

Anticoagulation-Related Epidural Hematoma Causing Cauda Equina Syndrome After Posterior Lumbar Interbody Fusion: A Case Report

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Case Report

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Abstract

Background

Postoperative spinal epidural hematoma (SEH) is a rare but potentially devastating complication of lumbar spine surgery, with an incidence of 0.1–0.4% [1, 2]. Anticoagulation therapy significantly increases this risk. The 2024 Chinese Expert Consensus on Diagnosis and Treatment of Spinal Epidural Hematoma emphasizes early recognition and timely surgical decompression as key to improving neurological outcomes.

Case presentation:

A 78-year-old Asian woman with a history of coronary stent implantation (2018) underwent posterior lumbar interbody fusion (L3–L5) for cauda equina syndrome. On postoperative day 3, she developed unstable angina, requiring initiation of therapeutic-dose enoxaparin (5000 IU subcutaneously every 12 hours). On postoperative day 5, approximately 6 hours after the onset of progressive perineal numbness and lower extremity weakness, she was diagnosed with postoperative SEH. A critical warning sign was a distinctive drainage pattern—40 mL on POD3 → 80 mL on POD4 (increased) → 15 mL on POD5 (sudden decrease), suggesting drain obstruction by clotted blood. Emergent surgical evacuation was performed within the 6-hour golden window recommended by the consensus, resulting in significant neurological recovery (muscle strength improved from grade 2 to grade 4).

Conclusions

This case highlights the delicate balance between anticoagulation for cardiac protection and bleeding risk prevention in elderly patients undergoing spinal surgery. Early recognition of warning signs—particularly sudden decreases in drainage volume—and emergent surgical decompression within 6 hours are critical for optimal neurological recovery. A multidisciplinary approach is essential.

Background

Postoperative spinal epidural hematoma (SEH) is a rare but potentially catastrophic complication following lumbar spine surgery, with reported incidence rates ranging from 0.1% to 0.4% [1, 2]. A 2020 retrospective study found that delayed-onset postoperative SEH (occurring beyond 24 hours) accounts for a significant proportion of cases, with risk factors including multilevel surgery, excessive blood loss, and coagulopathy [3]. Although asymptomatic hematomas may be more common (up to 30% on postoperative magnetic resonance imaging (MRI)), symptomatic hematomas requiring surgical evacuation are exceedingly rare and can lead to permanent neurological deficits, including cauda equina syndrome (CES), if not recognized and treated promptly [2].

With the aging population, an increasing number of elderly patients with multiple comorbidities—particularly coronary artery disease requiring antiplatelet or anticoagulant therapy—are undergoing lumbar spine surgery [4]. These patients present a unique clinical challenge. Postoperative cardiac complications may necessitate anticoagulation, which in turn increases the risk of postoperative bleeding and SEH. A 2022 single-center cohort study found that while appropriate perioperative interruption of antithrombotic therapy can avoid serious bleeding risk, the management of postoperative cardiac complications requiring therapeutic anticoagulation remains challenging [5]. This "anticoagulation-bleeding dilemma" is particularly pronounced in patients with coronary stent implants, where premature discontinuation of antiplatelet therapy carries significant risks of stent thrombosis and myocardial infarction [6].

The timing of surgical intervention for SEH is critical. The 2024 Chinese Expert Consensus on Diagnosis and Treatment of Spinal Epidural Hematoma recommends that for patients with progressive neurological deficits, surgical hematoma evacuation should be performed as early as possible, ideally within 6 hours of symptom onset [7]. Multiple systematic reviews have demonstrated that hematoma evacuation within 6 to 8 hours is associated with significantly better neurological outcomes compared to delayed intervention [8, 9]. However, early recognition of SEH can be challenging, especially in patients with pre-existing neurological deficits from the initial pathology.

Herein, we report a case of a 78-year-old woman with a history of coronary stent implantation who developed anticoagulation-related SEH causing acute CES exacerbation after posterior lumbar interbody fusion. We highlight the critical warning sign—a sudden drop in drainage volume—and emphasize the importance of emergent surgical decompression within the 6-hour golden window recommended by current guidelines [7].

