International Medical Case Reports Journal

Dovepress
open access to scientific and medical research

Open Access Full Text Article

CASE REPORT

Case Report and Literature Review of Acute Spontaneous Intraspinal Epidural Hematoma (SSEH) Secondary to Myeloproliferative Disease

Qinghao Liu*, Weiwen Zhao*, Hao Yin

Department of Orthopedic, The First Affiliated Hospital of Hunan Normal University Hunan Provincial People's Hospital, Changsha, China Mainland (PRC)

*These authors contributed equally to this work

Correspondence: Hao Yin, Email ehour@hunnu.edu.cn

Background: Spontaneous spinal epidural hematoma (SSEH) presenting in the context of JAK2 V617F-positive myeloproliferative neoplasms is a rare condition, characterized by the compression of the spinal cord leading to various symptoms. The etiology, pathogenesis, and optimal treatment strategies for this condition remain undetermined. The occurrence of spontaneous spinal epidural hematoma (SSEH) in the context of JAK2 V617F-positive myeloproliferative neoplasms (MPNs) represents a rare manifestation. Magnetic Resonance Imaging (MRI) plays a crucial role in the definitive diagnosis of this condition. With a good understanding of the pathogenic characteristics and clinical presentations of this disease, a diagnosis can be reasonably made, even in the absence of MRI, based on physical examinations indicating the affected area. Once diagnosed, immediate surgery is recommended to attempt the restoration of spinal cord function. Postoperatively, the use of hydroxyurea has proven effective in disease control.

Case Presentation: We report a case of a 65-year-old male patient who presented with progressive lumbar back pain and bilateral lower limb paralysis lasting for 36 hours. CT imaging revealed an intraspinal lesion at the L1-3 level, and genetic testing confirmed the presence of the JAK2V617F mutation. Following surgery, there was a significant recovery of sensory and motor function in the lower limbs. At one-year follow-up, the patient demonstrated good functional status, and blood tests indicated a platelet count within the normal range.

Conclusion: The presented case adds to the existing literature on SSEH by highlighting the association with myeloproliferative neoplasms (MPNs), as evidenced by the JAK2V617F mutation. MPNs constitute a group of hematologic malignancies, and the association with SSEH is a rare occurrence. The exact interplay between MPNs and SSEH warrants further investigation, as the underlying mechanisms linking these conditions remain elusive. The case also underscores the importance of a multidisciplinary approach, involving hematologists and neurosurgeons, in the comprehensive management of such complex cases.

Keywords: myeloproliferative neoplasms, spinal epidural hematoma, JAK2V617F

Introduction

Spontaneous spinal epidural hematoma (SSEH) is a rare clinical entity characterized by the occurrence of an epidural hematoma within the spinal canal without apparent trauma or iatrogenic injury, leading to compression of the spinal cord or nerves and subsequent development of related symptoms. Despite its infrequency, there is still no consensus on the etiology, pathophysiology, and optimal treatment approaches for this condition. Myeloproliferative neoplasms (MPNs) constitute a group of malignant hematologic disorders arising from somatic mutations in hematopoietic stem cells within the bone marrow, resulting in excessive accumulation of mature myeloid cells in the bloodstream. The primary causes of morbidity and mortality in these patients are attributed to a prothrombotic state leading to the formation of venous and arterial thrombi, including myocardial infarction (MI), deep vein thrombosis (DVT), and stroke.[1] In this study, we present a case of a 65-year-old male who experienced sudden-onset paralysis without apparent cause upon waking.

Received: 26 January 2024
Accepted: 29 April 2024
Published: 3 May 2024

Following surgical intervention, the patient was diagnosed with myeloproliferative neoplasm, and satisfactory outcomes were achieved with hydroxyurea therapy.

