



## Acute Intracranial Subdural Hematoma Following Dural Tear in Spine Surgery: A Rare but Potentially Life-Threatening Complication

João Paulo Souza de Castro\*, Caio Zacchi Martucci, Eloy Rusafa Neto, Danilo Gomes Quadros, Paulo Ricardo Correia Soares, and Roger Schmidt Brock

Department of Neurology and Neurosurgery, Hospital das Clínicas da Universidade de São Paulo, São Paulo, Brazil

\*Corresponding author: João Paulo Souza de Castro, Department of Neurology and Neurosurgery, Hospital das Clínicas da Universidade de São Paulo, São Paulo, Brazil, Tel: 5511942470315; E-Mail: [souzacastro.jp@gmail.com](mailto:souzacastro.jp@gmail.com)

Received date: February 13, 2021; Accepted date: February 28 2021; Published date: March 10, 2021

### Abstract

**Background:** Dural tearing on complex spinal surgeries is a well-known complication on literature, however, acute subdural hematoma due to Cerebral Spinal Fluid (CSF) and consequently intracranial hypotension is rare. This is the first case reported in the literature in which the immediately post-operative exam showed anisocoric pupils and acute subdural hematoma was promptly identified.

**Methods:** To report a case of an acute intracranial subdural hematoma following a CSF leak during a post infectious spine deformity correction surgery, leading to cerebral herniation and brain stem compression.

**Results:** A 39 year-old female patient, diagnosed with Pott's disease on 2014 treated with antibiotics and no prior surgery evolved with progressive thoracic kyphosis and paraparesis grade III. CT scan showed T11 vertebral body involvement with kyphotic deformity and MRI indicated spinal cord compression. A T11 vertebrectomy (VCR) and kyphosis correction was performed and an incidental dural tear was primary treated with direct suture. On immediate post-operative examination anisocoric pupils was noted and an immediate brain CT scan showed a left acute fronto-temporo-parietal subdural hematoma with uncal herniation requiring drainage. After the surgical procedure, patient was discharged from the hospital after 3 weeks with outpatient rehabilitation.

**Conclusion:** Dural tear and intracranial hypotension is usually a benign condition; however, a potentially fatal complication is the formation of an acute intracranial subdural hematoma. This case demonstrates the need for awareness of this potentially fatal complication after spine surgery.

**Keywords:** Spine surgery; Dural tear; Subdural hematoma

### Introduction

Intracranial hypotension is caused by decreased Cerebrospinal Fluid (CSF) volume and may result in changes in mental status, seizures, orthostatic headaches, neck stiffness, nausea, vomiting, visual and auditory disturbances [1,2]. It has been associated with the development of acute intracranial subdural hemorrhage, probably as a result of venous structures traction after a rapid drop in intracranial pressure [3-5].

Besides intracranial subdural hematomas, hygromas, cerebellar hemorrhages, venous congestion, and infarction have been reported to occur due to intracranial hypotension from durotomy [2,6-11].

Patients with a history of head trauma, cerebral atrophy, cranial vault abnormalities, arteriovenous malformations, hemorrhagic diatheses, cerebral aneurysms, meningovascular syphilis, and meningiomas may be at increased risk for such hemorrhagic complications [3,12].

Herein we report the first case in the literature in which the immediately post-operative exam showed anisocoric pupils and acute subdural hematoma was promptly identified and surgically treated.

### Methods

Report a case of an acute intracranial subdural hematoma following a CSF leak during a thoraco-lumbar spine surgery.

### Results

A 39-year old female patient presented to our institute on 2014 with persistent coughing and painful breathing. Thorax CT scan and further clinical investigation were performed and pleural tuberculosis was diagnosed. Also on CT scan and MRI T11 vertebral body involvement was noted as Pott's disease (Figure 1).

Patient was treatment with Rifampicine (R), Isoniazide (I), Pirazinamide (P) and Etambutol (E) according to infectology department protocol and kept with Jewett's Brace for 6 months, no neurologic symptoms were present and no surgery intervention was performed.