Case presentation

Patient presentation and medical history

A 78-year-old Asian woman presented with a 2-year history of progressive left lower extremity numbness and a 2-week history of symptom exacerbation accompanied by bowel and bladder incontinence. Her medical history was significant for hypertension (20+ years, maximum 220/110 mmHg, managed with amlodipine), coronary artery disease with stent implantation in 2018 (maintained on clopidogrel and atorvastatin), type 2 diabetes mellitus (8 years, managed with metformin), and cerebral infarction 5 years prior with residual mild left lower extremity numbness. She was a retired construction worker with no history of smoking or alcohol consumption.

On admission, physical examination revealed tenderness at the L4/L5 spinous process, saddle anesthesia, decreased anal sphincter tone, diminished left Achilles tendon reflex, and positive left straight leg raise test. Lower extremity muscle strength was grade 5 on the right and grade 4+ on the left. Preoperative lumbar MRI demonstrated degenerative changes, L5 grade I anterolisthesis, and a large left-sided disc extrusion at L4/L5 causing severe spinal canal stenosis (Fig. 1). Lumbar X-ray (Fig. 2) and

computed tomography (CT)(Fig. 3) confirmed segmental instability and ligamentum flavum calcification. Electromyography demonstrated left L5/S1 radiculopathy and anal sphincter neurogenic changes.

Initial surgery and postoperative course

Given progressive neurological deficits and CES, the patient underwent **posterior lumbar interbody fusion (L3–L5) with discectomy, hemilaminectomy decompression, and instrumentation** on April 14, 2026. Six pedicle screws were placed, and an interbody fusion cage was implanted at L4/L5. Intraoperative findings included a large left-sided disc extrusion with hypertrophic and ossified ligamentum flavum. Estimated blood loss was 200 mL, operative time was 240 minutes, and a surgical drain was placed. Meticulous hemostasis was achieved using bipolar coagulation and topical hemostatic agents, consistent with current recommendations for reducing postoperative SEH risk [12].

The postoperative course was initially uneventful. On postoperative day 1, left lower extremity numbness slightly improved, with drainage output of approximately 150 mL. On postoperative day 2, drainage decreased to 50 mL. On postoperative day 3 (April 17), drainage further decreased to 40 mL; however, on the same day, the patient developed acute precordial discomfort radiating to the shoulder and back. Electrocardiography demonstrated ST-segment depression. Cardiology consultation established the diagnosis of **unstable angina**, and therapeutic-dose anticoagulation was initiated: enoxaparin 5000 IU subcutaneously every 12 hours, rosuvastatin 10 mg nightly, isosorbide mononitrate 20 mg intravenously daily, and isosorbide dinitrate 5 mg orally three times daily. The patient and family were counseled about the increased risk of postoperative bleeding and epidural hematoma, consistent with the risk-benefit discussion recommended by perioperative anticoagulation guidelines [6, 11].

Close monitoring of drainage output revealed a concerning pattern: on postoperative day 3, drainage was 40 mL; on postoperative day 4 (April 18), drainage increased to 80 mL (suggesting increased bleeding related to anticoagulation); on postoperative day 5 (April 19), drainage **suddenly decreased to 15 mL**. This sudden decrease was interpreted as a potential sign of **drain obstruction** by clotted blood, rather than improvement, prompting intensified neurological monitoring. This pattern—increased output followed by sudden decrease—is a recognized but underreported warning sign of impending SEH [3].

Neurological deterioration and emergency management

On **April 19 at approximately 4:00 AM**, following a bowel movement, the patient developed progressive lower extremity numbness and perineal numbness. By **6:40 AM**, she reported complete loss of perineal sensation. Bedside assessment revealed bilateral lower extremity muscle strength of **grade 2** (decreased from preoperative grade 4+/5), fecal incontinence, complete saddle anesthesia, and worsening urinary retention. Immediate lumbar CT demonstrated a high-density lesion in the spinal canal consistent with **epidural hematoma** compressing the thecal sac (Fig. 4). Internal fixation hardware was in good position. Bedside aspiration of the drain using a syringe confirmed obstruction with clotted blood.