Case Presentation

The patient is a 65-year-old male who presented with progressive lower back pain accompanied by complete bilateral lower limb paralysis and was urgently admitted to Hunan Provincial People's Hospital for treatment under the diagnosis of "intraspinal mass". The patient reported waking up in the morning with unexplained lower back pain, which progressed steadily, culminating in complete paralysis of both lower limbs after 36 hours, with a complete loss of sensation and motor function. At the onset, there were no complaints of headache, dizziness, nausea, vomiting, chest or lumbar pain, and normal urinary and bowel habits.

Physical Examination

- Vital signs: normal, blood pressure: 18.7/12.0 kPa (140/90 mmHg).
- Conscious and oriented with normal heart and lung function.
- No palpable splenomegaly.
- Normal sensation and motor function in both upper limbs.
- Tenderness and percussion pain over the T12-L3 spinous processes.
- Diminished sensation in the thighs bilaterally.
- Complete loss of deep and superficial sensation below both knees and in both lower limbs.
- Reduced muscle tone, muscle strength graded as 0.
- Absent anal reflex, bilateral absent knee and ankle reflexes.
- Normal biceps and triceps reflexes, negative Hoffmann and Babinski signs.
- Negative meningeal signs.

Laboratory Results on Admission

- WBC: 37.52 x 10^9 g/l.
- HGB: 176 g/l.
- Platelet count: 1694 x 10^9/l.
- PCT: 1.77.
- Normal red blood cell and platelet distribution width, coagulation function, and blood glucose.

Emergency Lumbar Spine Interlaminar CT Findings

- L2-4 intraspinal wedge-shaped high-density lesion.

Treatment

After fluid resuscitation and symptomatic treatment, and completion of preoperative examinations (Figure 1), the patient underwent decompressive surgery under general anesthesia. Intraoperatively, a mass consistent with an epidural hematoma was identified, extending from the posterior aspect of the L1 vertebra to the lower border of the L3 vertebra. The hematoma was situated on the right side of the spinal cord (Figure 2), causing compression and flattening. The intraoperative diagnosis was confirmed as spontaneous spinal epidural hematoma. Microscopic exploration after hematoma evacuation did not reveal vascular rupture or significant bleeding within the spinal canal. The compressed spinal cord was irrigated with ice saline solution, and after confirming the absence of intraspinal vascular bleeding, posterior spinal fusion with pedicle screw fixation and bilateral bone grafting was performed. A negative-pressure drainage tube was placed, and the wound was closed after careful inspection, indicating normal bone quality in the thoracic and lumbar spine with mild soft tissue edema in the surgical area (Figure 3).

Owing to early application of hyperbaric oxygen therapy (HBOT) can reduce spinal cord hemorrhage, edema and hypoxia, and is beneficial to the recovery of spinal cord function. After surgery, the patient underwent hyperbaric oxygen therapy (HBOT) and emerged from the hyperbaric oxygen chamber two weeks later. Subsequent blood routine

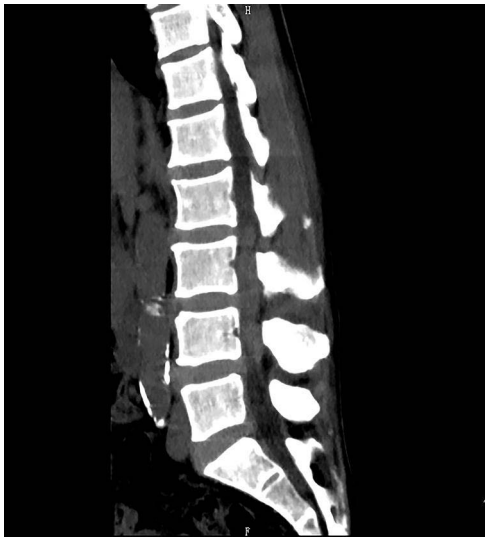

Figure 1 Preoperative CT showed lamellar hematomas in L2-L5 vertebral canal.