Figure 1: T11 involvement associated with Pott's disease.

On February 2020 patient evolved with progressive para paresis being referred to emergency department for evaluation, presenting with motor grade II on lower limbs, T10 hypoesthesia level and sphincter dysfunction. New thoracic spine MRI and CT scan were performed showing significant worsening of the thoracic kyphosis leading to anterior spinal cord compression (Figures 2 and 3).

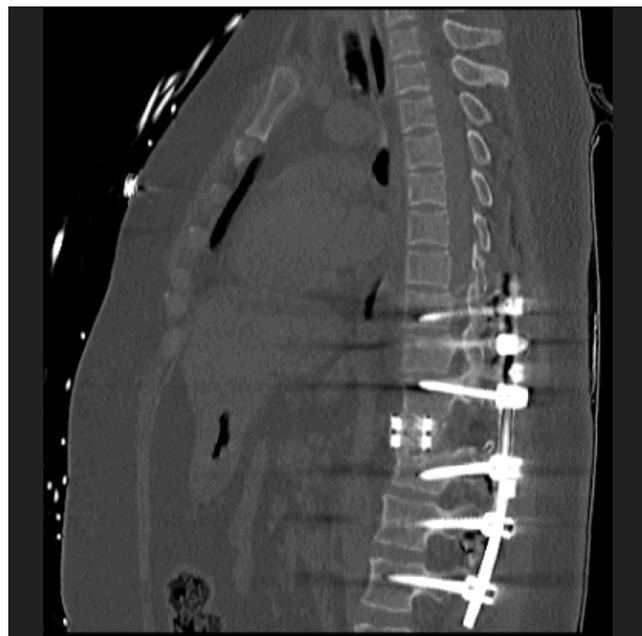


**Figure 2:** CT scan showing significant worsening of the thoracic kyphosis.



**Figure 3:** MRI showing worsening of the thoracic kyphosis leading to anterior spinal cord compression.

A surgery for deformity correction and spinal cord release by a posterior approach T11 VCR and reconstruction with vertebral body cage associated with T8-L3 pedicle screws fixation was performed (Figure 4). During spinal canal decompression an incidental dural tearing was noted, with prompt correction with primary suture.



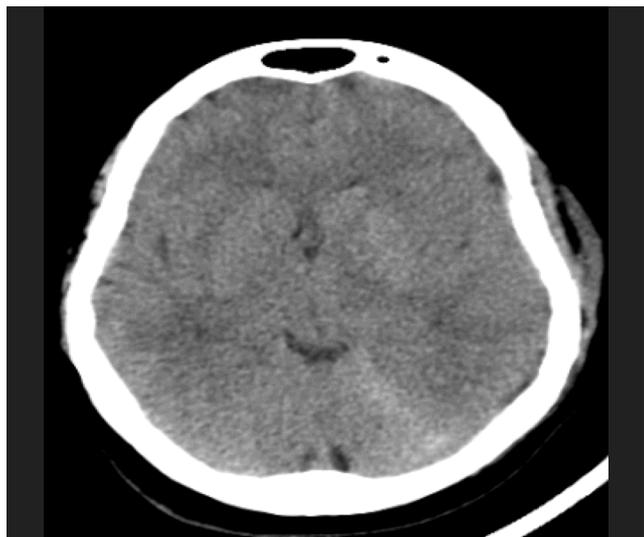
**Figure 4:** Post-operative spine CT showing T11 VCR and reconstruction with vertebral body cage and T8-L3 pedicle screws fixation.

On immediate post-operative neurological examination at the operating room the patient was anisocoric, still undergoing propofol and phentanyl infusion. Immediate brain CT scan was performed and an acute left fronto-temporo-parietal subdural hematoma was diagnosed with 13 mm thickness and causing a 10 mm subfalcine herniation (Figure 5).