Given the diagnosis of postoperative SEH with acute CES exacerbation and progressive neurological deficits, emergent surgical intervention was indicated, consistent with the 2024 Chinese Expert Consensus recommendations [7]. Approximately **6 hours after symptom onset**, the patient underwent **posterior lumbar epidural hematoma evacuation and nerve exploration**. Re-entry through the original incision revealed a large amount of unclotted blood and organized hematoma compressing the thecal sac, creating a visible compression groove on the thecal sac. Thorough evacuation with saline irrigation was performed, and a new surgical drain was placed. Estimated blood loss was 50 mL, and operative time was 105 minutes.

The postoperative course was favorable. The patient was transferred to the intensive care unit for 24-hour monitoring. Upon awakening from anesthesia, lower extremity motor function and muscle strength were significantly improved. On post-evacuation day 1 (April 20), bilateral lower extremity muscle strength recovered to grade 4. On post-evacuation day 3, she was able to sit up in bed. On post-evacuation day 5, she ambulated with a lumbar orthosis. Partial voluntary urination was restored, with mild residual urinary hesitancy. Sutures were removed on postoperative day 14 (April 28), and the patient was discharged in stable condition on postoperative day 16 (April 30, 2026) (Fig. 5).

Additional discharge diagnoses included osteoporosis, angina pectoris, anemia (postoperative hemoglobin nadir 75 g/L), and hypoproteinemia (albumin nadir 28.7 g/L). She was discharged with a lumbar orthosis and prescribed anti-osteoporosis medication. Cardiology follow-up was arranged for continued management of coronary artery disease and anticoagulation therapy.

Discussion

The Anticoagulation-Bleeding Dilemma in Stent Patients

This case exemplifies the critical clinical dilemma in managing elderly cardiac patients undergoing spinal surgery. Our patient, with a coronary stent implanted in 2018, developed unstable angina on postoperative day 3, necessitating therapeutic-dose enoxaparin. Within 48 hours of anticoagulation initiation, she developed a symptomatic epidural hematoma. This "anticoagulation-bleeding paradox" is particularly challenging in stent patients, where premature antiplatelet discontinuation carries significant risks of stent thrombosis and myocardial infarction [6].

A 2023 Delphi consensus on anticoagulation management in elective spine surgery recommended individualized risk stratification based on cardiac status, venous thromboembolism (VTE) history, and surgical approach [11]. However, these guidelines primarily address elective perioperative management; the complex scenario of postoperative cardiac complications requiring therapeutic anticoagulation remains less well-defined. A 2023 large cohort study confirmed that preoperative antithrombotic therapy significantly increases the risk of postoperative hematoma (OR = 1.54) and transfusion (OR = 2.61) in spine surgery patients [6].

Key principles derived from this case include: (1) multidisciplinary consultation involving orthopedic surgeons, cardiologists, and anesthesiologists is essential; (2) when therapeutic anticoagulation is unavoidable, intensified neurological and drainage monitoring is mandatory; (3) the threshold for emergent imaging should be extremely low in anticoagulated postoperative patients; and (4) reversal agents (protamine sulfate for heparin) should be readily available [11].

The Underrecognized "Drop" in Drain Output as a Critical Warning Sign

One of the most important teaching points from this case is the role of postoperative drainage monitoring in early recognition of SEH. The drainage pattern was highly instructive: 40 mL on POD3 → 80 mL on POD4 → 15 mL on POD5. The initial increase (40→80 mL) coincided with anticoagulation initiation and suggested increased bleeding. The subsequent sudden decrease (80→15 mL), rather than indicating improvement, was a warning sign of drain obstruction by clotted blood, preventing evacuation of the accumulating hematoma. Bedside syringe aspiration later confirmed drain obstruction with clotted blood.

A 2021 study on delayed-onset postoperative SEH found that delayed presentations beyond POD1 are often associated with anticoagulation initiation and drainage dysfunction [3]. The pattern—increased output followed by sudden decrease—is a classic but underrecognized sign. Nursing staff and clinicians should be educated to recognize this pattern and immediately investigate any sudden decrease in drainage output, particularly in patients on anticoagulation therapy. Recommended monitoring includes measuring output every 1–2 hours during the first 48–72 hours after anticoagulation initiation [12], monitoring for both sudden increases and decreases as warning signs of drain obstruction, and correlating drainage trends with neurological status [3].

