Post–dural puncture headache has been reported to occur in 1%–25% of children following a lumbar puncture,4,6,8 a rate similar to that seen in adults. Persistence of post–dural puncture headache in spite of bed rest, increased fluid intake, and epidural blood patch treatment, however, is rare. The authors reviewed the medical records and imaging studies of all patients 19 years of age or younger who they evaluated between 2001 and 2010 for intracranial hypotension, and they identified 8 children who had persistent post–dural puncture headache despite maximal medical treatment and placement of epidural blood patches. A CSF leak could be demonstrated radiologically and treated surgically in 3 of these patients, and the authors report these 3 cases.

The patients were 2 girls (ages 14 and 16 years) who had undergone lumbar puncture for evaluation of headache and fever and 1 boy (age 13 years) who had undergone placement of a lumbarperitoneal shunt using a Tuohy needle for treatment of pseudotumor cerebri. The boy also had undergone a laminectomy and exploration of the posterior dural sac, but no CSF leak could be identified. All 3 patients presented with new-onset orthostatic headaches, and in all 3 cases MRI demonstrated a large ventral lumbar or thoracolumbar CSF collection. Conventional myelography or digital subtraction myelography revealed a ventral dural defect at L2–3 requiring surgical repair. Through a posterior transdural approach, the dural defect was repaired using 6-0 Prolene sutures and a dural substitute. Postoperative recovery was uneventful, with complete resolution of orthostatic headache and of the ventral cerebrospinal fluid leak on MRI.

The authors conclude that persistent postdural puncture headache requiring surgical repair is rare in children. They note that the CSF leak may be located ventrally and may require conventional or digital subtraction myelography for exact localization and that transdural repair is safe and effective in eliminating the headaches.

This study was approved by our medical center’s institutional review board.

Case Reports

All 3 patients presented with new-onset orthostatic headaches, and a large ventral lumbar or thoracolumbar CSF collection was found on MRI in all 3 cases. Conventional myelography or digital subtraction myelography demonstrated a ventral dural defect at L2–3 requiring surgical repair. Through a posterior transdural approach, the dural defect was repaired using 6-0 Prolene sutures. Postoperative recovery was uneventful and all 3 patients experienced complete resolution of orthostatic headache.

This article contains some figures that are displayed in color online but in black-and-white in the print edition.
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with resolution of the ventral CSF leak demonstrated on MRI.

Case 1

**History and Examination.** This 14-year-old girl presented with a 6-week history of intractable orthostatic headaches. These headaches occurred immediately after an uneventful diagnostic lumbar puncture performed for the evaluation of a new-onset nonpositional biparietal headache associated with nausea and fever. Examination of the CSF had shown no abnormality. The patient’s headaches had persisted in spite of bed rest and 4 lumbar epidural blood patches. The results of neurological examination were normal. The results of an MRI examination of the brain prior to the lumbar puncture were normal, but MRI following the lumbar puncture showed brain sagging and pachymeningeal enhancement. An MRI examination of the spine showed a ventral extradural fluid collection extending from L-2 to L-4 (Fig. 1). Conventional myelography demonstrated a ventral dural defect at the L2–3 level (Fig. 1).

**Operation and Postoperative Course.** An L2–3 laminectomy and midline durotomy were performed. A small circular ventral dural defect was identified (Fig. 2), and it was repaired with a 6-0 Prolene suture. The area was reinforced with a small pledget of muscle and Tisseel. The patient tolerated the procedure well and the orthostatic headaches resolved. Postoperative MRI examination showed resolution of the brain sagging, meningeal enhancement, and ventral extradural fluid collection (Fig. 1). No recurrence has been noted during 3 years of follow-up.

Case 2

**History and Examination.** This 16-year-old girl presented with a 6-week history of intractable orthostatic headaches. These headaches began immediately following an uneventful diagnostic lumbar puncture performed for the evaluation of a new-onset nonpositional generalized headache associated with nausea, vomiting, and fever. Examination of the CSF showed a mildly elevated white blood cell count. The headaches had persisted in spite of bed rest and 2 lumbar epidural blood patches. The results of neurological examination were normal. The results of MRI examination of the brain were normal, but MRI examination of the spine showed a ventral extradural fluid collection extending from L-2 to L-5 (Fig. 3). Conventional myelography demonstrated a ventral dural defect at the L2–3 level (Fig. 3).