**Figure 5:** Post-operative brain CT scan revealed an acute left fronto-temporo-parietal subdural hematoma with 13 mm thickness and 10mm subfalcine herniation.

Patient underwent emergency hematoma evacuation. Satisfactory hemostasis was achieved after dural bridging veins coagulation and there was no associated brain edema, allowing craniotomy replacement (Figure 6). Subdural ICP catheter was placed.



**Figure 6:** Post-operative brains CT after subdural hematoma drainage.

After the surgical procedure, the patient was discharged from the hospital after 3 weeks with outpatient rehabilitation. At 6 months follow-up, patient was walking without support and completely independent for daily activities, about to return to work.

### Discussion

Dural injuries in spinal surgery are usually the result of direct trauma. Excessive nerve root traction, instrumentation and residual bony spicules are factors that can lead to a durotomy [6,13]. Prompt intraoperative recognition of an injury is ideal and can lead to its repair and subsequent prevention of sequelae [14].

Intracranial hypotension is a well-known consequence of procedures that reduce CSF volume and pressure, such as lumbar puncture, spinal anesthesia, myelography, craniotomy, and ventricular shunts [1].

Though usually benign in nature, intracranial hypotension has been shown to result in potentially fatal complications, as an acute intracranial subdural hematoma. Some series reported subdural hematomas in 10% of all cases of intracranial hypotension [1]. According to Isik et al. the incidence of intracranial pathology following spinal surgery is uncommon and as low as 0.8% [15]. Pham et al. demonstrate an incidence of 0.4%, demonstrating how rare it is [14].

According to the Monro-Kellie doctrine, the Intracranial Pressure (ICP) is regulated by a fixed system with any change in one component resulting in compensatory change in another to maintain equilibrium. Hence, the subdural space expands as the ICP drops from CSF leakage. This places tension and stretching on the fragile bridging subdural veins with risks for rupture and ensuing subdural hematomas [16].

Burkhard and Duff described a patient with diffuse headache, nausea, vomiting, and dizziness following a L5-S1 discectomy for sciatica. A head CT showed bilateral acute subdural hematomas [2].

Lu et al. report a case of a 59-year-old woman who underwent a posterior laminectomy and spinal fusion at the L5-S1 level with a spinal dural tear made unintentionally during the course of the surgery. Postoperatively patient evolved with headache complicated with unconsciousness and the appearance of focal neurological signs on the eighth day, performing a brain CT which showed a right subdural hematoma requiring surgical drainage [17].

Hentschel et al. described a patient with an extradural metastatic breast cancer to the T5 vertebra who underwent resection with reconstruction and seven months after the procedure became acutely obtunded and was found to have bilateral subdural fluid collections and pneumocephalus. Nuclear cisternography demonstrated a CSF-pleural fistula and reexploration revealed a dural leak, which was closed with an intercostal muscle flap, and the patient recovered with no residual neurologic deficits [18].

Sciubba et al. reported a 55-year-old woman who underwent lumbar surgery for failed back syndrome. A dural tear was noted and repaired intraoperatively. She evolved with expressive aphasia and CSF drainage from her lumbar wound one week later. A head CT showed an acute intracranial subdural hematoma with mass effect and evacuation was performed via craniotomy; the lumbar dura was repaired intraoperatively [19].

Jung et al. described a 58-year-old man with a disc herniation and upward migration at the L1-L2 level. A posterior lumbar inter-body fusion and decompression was performed; dural tear was not noted microscopically during the operation, however, there was continuous fluid drainage from the inferior edge of lumbar incision after removal of the hemovac drainage system. The patient complained of a severe headache with nausea and vomiting and associated with standing position. Three days after the surgery a brain CT was performed and revealed acute subdural hematomas at the frontoparietal area, bilaterally. The surgical lumbar wound was explored again and a small dural breach, at the discectomy site, was identified and repaired. The symptoms including headache resolved immediately after repair of the dura and the follow-up serial CT showed marked resolution of the subdural hematoma [20].