The 6-Hour Golden Window vs. Pre-existing Neurological Deficit

The timing of surgical evacuation for SEH is a critical determinant of neurological outcome. The 2024 Chinese Expert Consensus recommends that for patients with confirmed SEH and progressive neurological deficits, surgical decompression should be performed as early as possible, ideally within 6 hours of symptom onset [7]. A 2022 multicenter retrospective study published in *Neurology* confirmed that extended paraplegia time (> 12 hours) and severe preoperative neurological deficits are independent adverse prognostic factors [8]. A 2023 systematic review and meta-analysis further demonstrated that shorter operative interval is significantly associated with better postoperative outcomes [9].

An important consideration in this case is that the patient had pre-existing cauda equina syndrome (CES) preoperatively, including bowel/bladder incontinence and saddle anesthesia. After the initial fusion surgery, her neurological status partially improved (lower extremity strength recovered to grade 4+/5). On POD5 at 4:00 AM, she developed new, progressive neurological deterioration—perineal numbness progressed to complete saddle anesthesia, and bilateral lower extremity strength acutely declined from grade 4+ to grade 2. The 6-hour window was counted from 4:00 AM, the onset of this acute exacerbation, rather than from the pre-existing CES. This approach is consistent with the consensus

definition of "progressive neurological deficit" as the key indicator for emergent intervention [7]. The distinction between pre-existing stable deficits and acute progressive deterioration is crucial: the former does not mandate emergent surgery, while the latter requires immediate decompression.

In our case, emergent evacuation was performed approximately 6 hours after the onset of acute deterioration, resulting in significant recovery (grade 2 to grade 4 within 24 hours), consistent with favorable outcomes reported for timely intervention [8, 9]. Factors contributing to timely intervention included early recognition of drainage changes, frequent neurological assessments by nursing staff, rapid CT confirmation, multidisciplinary coordination, and a low threshold for reoperation given the known anticoagulation-related bleeding risk.

Strengths and limitations

Strengths include complete clinical documentation with a detailed timeline, significant teaching value regarding the anticoagulation-bleeding dilemma and drainage monitoring, and good neurological outcome demonstrating the effectiveness of prompt recognition and treatment within the 6-hour window. Limitations include the single-case design, relatively short follow-up (long-term bowel and bladder outcomes require extended monitoring), use of CT rather than MRI for diagnosis (appropriate in the emergent setting but MRI is the gold standard), and lack of quantitative intraoperative hematoma volume measurement.

Conclusions

This case of a 78-year-old woman with coronary stent implantation who developed anticoagulation-related SEH after lumbar fusion highlights several critical clinical lessons consistent with current guidelines and recent literature: (1) the anticoagulation-bleeding dilemma requires careful multidisciplinary management, balancing cardiac protection against bleeding risk [6, 11]; (2) drainage monitoring is essential—sudden decreases in output may indicate drain obstruction rather than improvement, and should prompt immediate evaluation [3]; (3) timely recognition and intervention within the 6-hour golden window recommended by the 2024 Chinese Expert Consensus are critical for optimal neurological recovery [7, 8]; and (4) a multidisciplinary approach involving orthopedic surgeons, cardiologists, anesthesiologists, and nursing staff is essential for managing these complex patients. With increasing numbers of elderly patients with cardiac comorbidities undergoing spinal surgery, heightened awareness of these risks and implementation of proactive monitoring protocols are essential to prevent and manage this serious complication.

Abbreviations

SEH: Spinal epidural hematoma; CES: Cauda equina syndrome; LMWH: Low-molecular-weight heparin; MRI: Magnetic resonance imaging; CT: Computed tomography; POD: Postoperative day; VTE: Venous thromboembolism.

Declarations

Ethics approval and consent to participate

Ethical approval was not required for this case report in accordance with the policies of the Institutional Review Board of the Affiliated Hospital of Inner Mongolia Medical University, as this study did not constitute clinical research. Written informed consent was obtained from the patient for publication of this case report and any accompanying images.

Consent for publication

Written informed consent was obtained from the patient for publication of this case report and accompanying images. A copy of the written consent is available for review by the Editor-in-Chief of this journal.

