

Intracranial subdural hematoma after unintended durotomy during spine surgery

[Un hématome sous-dural intracrânien causé par la durotomie involontaire lors d'une opération à la colonne vertébrale]

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Purpose: To report a case of intracranial subdural hematoma occurring after a spinal dural tear that was made unintentionally during the course of a posterior laminectomy and spinal fusion at the L₅-S₁ level. The possible physiopathological mechanisms are discussed.

Clinical features: On the fourth postoperative day, a 59-yr-old woman displayed persistent headache following unintended durotomy during spine implant revision. Perioperative blood loss was 2840 mL and intravascular replacement was about 3000 mL. She was hydrated with iv fluids and treated with non-steroidal anti-inflammatory drugs. The symptoms improved but persisted. With the aggravation of the headache complicated with unconsciousness and the appearance of focal neurological signs on the eighth day, a computed tomography was obtained and revealed a right subdural hematoma. Following surgical drainage, the patient made an uneventful recovery.

Conclusion: This case reminds us that subdural hematoma formation can complicate durotomy during spine surgery. Neurological deterioration in the postoperative period should prompt clinicians to rule out the diagnosis and intervene rapidly as appropriate.

Objectif: Rapporter un cas d'hématome sous-dural intracrânien survenu après une brèche involontaire de la dure-mère spinale au cours d'une laminectomie postérieure et d'une arthrodeèse au niveau L₅-S₁. Les mécanismes physiopathologiques possibles sont discutés.

Éléments cliniques: Au quatrième jour postopératoire, une femme de 59 ans présentait des céphalées persistantes après une durotomie involontaire survenue pendant la reprise d'un implant rachidien. La perte sanguine périopératoire a été de 2 840 mL et le remplissage vasculaire d'environ 3 000 mL. La patiente a été hydratée avec des liquides iv et traitée par des anti-inflammatoires non stéroïdiens. Ce

qui a diminué les symptômes sans les éliminer. Étant donné l'aggravation des céphalées, compliquées d'inconscience, et de l'apparition de signes neurologiques le huitième jour, on a demandé un examen tomodensitométrique qui a révélé un hématome sous-dural droit. Après le drainage chirurgical, la patiente s'est bien rétablie.

Conclusion : Ce cas rappelle que la formation d'un hématome sous-dural peut compliquer la durotomie survenant pendant une opération à la colonne vertébrale. La détérioration neurologique postopératoire incite à poser rapidement le diagnostic et à intervenir en conséquence.

CEREBROSPINAL fluid (CSF) leakage induced headache is often noted after spinal anesthesia and unintentional dural puncture during epidural anesthesia and results from traction on pain-sensitive structures within the cranium.¹⁻³ Unintended durotomy is one of the most common complications encountered during spine surgery.⁴ An accidental dural tear allows a continued leakage of CSF with caudal displacement of the brain. It may further tear the intracranial subdural veins and result in subdural hematoma formation. The present report describes a case of intracranial subdural hematoma formation following accidental durotomy during spine surgery consisting of posterior laminectomy with variable screw placement stabilization. Here, we emphasize the importance of early diagnosis and appropriate treatment of this serious complication.

Case report

A 59-yr-old woman (height 158 cm, weight 62 kg) was admitted with a diagnosis of failure of the spine

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instrumentation over L₅–S₁ and surgical revision was planned. Hypertension and diabetes mellitus had been noted for years and were under regular medical treatment. All laboratory data including coagulation status were within normal limits on admission. Preoperative blood pressure was 150/80 mmHg with heart rate around 90 beats·min⁻¹. Anesthesia was induced with thiopentone 300 mg and fentanyl 100 µg and tracheal intubation facilitated by succinylcholine 80 mg. Anesthesia was maintained with isoflurane 4–5% in O₂ (300 mL·min⁻¹). The arterial hemoglobin O₂ saturation (SpO₂) remained between 98–99% during surgery. The patient was ventilated mechanically and end-tidal CO₂ maintained between 35–40 mmHg.

The patient underwent posterior laminectomy for L₅ to S₁ fusion with autologous iliac bone graft and stabilization with a variable screw placement system. A dural tear was identified during the procedure. Primary closure was performed with 4-O and 5-O silk, and gelfoam was used to cover the repair site. A subfascial suction drain was placed and the wound closed layer by layer. Total perioperative blood loss was 2840 mL. Total fluid replacement included four units of packed red blood cell (125 mL per unit; total 500 mL), six units of whole blood (250 mL per unit; total 1500 mL) and 3000 mL of crystalloids during the operation.