**Operation and Postoperative Course.** An L2–3 laminectomy and midline durotomy were performed. A small ventral dural defect was identified, and it was repaired with a 6-0 Prolene suture. The area was reinforced with Durepair and Tisseel. The patient tolerated the procedure well and the orthostatic headaches resolved. Postoperative MRI examination showed resolution of the ventral extradural fluid collection (Fig. 3). No recurrence has been noted during 2 years of follow-up.

![Fig. 1. Case 1. Preoperative (A) and postoperative (B) T2-weighted MR images showing the ventral CSF collection (A, arrows) and its resolution (B). C: Conventional myelogram showing a ventral leak at L2–3 (arrow). D: Postmyelogram CT image showing the ventral CSF collection (arrow).](image)

![Fig. 2. Case 1. Intraoperative view of the ventral dural defect (arrow).](image)
Case 3

History and Examination. This 13-year-old boy presented with a 9-month history of intractable orthostatic headaches. These headaches started following placement of a lumboperitoneal shunt using a Tuohy needle for the treatment of pseudotumor cerebri (diagnosed when the patient was 11 years old). The headaches had persisted in spite of bed rest, removal of the lumboperitoneal shunt and placement of a ventriculoperitoneal shunt, multiple lumbar epidural blood patches, and a lumbar laminectomy for possible repair of a CSF leak with negative exploration of the posterior dura. The results of neurological examination were normal, and the results of MRI examination of the brain were normal, but MRI examination of the spine showed a ventral extradural fluid collection extending from T-11 to L-3 (Fig. 4). Digital subtraction myelography demonstrated a ventral dural defect at the L2–3 level (Fig. 4).

Operation and Postoperative Course. The previously made L2–3 laminectomy was enlarged and a midline durotomy was performed. A small C-shaped ventral dural defect was identified, and this was repaired with a 6-0 Prolene suture. The area was reinforced with Durepair and Tisseel. The patient tolerated the procedure well with eventual resolution of the orthostatic headaches. Postoperative MRI examination showed resolution of the ventral extradural fluid collection (Fig. 4). No recurrence has been noted during 9 months of follow-up.

Discussion

All 3 children in our study with persistent post–dural puncture headache and radiologically confirmed CSF leak were found to have a ventral dural defect. This suggests that the needle was placed “through-and-through,” breaching the ventral as well as posterior dural sac. It is perhaps not surprising that these patients with persistent headaches had a ventral source of CSF leakage in spite of multiple epidural blood patches, because such blood patches are placed through a midline posterior approach, and the resultant epidural hematoma generally is confined to the posterior or occasionally posterolateral intraspinal compartment. Also, recalcitrant spontaneous spinal CSF leaks that may persist for years or even decades are almost always ventral in location.10
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Magnetic resonance imaging or postmyelography CT scans showed a ventral extrathecal CSF collection in the lumbar or thoracolumbar spine spanning between 3 and 5 spinal levels. This did not allow adequate localization of the dural defect for surgical planning, because the original spinal dural punctures were not performed using radiographic confirmation and the exact spinal levels were thus unknown. To visualize the exact site of the ventral dural defect, we found that conventional myelography or preferably digital subtraction myelography5,9 was useful.

Conclusions

Persistent post–dural puncture headache requiring surgical repair is rare in children. The CSF leak may be located ventrally and may require conventional myelography for exact localization. Transdural repair is safe and effective in eliminating the headaches.

Disclosure

The authors report no conflict of interest concerning the materials or methods used in this study or the findings specified in this paper.

Author contributions to the study and manuscript preparation include the following. Conception and design: Schievink. Acquisition of data: both authors. Analysis and interpretation of data: both authors. Drafting the article: Schievink. Critically revising the article: both authors. Reviewed submitted version of manuscript: both authors. Approved the final version of the manuscript on behalf of both authors: Schievink. Statistical analysis: both authors.

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