Availability of data and materials

All data generated or analyzed during this study are included in this published article. De-identified imaging data are available from the corresponding author upon reasonable request.

Competing interests

The authors declare that they have no competing interests.

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Authors' contributions

Jinyan Cui and Yaou Liu contributed equally to this work and share first authorship. Jinyan Cui: Conceptualization, data acquisition, writing—original draft, writing—review and editing. Yaou Liu: Conceptualization, data acquisition and interpretation, writing—original draft, writing—review and editing. Lijuan Wu: Conceptualization, data acquisition, writing—review and editing, supervision, project administration. All authors read and approved the final manuscript and agree to be accountable for all aspects of the work.

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Figures

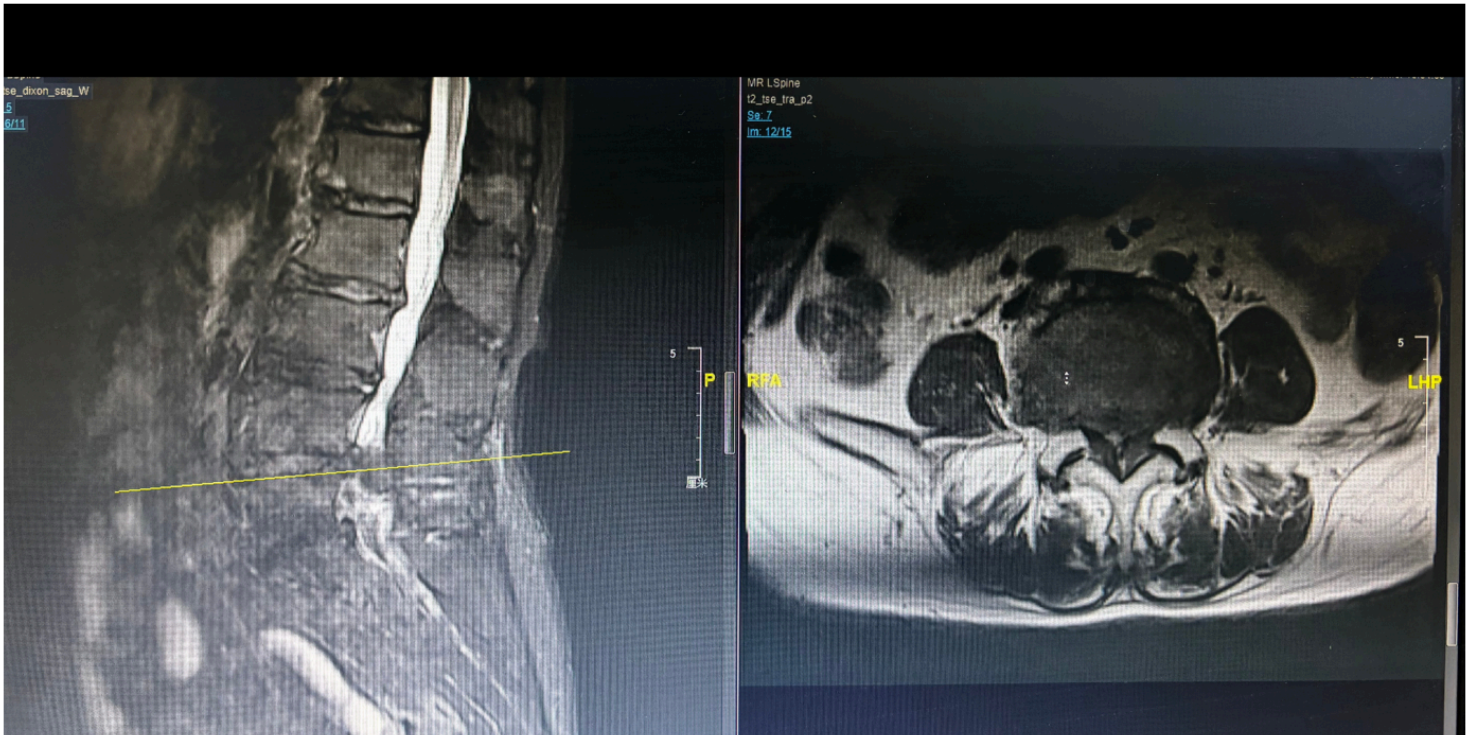


Figure 1

Preoperative lumbar MRI (T2-weighted images). Sagittal view (left) demonstrating degenerative disc disease, L5 grade I anterolisthesis, and severe spinal canal stenosis at L4/L5 level. Axial view (right) showing large left-sided disc extrusion at L4/L5 with compression of the thecal sac and nerve roots.