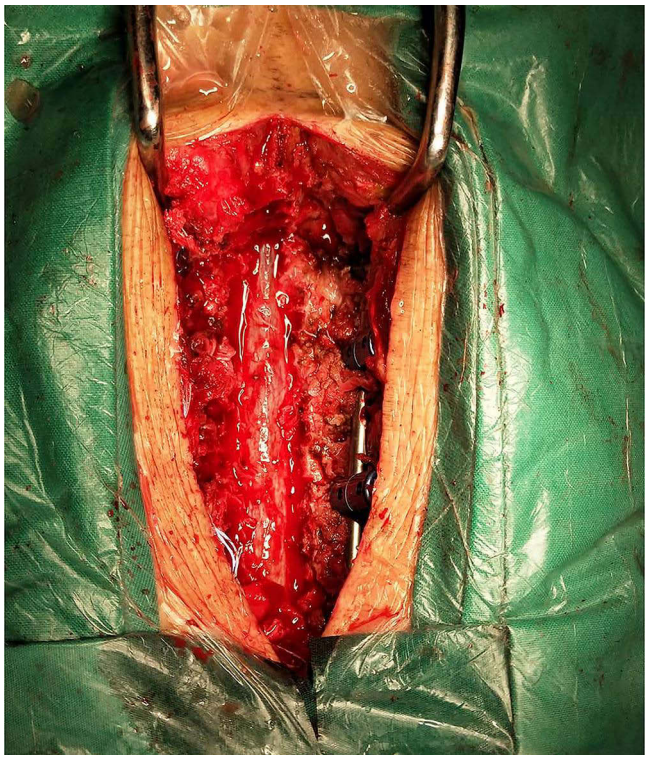

Figure 2 The hematoma was situated on the right side of the spinal cord.

examinations revealed a persistent elevation of platelet count, significantly exceeding the normal range. Bone marrow aspiration and peripheral blood smears were performed, along with JAK2, CALR, and MPL gene testing. The results indicated active bone marrow proliferation with a clustered distribution of platelets. The JAK2V617F mutation was identified as positive, while CALR and MPL gene mutations were negative. Comprehensive analysis could not definitively distinguish between primary thrombocythemia and early-stage primary myelofibrosis. Hydroxyurea therapy was initiated, resulting in a gradual normalization of platelet levels.

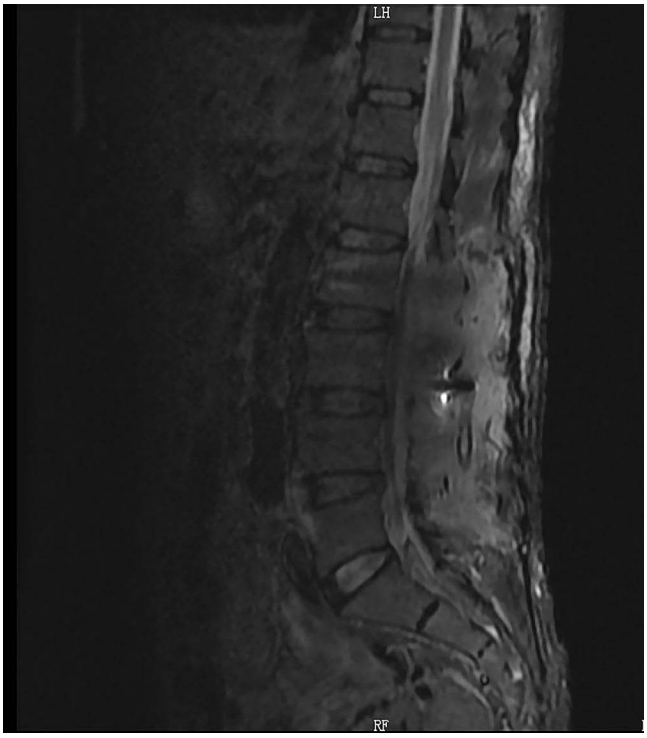

Figure 3 Postoperative MRI indicated that the L2-L5 intraspinal hematoma had been completely cleared.

