Research Square

Preprints are preliminary reports that have not undergone peer review.
They should not be considered conclusive, used to inform clinical practice,
or referenced by the media as validated information.

Severe multisite methicillin-susceptible Staphylococcus aureus infection in an elderly critically ill patient: a case report of spinal subdural abscess caused by iliopsoas abscess erosion

Gengwu Li[1]
Panzhihua Central Hospital
Guangxin Li[2]
Panzhihua Central Hospital
Shihai Mu[3]
Panzhihua Central Hospital
Heng Xiao[1]
188812364650163.com

Panzhihua Central Hospital

Case Report

Keywords: Methicillin-susceptible Staphylococcus aureus, Iliopsoas abscess, Spinal subdural abscess, Septic shock, Comprehensive treatment, Case report

Posted Date: August 11th, 2026

DOI: https://doi.org/10.21203/rs.3.rs-10449240/v1

License: This work is licensed under a Creative Commons Attribution 4.0 International License.
Read Full License

Additional Declarations: No competing interests reported.

Version of Record: A version of this preprint was published at BMC Infectious Diseases on October 15th, 2026. See the published version at https://doi.org/10.1186/s12879-026-14636-1.

Abstract

Background

Spinal subdural abscess (SSA) is rarely reported in elderly critically ill patients, and its association with iliopsoas abscess remains poorly understood. Staphylococcus aureus infection complicated by central nervous system involvement carries a mortality rate exceeding 30%. We report a rare case of methicillin-susceptible S. aureus (MSSA) SSA secondary to an iliopsoas abscess and propose a potential route of infection.

Case presentation

A 75-year-old man was admitted with low back and leg pain, fever, altered mental status, and progressive lower-limb weakness. He was diagnosed with sepsis, a left iliopsoas abscess, and an SSA at the T12–S1 level. Management comprised empirical broad-spectrum antibiotics followed by targeted therapy with linezolid plus levofloxacin guided by microbiological findings, computed tomography-guided drainage of the iliopsoas abscess, emergency arachnoid-sparing surgical drainage of the spinal abscess, and organ function support. Cultures identified MSSA. The infection was controlled, organ function recovered, and neurological function improved significantly. At discharge, lower-limb muscle strength had improved to grade 4/5, with bowel and bladder function returning to normal; no recurrence was observed during follow-up. Imaging supported a potential route whereby the iliopsoas abscess eroded the epineurium at the lumbosacral foramen and spread into the subdural space.

Conclusions

Rapid diagnosis, pathogen-targeted antimicrobial therapy, and arachnoid-sparing surgical drainage are key to the successful treatment of this rare condition. The proposed infection pathway provides new insights into the pathogenesis of rare spinal infections.

Background

The mortality rate is high in elderly patients with Staphylococcus aureus infection, particularly when complicated by bacteremia or central nervous system involvement [1, 2], and the mortality rate of those complicated by central nervous system infections exceeds 30% [3, 4]. Timely diagnosis and proper treatment are critical, especially when complicated by rare spinal abscesses. Notably, spinal subdural abscess (SSA) is rarely reported in elderly critically ill patients, and its association with other extrapulmonary infections (e.g., iliopsoas abscess) remains poorly understood, posing significant challenges to clinical management.

In this study, we report an elderly critically ill patient presenting with multifocal S. aureus infection complicated by a thoracolumbar subdural abscess and a left iliopsoas abscess. We propose a novel transmission pathway in which infection spreads from an iliopsoas abscess to a spinal subdural abscess, a route not previously described in the literature. We elaborate on the comprehensive

management involving medical and surgical interventions and highlight key surgical techniques, aiming to offer practical references for clinicians treating similar complex cases. This case is reported in accordance with the CARE guidelines.

Case presentation

A 75-year-old Han male (height 165 cm, weight 50 kg, body mass index [BMI] 18.4 kg/m²) was admitted to our hospital presenting with lumbocrural pain and difficulty walking for 9 days, fever for 5 days, as well as cough, vomiting and altered mental status for 1 day.

Five days prior to admission, his lumbocrural pain deteriorated significantly, and he was treated at a local hospital. He was diagnosed with left iliopsoas abscess and pulmonary infection and received antimicrobial therapy (specific antibiotics unknown). However, his symptoms failed to improve and progressively worsened. One day prior to admission, he developed chills and high fever up to 39.5°C, accompanied by cough, vomiting and altered mental status, and was then transferred to our hospital.