Figure 2

Preoperative lumbar X-ray (flexion-extension views). Lateral views demonstrating grade I anterolisthesis of L5 with segmental instability at L4/L5 level.

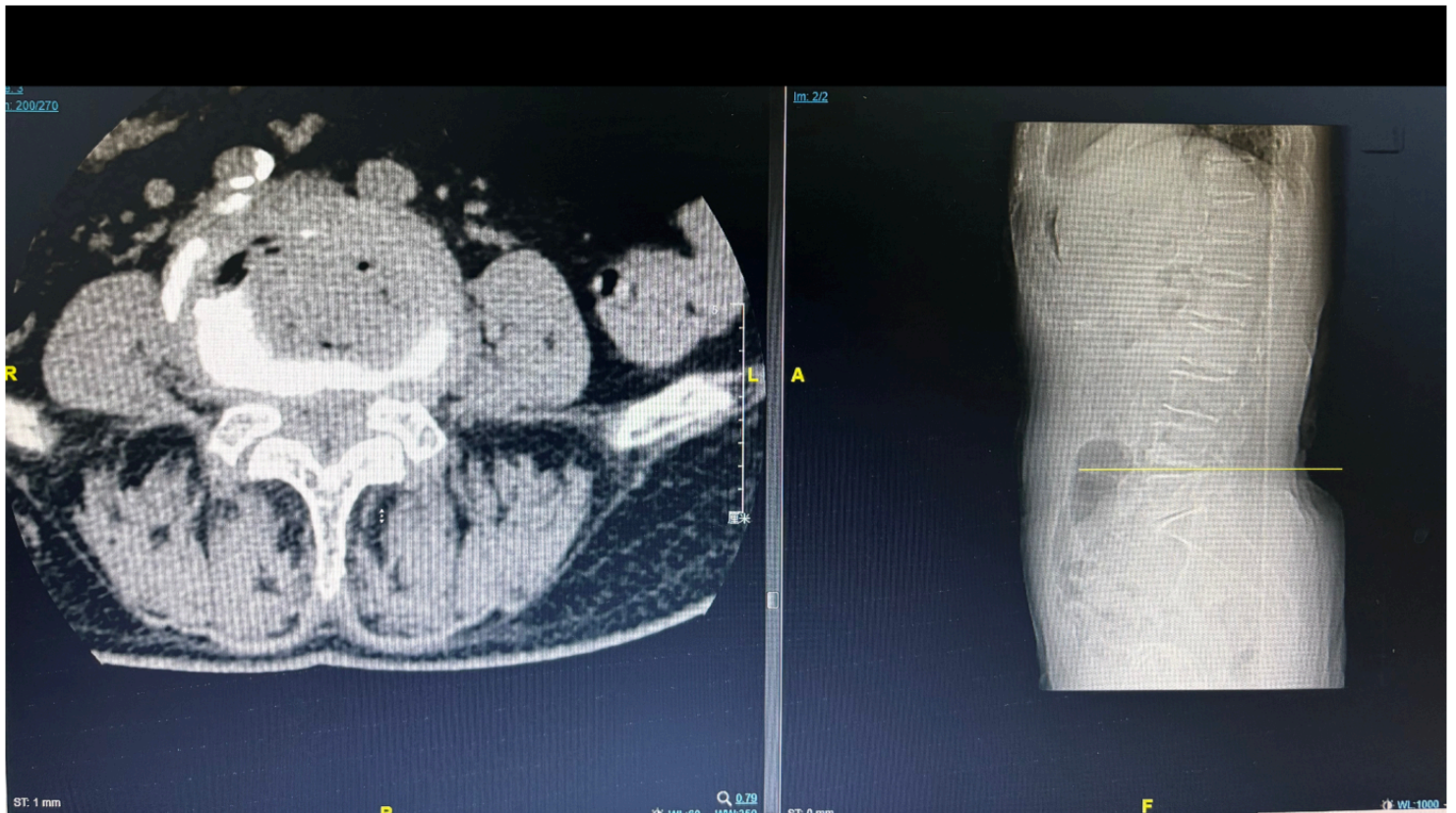


Figure 3

Preoperative lumbar CT. Axial view (left) and sagittal reconstruction (right) demonstrating spinal canal stenosis at L4/L5 level, ligamentum flavum calcification, and facet joint hypertrophy.

