underwent L4-L5 laminectomy and release of tethered cord. A posterior midline incision was made and a hemilaminotomy at the inferior aspect of L4 and superior aspect of L5 performed for exposure. Upon opening the meninges, a terminal lipoma was visualized and separated from the cauda equina with bipolar cautery and sharp dissection. No other pathology was evident. The dura was closed in a primary fashion and fibrin sealant placed on the incision. No intraoperative complications were noted. Following surgery, the patient was instructed to lie flat and provided 24 h of intravenous antibiotic coverage. The immediate postoperative course was uncomplicated, and the patient was discharged home on postoperative day (POD) 3.

The patient returned for a routine postoperative visit on POD 9. At that time, she was asymptomatic and functioning at her baseline without wound drainage or evidence of infection. On POD 14, the patient presented to the ED with 1 day of episodic neck pain and occipital headache followed by emesis and lethargy. She was otherwise at her neurologic baseline. Vital signs were unremarkable and labs notable only for a mild leukocytosis of 13,800 WBC per microliter. No focal neurological signs or meningismus was demonstrated on examination. MRI of the brain and total spine was performed. The brain MRI revealed findings suspicious for intracranial hypotension including diffuse smooth pachymeningeal enhancement, slight sagging of the brainstem with abnormal mammilopontine distance, and prominent epidural venous plexus engorgement (Fig. 1). The lumbar spine demonstrated expected postoperative changes including the transected fibrolipoma, as well as a small nonenhancing fluid collection in the surgical bed (Fig. 2). Given these findings, the patient was managed with 48 h of bedrest, standing caffeine, and IV corticosteroids for possible aseptic meningitis. Pain control was provided with standing oxycodone, ketorolac, Tylenol, and diazepam with PRN Dilaudid. Despite these measures, the patient experienced minimal symptomatic improvement.

On POD 17, the patient underwent EBP placement. The procedure was performed with local anesthetic and the assistance of an anesthesia team. Utilizing CT guidance and a loss-of-resistance technique with air contrast, a 22-gauge spinal needle was advanced into the dorsal epidural space at L3-L4 from a right paraspinous interlaminar approach so as to avoid the surgical bed (Fig. 3). Nine milliliters of blood was withdrawn from an intravenous line, the first 3 ml intentionally wasted and the remaining 6 ml mixed with 1 ml Iohexol-180 contrast. Six milliliters of the blood:contrast mixture was then slowly instilled into the epidural space. CT imaging confirmed appropriate position, after which the needle was removed and a sterile dressing applied. No complications were encountered. The patient was instructed to lie flat overnight following the procedure.

The patient and mother reported an immediate improvement of symptoms after the EBP and the following morning the patient's symptoms had resolved entirely. Pain medications were weaned and she was discharged home on postprocedure day 3. She remained asymptomatic with return to baseline function through her most recent follow-up appointment 1 month after blood patch placement.

3. Discussion

When intracranial hypotension is clinically suspected, MRI may be obtained for noninvasive diagnosis. The classic imaging features include diffuse pachymeningeal thickening and enhancement, sagging of the brain with descent of the brainstem and tonsillar herniation, engorgement of epidural venous sinuses, subdural collections, enlargement of the pituitary, and decrease in the size of the cisterns and ventricles. Spinal MRI may be obtained for better localization of

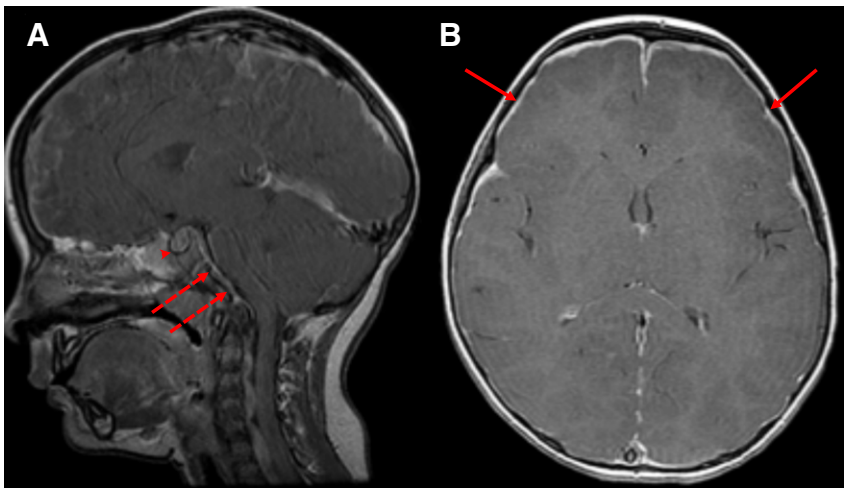

Fig. 1. Sagittal (A) and axial (B) T1 postcontrast images demonstrating diffuse pachymeningeal enhancement (solid arrows), sagging of the brainstem, pituitary hyperemia (arrowhead), and engorgement of the preclival venous plexus (dashed arrows), suspicious for intracranial hypotension.