Upon discharge, the patient still had motor dysfunction and was unable to walk unaided, and reported sensory deficits extending from the left lateral surface of the leg to the outer side of the calf and from the right lateral surface of the thigh to the middle of the outer side. Muscle strength assessments revealed:

- Left lower limb: Iliopsoas muscle at grade III, Extensor hallucis longus muscle at grade I–II.
- Left thigh: Quadriceps femoris muscle at grade II–III.
- Right thigh: Quadriceps femoris muscle at grade I.

Howbeit at the 12-month follow-up post-discharge, routine blood examinations and other assessments returned to normal. Bladder and bowel functions were restored, and muscle strength in both lower limbs had reached grade 4. The patient was able to walk normally but with a slight limp and had a history of overall good health, with no trauma, hypertension, diabetes, family hereditary diseases, or infectious disease history.

This study adhered to ethical standards established by the ethics committee, and the subject was well-informed and provided consent for participation in the research.

Discussion

Acute spontaneous spinal epidural hematoma (SSEH) is a relatively rare clinical entity, with an incidence reported to be around 0.1 per 100,000, constituting 0.3% to 0.9% of extradural space lesions.[2,3] It was first reported by Jackson in 1869, and the diagnosis has seen an increase with the widespread application of MRI. However, the etiology and pathophysiology of SSEH remain unclear. Known risk factors include vascular malformations, anticoagulant therapy, thrombolysis, coagulation or platelet disorders, hemophilia, Paget's disease, pregnancy, hypertension, minor trauma, and exertion.[4] The cause of 40% of hematomas remains unidentified.[5] The prevailing view suggests that the mechanisms involve bleeding from the intraspinal venous plexus, arterial rupture, and vascular abnormalities. Domenicucci et al reviewed 1010 cases of SSEH over 16 years, categorizing contributing factors as iatrogenic, non-iatrogenic, or

multifactorial. Surgery is the preferred treatment, with outcomes influenced by factors such as the patient's clinical and neurological status at admission, age, and location of the hematoma.[6]

Myeloproliferative Neoplasms (MPNs), previously termed Myeloproliferative Diseases (MPDs), constitute a group of disorders characterized by neoplastic proliferation of multipotent myeloid stem cells, resulting in malignant growth within one or more cell lines of the myeloid series, including erythrocytes, platelets, and granulocytes/monocytes. Based on the composition of proliferating cells, this group of diseases can be categorized into four distinct entities: Chronic Myeloid Leukemia (CML), Polycythemia Vera (PV), Essential Thrombocythemia (ET), and Primary Myelofibrosis (PMF). While these diseases manifest differently, they can undergo mutual transformation. MPN patients exhibit a higher incidence of JAK2 V617F mutation, leading to thrombotic and hemorrhagic complications such as stroke, resulting in elevated mortality and morbidity rates.[7] In 2005, Baxter et al[8] reported the G → A mutation at nucleotide position 1849 in exon 12 of the JAK2 gene in MPN patients, replacing JAK2 V617F with phenylalanine. This mutation is caused by the substitution of guanine (G) with thymine (T) in exon 12, resulting in the erroneous coding of JAK2 V617F as phenylalanine (F). Moreover, JAK2-positive patients post-mutation exhibit a higher incidence of venous thrombosis compared to JAK2-negative patients.[9] However, precise subtyping is exceedingly challenging. Scholars have outlined morphological characteristics of megakaryocytes in relevant diseases to facilitate differentiation among myeloproliferative disorders. In Reactive Thrombocytosis, megakaryocytes display normal morphology. In Primary Thrombocythemia, megakaryocytes are larger, appearing mature, and forming loose aggregates. In prefibrotic myelofibrosis, megakaryocytes exhibit high chromatin density, irregularly folded nuclei, and form tightly clustered formations. In cases of overlap between myeloproliferative neoplasms and myelodysplastic/myeloproliferative neoplasms, a characteristic morphological feature is increased red cell production with concurrent abnormal erythropoiesis. Finally, in Chronic Myelomonocytic Leukemia, megakaryocytes are smaller than normal cells, referred to as dwarf megakaryocytes.[10]