Khalatbari et al. reviewed 1077 patients who underwent lumbar spine surgery at their institution from 2003 to 2010 and found one case of acute subdural hematoma, one case of epidural hematoma, and two cases of remote cerebellar hemorrhage. The acute subdural hematoma was managed conservatively, the epidural hematoma required craniotomy for evacuation, and both of their remote cerebellar hemorrhages required ventriculostomy placement [21].

Pham et al. in a retrospective review of 1113 consecutive patients with 1396 spine surgeries evaluate the incidence of intracranial complications and put into perspective these risks associated with durotomy in spinal surgery. These authors demonstrate an incidence of 0.4% of total intracranial pathology, which were subdural hygroma 4 patients, subdural hematoma 1 patient, and remote cerebellar hemorrhage 1 patient [14].

Zakaria e Tsuji describe a case of intracranial subdural hematoma developing after an S1 arachnoid cyst resection in a 41-year-old woman. Under microscopic vision, a tract at the subarachnoid space was identified as the cause of CSF collection in the cyst; the cyst was excised and the tract closed with non-absorbable sutures. This was followed by repair of the dura with non-absorbable sutures and fibrin glue. A non-vacuum lumbar drain was inserted prior to closure. Postoperatively, patient evolved with a sub-fascia lumbar drain collection with persistent volume increment of 30, 70 and 300ml on post-operative day one, two and three, respectively. This was accompanied by postural headache on day two, worse upon sitting and relieved in supine position. At day three post-operatively, she experienced left sided hemiparesis and an urgent brain CT revealed a large right-sided subdural hematoma. She underwent emergency evacuation of hematoma. Further re-exploration of CSF leak was not done. Patient continued to show positive outcome with complete recovery of left sided hemiparesis [16].

We report the rare case of an acute intracranial subdural hematoma caused by a CSF leak following a spine surgery. To our knowledge, this is the first case reported in the literature in which the immediately post-operative exam showed anisocoric pupils and acute subdural hematoma was promptly identified and treated.

## Conclusion

This report illustrates the potential morbidity associated with CSF leaks occurring after spinal surgery and the need for awareness of this potentially fatal complication after spine surgery. Although a rare occurrence, the spinal surgeon must have a strong clinical suspicion of subsequent intracranial pathology should there be some CSF leak observed intraoperatively during surgery. Neurologic symptoms of headache, altered mental status, seizure, or cranial nerve deficits after spinal surgery should be worked up to exclude these rare but potentially life-threatening complications.

Lastly, we emphasize the importance of immediate physical examination after the patient's operation, including the evaluation of pupils, since a failure to identify the patient's anisocoria as reported in this case could not lead to prompt identification of the acute subdural hematoma with uncal herniation by the brain CT early performed.

## Author Contributions

Conceptualization: JPSC. Methodology: CZM. Software: CZM. Validation: JPSC. Formal analysis: JPSC. Investigation: JPSC. Resources: ERN. Data curation: JPSC. Writing-Original Draft: \*JPSC, DGM. Writing-Review & Editing: JPSC, ERN, RSB. Visualization: PRCS. Supervision: RSB. Project administration: RSB.