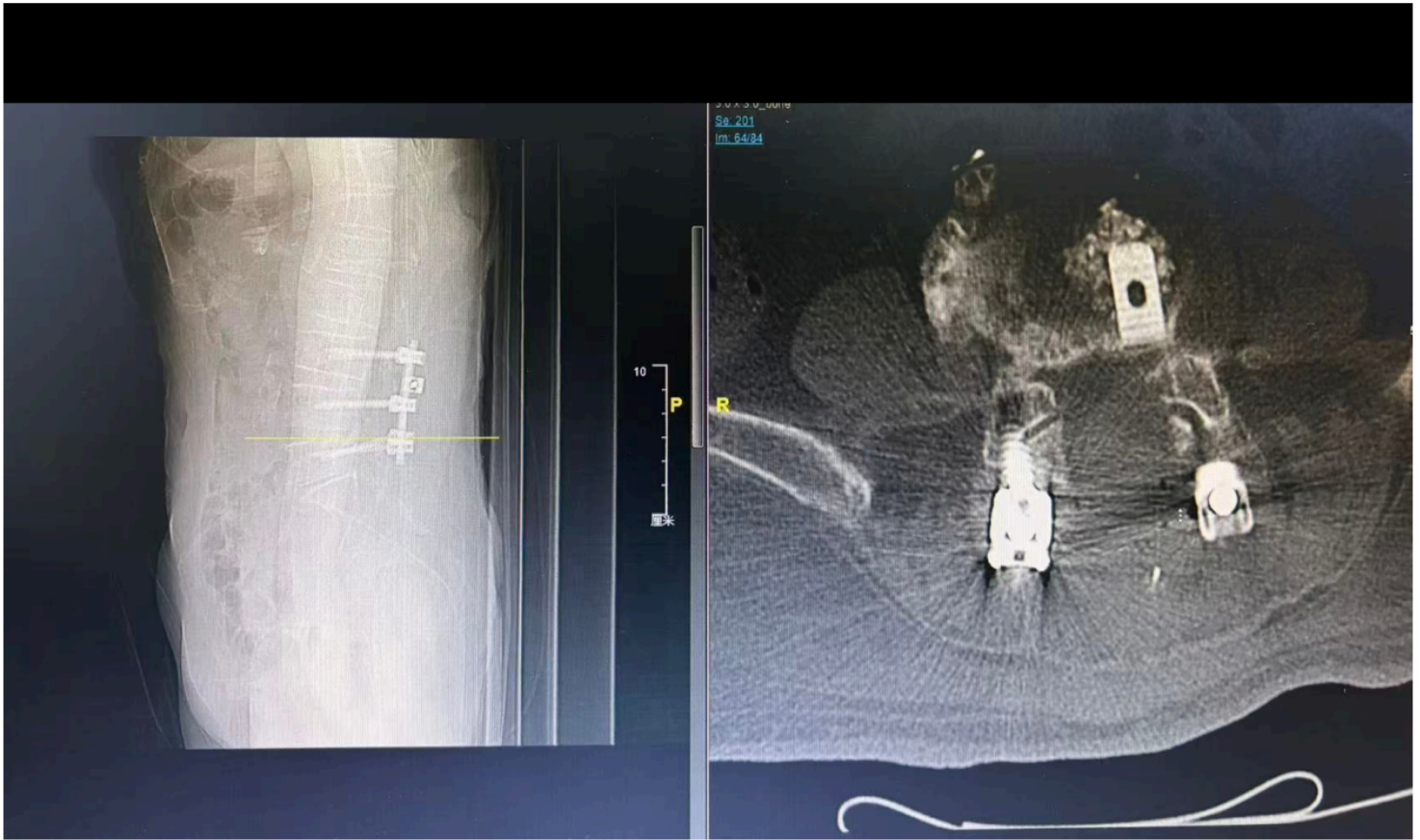


Figure 4

Postoperative lumbar CT (day of neurological deterioration). Axial view demonstrating high-density epidural hematoma compressing the thecal sac. Internal fixation hardware is in good position.

