LV-EBP: Record-setting large volume epidural blood patch

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SIH Treatment

• Typical cases of **spontaneous intracranial hypotension (SIH)** often improve with conservative management, including bed rest, hydration, and caffeine.

• When conservative management fails, an **epidural blood patch (EBP)** or **fibrin glue injection** may be considered.
Epidural Blood Patch: A Rapid Coagulation Response

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Epidural Blood Patch: Why the Rapid Response?

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Epidural Injection Does Cause an Increase in CSF Pressure

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In a controlled model simulating the mixing of blood and cerebrospinal fluid (CSF) at a dural leakage site, we have found that a clot forms in an average of only 22 s. This is some four times faster than even an activated clotting time.

We have observed a rapidity of clotting more in keeping with the nearly immediate relief of spinal headache treated with epidural blood patches, and suggest that there may be coagulation at this interface of blood and CSF that causes almost instantaneous formation of a plug.
Epidural Blood Patch: A Rapid Coagulation Response

I beg to take issue with them, however, on their suggestion that the rapid clotting might explain the nearly immediate relief of postspinal headache sometimes seen after treatment by epidural blood patch.

An epidural blood patch then must effect a cure in a two-stage manner; first, the blood clot seals the hole in the dura, and, second, the brain’s “cushion” of cerebrospinal fluid is replenished by the choroid plexuses in the ventricles—too slow a process (~0.5 mL/min) to explain the almost instant relief of headache sometimes seen after blood patching. It is more likely that this rapid relief is the result of the injected volume of blood raising the pressure in the epidural and spinal subarachnoid spaces so that cerebrospinal fluid is forced back inside the cranium and immediately restores the cushioning effect on the brain.

Epidural Blood Patch: Why the Rapid Response?

Epidural Injection Does Cause an Increase in CSF Pressure

Anesth Analg 1991;73:668–76
Epidural Blood Patch: A Rapid Coagulation Response

ANESTH ANALG
1990;70:567–72

Epidural Blood Patch: Why the Rapid Response?

ANESTH ANALG
1991;72:127–31

Epidural Injection Does Cause an Increase in CSF Pressure

Anesth Analg 1991;73:668–76

A 74-yr-old, 70-kg man underwent a descending thoracic aortic aneurysm repair. The epidural catheter was placed in the second to third lumbar interspace. To enhance spinal cord protection, a second catheter was placed in the lumbar subarachnoid space two levels below the lumbar epidural catheter. The CSF pressure was measured and CSF was withdrawn at the time of aortic cross-clamping to reduce the subarachnoid pressure and improve spinal cord perfusion. Withdrawing 20 mL of CSF reduced the CSF pressure from 17 to 7 mm Hg. It was noted that a bolus injection of 10 mL of 1.5% lidocaine with 1:200,000 epinephrine into the epidural space transiently increased the CSF pressure by 12 mm Hg for 1–2 min (Figure 1). This was a repeatable phenomenon.
Compare the efficacy of various methods of epidural injection for restoring and maintaining CSF pressure for up to 240 min.

Continuous infusion of saline after bolus could maintain pressure increase, but within 60 min of stopping infusion, pressure returned to baseline.

Only whole blood or fibrin glue consistently increased CSF pressure.

Sealing the dural defect does not effectively correct CSF pressure unless an epidural tamponade effect is also maintained.
The immediate effect of an EBP is to raise the pressure in the epidural and subarachnoid spaces to restore CSF buoyancy and cushioning on the brain, whereas the long-lasting benefit is derived from sealing of an identified or suspected leak with clot.

The rationale of site-directed EBP or fibrin glue injections presumes focal clot sealing, whereas indirect injections rely on diffusion of blood to a suspected leak site prior to clotting.
Efficacy of EBP

• Great for...
  – known CSF leak sites (i.e. lumbar puncture)
  – clearly identified CSF leaks on imaging

• Not so great for...
  – widely separated or multiple CSF leaks
  – refractory cervical or thoracic CSF leaks
  – occult leaks
A novel technique of multiple-site epidural blood patch administration for the treatment of cerebrospinal fluid hypovolemic

Clinical article

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- **Multiple-site EBP administration technique** that involves a one-time placement of a catheter in the epidural space from the lumbar entry point up to as high as the C2 level.

- 5 patients with SIH
  - Autologous blood ranging from 7 to 75 ml.
  - Improvement in orthostatic headaches and prevention of chronic SDH recurrence.
mean volume: 45.6 mL

mean volume: 54.1 mL
55 year-old man with SIH

- Initially presenting with headache, followed by profound fatigue and somnolence.
- Eventually cognitive impairment and complete loss of short term memory (MOCA 14/30).

**MRI:** multiple large perineural cysts throughout the entire length of the spine.

**CT/MR myelography:** no leak.

**Thoracic laminectomy** for marsupialization of the largest cyst at T10–11.
LV-EBP Technique

- Prone positioning on the angiography table.

- Epidural puncture at L2-3 or L3-4 followed by injection of 2–3 ml of contrast to confirm epidural position.

- Guidewire insertion followed by 4-Fr 0.035-inch × 100-cm angiography catheter.

- Advanced to cervical level and guidewire withdrawn.

- Autologous blood carefully injected as catheter slowly withdrawn from the cervical levels, approximately 2.5–5 ml at each vertebral level.
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“Since I last saw him, he thinks he is 100% back to normal. He is going to work and not having any trouble at work. He is handling computer spreadsheets and multiple accounts. His wife says he is 95% back to his normal self. She does not really see any concerns around the house. There are no changes or unusual behaviour.”
Limitations

- LV-EBP is a novel procedure with limited literature; the risk profile is not known.
  - No adverse outcomes in the literature other than mild, transient headaches.

- Theoretically, LV-EBP could lead to epidural abscesses or symptomatic hematomas.

- There is potential for injury to a neural structure during the introduction of the catheter, and the difficulty in navigating around the epidural scar from previous procedures.
Summary

• LV-EBP avoids the pitfalls associated with SV-EBP:
  (1) The indirect effect of lumbar access.
  (2) The technical challenges of site-specific targeting in cervical
       or thoracic regions.

• The ability to target multiple levels with a large surface area of
  autologous blood is more likely to cover a suspected leak site.

• The true effectiveness of this procedure may be for patients with
  multilevel or occult CSF leaks.

  Injections of up to 120 mL can be performed safely.