## Conflict of Interest

*The authors declare that they have no conflicts of interest.*

## References

1. Francia A, Parisi P, Vitale AM, Esposito V (2001) Life-threatening intracranial hypotension after diagnostic lumbar puncture. *Neurol Sci* 22: 385-389.
2. Burkhard PR, Duff JM (2000) Bilateral subdural hematomas following routine lumbar discectomy. *Headache* 40:480-482.
3. Acharya R, Chhabra SS, Ratra M, Sehgal AD (2001) Cranial subdural haematoma after spinal anaesthesia. *Br J Anaesth* 86:893-895.
4. Dillon WP, Fishman RA (1998) Some lessons learned regarding the diagnosis and treatment of spontaneous intracranial hypotension. *AJNR Am J Neuroradiol* 19:1001-1002.
5. de Noronha RJ, Sharrack B, Hadjivassiliou M, Romanowski C (2003) Subdural haematoma: a potentially serious consequence of spontaneous intracranial hypotension. *J Neurol Neurosurg Psychiatry* 74:752-755.
6. Alexandra DB, Soo TM, Claybrooks R (1009) Subdural hematoma after microdiscectomy: a case report and review of the literature. *Spine J* 9: e9-e12.
7. Yaroslav P, Urbach H, Kovacs A, Klehr M, Kristof RA (2011) Pseudohypoxic brain swelling (postoperative intracranial hypotension-associated venous congestion) after spinal surgery: Report of 2 cases. *Neurosurgery* 68: E277-E283.
8. Jonathan AF, Ecker RD, Piepgras DG, Duke DA (2002) Cerebellar hemorrhage after spinal surgery: report of two cases and literature review. *Neurosurgery* 50: 1361-1364.
9. Konya D, Ozgen S, Necmettin PM (2006) Cerebellar hemorrhage after spinal surgery: case report and review of the literature. *Eur Spine J* 15: 95-99.
10. Kuhn J, Hofmann B, Knetelius HO, Coenen HH, Bewermeyer H (2005) Bilateral subdural haematomata and lumbar pseudomeningocele due to a chronic leakage of liquor cerebrospinalis after a lumbar discectomy with the application of ADCON-L gel. *J Neurol Neurosurg Psychiatry* 76: 1031-1033.
11. Thomas G, Jayaram H, Cudlip S, Powell M (2002) Supratentorial and infratentorial intraparenchymal hemorrhage secondary to intracranial CSF hypotension following spinal surgery. *Spine (Phila Pa 1976)* 27:E410-E412.
12. Gaucher DJ Jr, Perez JA Jr (2002) Subdural hematoma following lumbar puncture. *Arch Intern Med* 162:1904-1905.
13. Bosacco SJ, Gardner MJ, Guille JT (2001) Evaluation and treatment of dural tears in lumbar spine surgery: A review. *Clin Orthop Relat Res* 389: 238-247.
14. Martin HP, Tuchman A, Platt A, Hsieh PC (2016) Intracranial complications associated with spinal surgery. *Eur Spine J* 25:888-894.
15. Isik S, Yilmaz B, Ekşi MS, Özcan-Ekşi EE, Akakin A, et al (2016) Delayed onset intracranial subdural hematoma following spinal surgery. *J Craniofac Surg* 27: e370-e373.
16. Zakaria AF, Tsuji M (2019) Intracranial Subdural Hematoma after Lumbar Spine Surgery: A Case Report. *Malays Orthop J* 13: 85-87.
17. Chueng-He L, Ho S-T, Kong S-S, Cherng C-H, Wong C-S (2002) Intracranial subdural hematoma after unintended durotomy during spine surgery. *Can J Anaesth* 49: 100-102.
18. Hentschel SJ, Rhines LD, Wong FC, Gokaslan ZL, McCutcheon IE (2004) Subarachnoid-pleural fistula after resection of thoracic tumors. *J Neurosurg* 100: 332-336.
19. Sciubba DM, Kretzer RM, Wang PP (2005) Acute intracranial subdural hematoma following a lumbar CSF leak caused by spine surgery. *Spine (Phila Pa 1976)* 30: E730-E732.
20. Jung YY, Ju C, Kim SW (2010) Bilateral subdural hematoma due to an unnoticed dural tear during spine surgery. *J Korean Neurosurg Soc* 47: 316-318.
21. Khalatbari MR, Khalatbari I, Moharamzad Y (2012) Intracranial hemorrhage following lumbar spine surgery. *Eur Spine J* 21: 2091-2096.

**Citation:** Castro JPS (2021) Acute Intracranial Subdural Hematoma Following Dural Tear in Spine Surgery: A Rare but Potentially Life-Threatening Complication. *J Spine Neurosurg* 10:3.

---