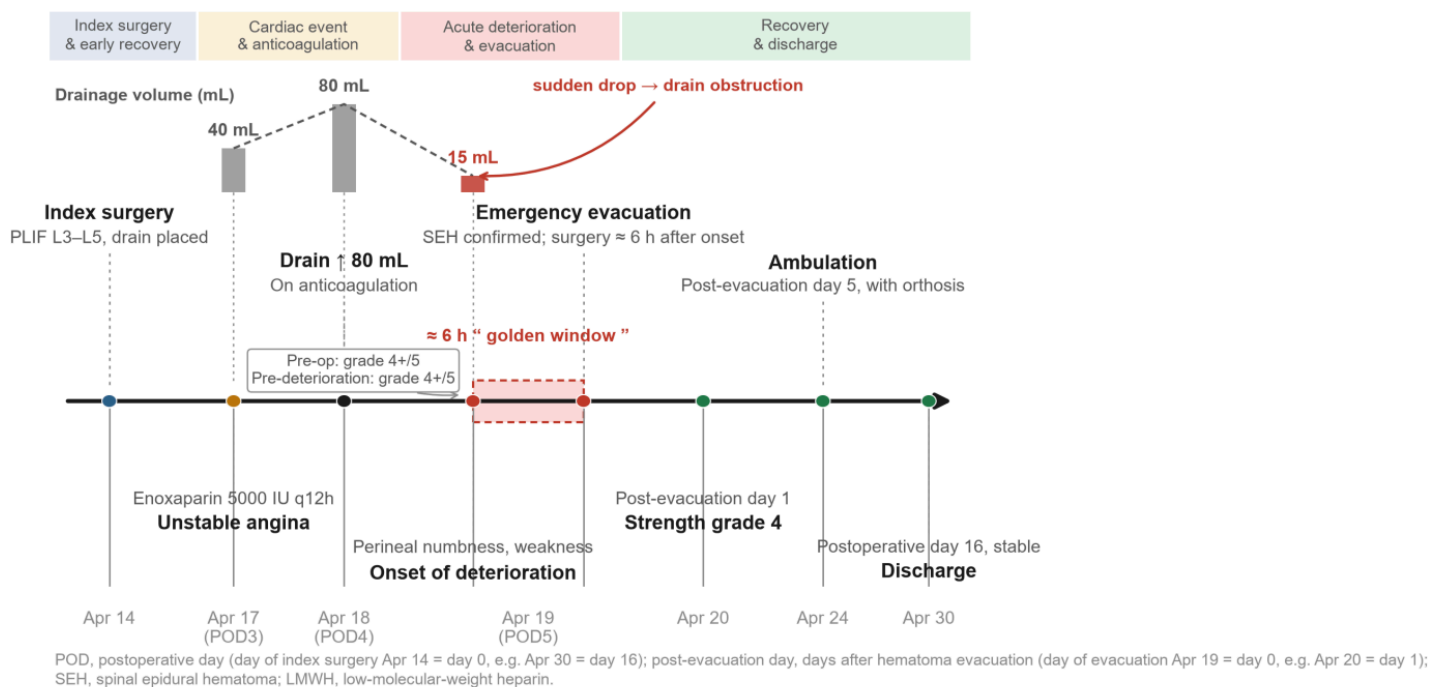


Figure 5

Timeline of key clinical events. Schematic representation of the patient's clinical course, including initial surgery, postoperative angina with anticoagulation initiation, drainage volume changes (40 mL → 80 mL → 15 mL), neurological deterioration (4:00 AM onset, 6:40 AM grade 2 weakness), emergent hematoma evacuation performed approximately 6 hours after symptom onset, and recovery (post-evacuation day 1: grade 4, day 5: ambulation; discharge on postoperative day 16).