The patient denied the presence of headache during the first three days after surgery. On the fourth day, the patient developed a persistent, throbbing right retro-orbital and right hemicranial headache with a mild neck stiffness. However, her vital signs, including temperature, were within normal limits and no abnormalities were found on physical or neurologic examination. These symptoms were first thought to be due to CSF leakage, thus she was hydrated with 1000 mL *iv* fluids and treated with non-steroidal anti-inflammatory drugs (NSAIDs). The symptoms improved but did not disappear. On the seventh postoperative day, the patient complained of severe headache with nausea and vomiting that was not related to position changes. Moreover, general weakness and loss of appetite were also noted. Again, her medical history revealed no previous head trauma, coagulation abnormalities, or neurologic disorders. Once more, *iv* fluids and NSAIDs were given, and resulted in some improvement. Two days later, the patient's condition deteriorated further and she became drowsy. Neurological examination revealed a left hemiparesis with left Babinski's sign and the Glasgow coma scale was 9. Emergent computed tomography (CT) scan showed a large subdural hematoma over the right convexity with midline shift and marked subfascial herniation. Emergent right-parietal burr-hole with drainage was performed under gen-

eral anesthesia without any complication. This second operation relieved the patient's symptoms, and she was discharged 14 days later without any neurological sequelae.

Discussion

Dural tear is one of the most common complications of spine surgery, with a prevalence of 1 to 17% in series reporting from 5 to 450 patients.^{5–8} The causes of dural tear during primary operation include eroded or thin dura, dura adhesion, and redundant dura in patients diagnosed with a tight spinal stenosis. It is particularly prevalent in patients who have epidural fibrosis and scar tissue adherent to the dura during revision of spine surgery.⁴ The operative technique plays a key role in avoiding injury to the dural tissue.

Intracranial subdural hematoma formation has been reported after dural tear with persistent leakage of CSF.⁹ However, the exact pathophysiological mechanism is not known. One possible explanation is that CSF leakage reduces intraspinal as well as intracranial pressure. The altered CSF dynamics may result in a caudally-directed movement of the spinal cord and brain, which in turn stretches the pain-sensitive structures, dura, cranial nerves and bridging veins.¹⁰ Cerebral veins drain into dural sinuses that are adherent to the inner table of the skull. Many structural features, based mainly on electron microscopic data, imply that bridging veins are more fragile in the subdural portion than in the subarachnoid space.¹¹ Therefore, any traction exerted on the bridging veins will rupture at their weakest point in the subdural space. It is presumed that CSF leaked via a dural fistula created by accidental durotomy may cause a caudal displacement of the brain, which in turn pulls and tears the bridging vessels, and results in a subdural hemorrhage and hematoma formation. The symptoms of such intracranial hematoma are persistent headache, sometimes accompanied with other symptoms and signs such as vomiting and a feeling of unreality. In many cases, somnolence, confusion, even coma are the symptoms that first lead to the diagnosis. A CT-scan will confirm the diagnosis and must be performed as early as it is suspected.

Dehydration may further increase the risk of imbalance between CSF loss and production.¹² Dehydration induced reduction of brain volume could lead to subdural hemorrhage. Low intracranial pressure, as a result of perioperative dehydration, promotes excessive blood congestion in the bridging veins with consequent dilatation and increasing tension of the vessels, which are further stretched by a downward displacement of the brain, and consequently more vulnerable to the

movement of the brain within its coverings due to the decreased cerebral volume.¹³ In the present case, total intraoperative blood loss was 2840 mL, fluid replacement totalled 5500 mL, ruling out dehydration. Trivial head injury may also lead to a subdural hematoma in elderly patients and spontaneous hematoma is also observed in anticoagulated patients.¹⁴ In the present case, the patient neither had a history of head injury nor received anticoagulants and the postoperative coagulation status was within normal limits.

In summary, a 59-yr-old woman developed an intracranial subdural hematoma ten days after unintended durotomy during revision spine surgery. This case reminds us that subdural hematoma formation can complicate durotomy during spine surgery. Neurological deterioration in the postoperative period should prompt clinicians to rule out the diagnosis and intervene rapidly as appropriate.

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