In this case, the initial diagnosis through imaging and postoperative vertebral tissue biopsy indicated Acute Spontaneous Spinal Epidural Hematoma (SSAH). Intriguingly, the concurrent presence of thrombocytosis in the patient prompted further consideration, leading to the identification of a high probability of concomitant Myeloproliferative Neoplasms (MPNs). Subsequent examinations, including bone marrow and peripheral blood smears, confirmed the diagnosis of MPNs. However, the distinction between thrombocytosis and early-stage myelofibrosis remained unclear. To address this, we conducted a comprehensive literature search on platforms such as PubMed, Scholar, and Web of Science, revealing reports by various scholars documenting occurrences of venous thrombosis in MPNs. Notably, such events were more commonly associated with epidural hematoma of the brain, making the present case the first report of a primary association with intraspinal epidural hematoma. The patient had no history of trauma, and preoperative and intraoperative examinations ruled out potential underlying primary conditions, including but not limited to cardiovascular diseases, trauma, and postoperative anticoagulant use. Active bleeding or abnormalities in the large vessels within the spinal canal were not observed during surgery; however, a significant amount of thrombus was discovered within the spinal canal. Bone marrow cell analysis revealed active marrow proliferation, with granulocytes constituting 90.50% and red blood cells 4.50%, resulting in a granulocyte-to-red blood cell ratio of 20.11:1, This suggests that bone marrow biopsy revealed active hyperplasia, platelet counts are increased and erythroid cells are significantly reduced. We hypothesized that this might be due to necrosis following thrombus formation in the vertebral venous plexus, leading to hemorrhage. Unfortunately, due to the urgency of the situation, there was no opportunity to conduct an enhanced MRI to exclude congenital arteriovenous malformations of the vertebrae. Although the specific etiology of the patient remains unclear, the main diagnosis and treatment prognosis appear to be widely accepted. The initial symptoms of the disease were lower back pain, followed by numbness and weakness in both lower limbs, urinary retention, and corresponding segmental weakness below the plane, reduced muscle tone, sensory impairment, and weakened or absent tendon reflexes. As epidural fat is not affected by bleeding, maintaining normal structure, the demarcation between hematoma and fat is a crucial feature that should be clearly defined in imaging examinations. The use of MRI is recommended as the preferred diagnostic method for spinal epidural hematomas.[11] Once diagnosed, prompt surgery is recommended; however, the optimal timing remains controversial.[12–14] Most scholars suggest surgery within 48 hours of onset for patients with incomplete spinal cord dysfunction and within 36 hours for those with complete dysfunction to achieve the expected

surgical outcomes. Prognostically, the severity of preoperative spinal cord dysfunction, coagulation disorders, bleeding tendencies, the severity of the lesion, and the time from onset to surgery are closely related to the patient's prognosis.

In conclusion, while SSEH is an uncommon condition, its association with myeloproliferative neoplasms adds complexity to its understanding and management. Further research is needed to elucidate the intricate relationship between these entities and to guide optimal treatment strategies.

Conclusion

The occurrence of spontaneous spinal epidural hematoma (SSEH) in the context of JAK2 V617F-positive myeloproliferative neoplasms (MPNs) represents a rare manifestation. Magnetic Resonance Imaging (MRI) plays a crucial role in the definitive diagnosis of this condition. With a good understanding of the pathogenic characteristics and clinical presentations of this disease, a diagnosis can be reasonably made, even in the absence of MRI, based on physical examinations indicating the affected area. Once diagnosed, immediate surgery is recommended to attempt the restoration of spinal cord function. Postoperatively, the use of hydroxyurea has proven effective in disease control.

Ethical Statement

Ethical approval was obtained from The First Affiliated Hospital of Hunan Normal University Hunan Provincial People's Hospital review board to publish the case details. Ethics approval and consent to participate: written informed consent was obtained from the case. Written informed consent was obtained from the patient for publication of this case report and any accompanying images.

Acknowledgments

We express gratitude to the patients and emergency physicians who participated in this study.

Author Contributions

All authors made a significant contribution to the work reported, whether that is in the conception, study design, execution, acquisition of data, analysis and interpretation, or in all these areas; took part in drafting, revising or critically reviewing the article; gave final approval of the version to be published; have agreed on the journal to which the article has been submitted; and agree to be accountable for all aspects of the work.

Disclosure

The authors report no conflicts of interest in this work.

References

1. Bhuria VA, Baldauf CK, Schraven B, Fischer T. Thromboinflammation in Myeloproliferative Neoplasms (MPN)-A puzzle still to be solved. *Int J Mol Sci*. 2022;23(6):3206. doi:10.3390/ijms23063206
2. Holtas S, Heiling M, Lonntoft M. Spontaneous spinal epidural hematoma: findings at MR imaging and clinical correlation. *Radiology*. 1996;199 (2):409–413. doi:10.1148/radiology.199.2.8668786
3. Lonjon MM, Paquis P, Chanalet S, Grellier P. Nontraumatic spinal epidural hematoma: report of four cases and review of the literature. *Neurosurgery*. 1997;41(2):483–6; discussion 6–7. doi:10.1097/00006123-199708000-00035
4. Bhat KJ, Kapoor S, Watali YZ, Sharma JR. Spontaneous epidural hematoma of spine associated with clopidogrel: a case study and review of the literature. *Asian J Neurosurg*. 2015;10(1):54. doi:10.4103/1793-5482.151521
5. Foo D, Rossier AB. Preoperative neurological status in predicting surgical outcome of spinal epidural hematomas. *Surg Neurol*. 1981;15 (5):389–401. doi:10.1016/0090-3019(81)90178-6
6. Domenicucci M, Mancarella C, Santoro G, et al. Spinal epidural hematomas: personal experience and literature review of more than 1000 cases. *J Neurosurg*. 2017;27(2):198–208. doi:10.3171/2016.12.SPINE15475
7. Sugiyama M, Ueno Y, Kamo H, et al. Specific mechanisms of subarachnoid hemorrhage accompanied by ischemic stroke in essential thrombocythemia: two case reports and a literature review. *J Neurol*. 2019;266(8):1869–1878. doi:10.1007/s00415-019-09347-4
8. Baxter EJ, Scott LM, Campbell PJ, et al. Acquired mutation of the tyrosine kinase JAK2 in human myeloproliferative disorders. *Lancet*. 2005;365 (9464):1054–1061. doi:10.1016/S0140-6736(05)71142-9
9. McMahon B, Stein BL. Thrombotic and bleeding complications in classical myeloproliferative neoplasms. *Semin Thromb Hemost*. 2013;39 (1):101–111. doi:10.1055/s-0032-1331153
10. Tefferi A, Solomon CG, Pardanani A. Essential Thrombocythemia. *N Engl J Med*. 2019;381(22):2135–2144. doi:10.1056/NEJMcp1816082

11. Kobayashi K, Imagama S, Ando K, Nishida Y, Ishiguro N. Acute non-traumatic idiopathic spinal subdural hematoma: radiographic findings and surgical results with a literature review. *Eur Spine J*. 2017;26(11):2739–2743. doi:10.1007/s00586-017-5013-y
12. Shin HS, Lee SH, Ko HC, Koh JS. Extended pneumocephalus after drainage of chronic subdural hematoma associated with intracranial hypotension: case report with pathophysiologic consideration. *J Korean Neurosurg Soc*. 2016;59(1):69. doi:10.3340/jkns.2016.59.1.69
13. Groen RJ, van Alphen HA. Operative treatment of spontaneous spinal epidural hematomas: a study of the factors determining postoperative outcome. *Neurosurgery*. 1996;39(3):494–509. doi:10.1097/00006123-199609000-00012
14. Liu Z, Jiao Q, Xu J, Wang X, Li S, You C. Spontaneous spinal epidural hematoma: analysis of 23 cases. *Surg Neurol*. 2008;69(3):253–260. doi:10.1016/j.surneu.2007.02.019