On admission, physical examination revealed: temperature 39°C, pulse 118 beats per minute, respiratory rate 24 breaths per minute, and blood pressure 121/70 mmHg. The patient was delirious and uncooperative during examination. Spontaneous movement was preserved in both upper extremities and the right lower limb, while the left lower limb was immobile, presumably due to severe pain. Marked tenderness was detected over the lumbosacral region and around the left hip. Passive movement of the left hip joint elicited severe pain.

We made a preliminary diagnosis of sepsis, left iliopsoas abscess and severe pneumonia. The patient was directly admitted to the intensive care unit (ICU).

Laboratory tests revealed severe systemic inflammation with a white blood cell count of 22.01×10⁹/L and multiple organ impairment. Elevated troponin I (0.494 ng/mL) and brain natriuretic peptide (BNP; 2,607.80 pg/mL) indicated cardiac involvement. Blood gas analysis confirmed respiratory failure (partial pressure of oxygen [PO_2] 46 mmHg) complicated by metabolic acidosis (base excess [BE] − 4.6 mmol/L). Serum albumin was 28.5 g/L, and transaminase and creatinine were mildly elevated, suggesting early hepatorenal dysfunction. Coagulation indices were slightly prolonged, consistent with septic coagulopathy.

Supportive treatments including mechanical ventilation, cardiac monitoring, antimicrobial therapy, acid suppression, expectorant treatment, albumin supplementation, organ function protection and diuresis were implemented. As the infection source was unidentified, empirical broad-spectrum antimicrobial therapy with meropenem (for gram-negative bacteria) and norvancomycin (for gram-positive bacteria) was administered. Microbiological tests of sputum and serum conducted on the same day yielded negative results for fungi, Mycobacterium tuberculosis and multiple viral nucleic acids. Blood bacterial culture results were pending.

On day 2, whole-spine and pelvic magnetic resonance imaging (MRI) demonstrated a left iliopsoas abscess and a subdural abscess from T12 to S1 (Fig. 1). T1-weighted post-contrast MRI showed diffuse inflammatory edema in the lumbosacral region, indicating continuous spread of infection (Fig. 2).

On day 3, computed tomography (CT)-guided percutaneous drainage of the iliopsoas abscess was performed (Fig. 3). Nucleic acid testing confirmed Staphylococcus aureus. The antimicrobial regimen was adjusted accordingly: because the isolate had not yet been classified as methicillin-resistant S. aureus (MRSA) or methicillin-susceptible S. aureus (MSSA) at that time, norvancomycin was temporarily continued for gram-positive coverage, while gram-negative coverage was de-escalated to piperacillin-sulbactam. The isolate was later confirmed as MSSA.

From day 4 to day 6 after admission, the patient's cardiopulmonary parameters gradually improved and his mental status recovered, though he remained agitated. He complained of weakness and numbness in both lower extremities as well as bowel and bladder dysfunction. Physical examination revealed grade 3 muscle strength in the lower limbs with preserved voluntary anal contraction, together with hypoesthesia over the lower limbs and saddle region. Repeat liver and kidney function tests showed progressive organ impairment. Serial blood cultures yielded no bacterial growth, while culture of pus from the iliopsoas abscess identified MSSA. The antimicrobial susceptibility results are shown in Table S1 (see Additional file 1). Comprehensive assessment indicated partial control of infection complicated by cauda equina compression. To reduce organ toxicity and ensure good penetration into bone and dural tissues, the antibiotic regimen was switched to linezolid combined with levofloxacin (Fig. 4).

From day 6 to day 9 after admission, the patient's general conditions improved markedly. Serial cultures of pus from the iliopsoas abscess were repeatedly negative. Nevertheless, neurological symptoms such as lower limb weakness and bowel and bladder dysfunction persisted, along with daily intermittent fever.

The symptoms involving the lower extremities and sacrococcygeal region were presumed to be secondary to compression of the lumbosacral nerve roots and cauda equina by the spinal subdural abscess. The intermittent fever was likely attributable to the persistent release of bacterial toxins from the spinal subdural abscess into the bloodstream. Given that CT-guided aspiration of the spinal subdural abscess posed a high risk of pus entering the cerebrospinal circulation and abscess dissemination, surgical treatment was planned.

Key surgical principles: 1) avoid damage to the zygapophyseal joints to maintain maximal spinal stability and lower the risk of reoperation; 2) preserve the arachnoid membrane whenever possible, achieve maximal drainage of the abscess, and adequately decompress the compressed neural structures.

Although MRI demonstrated a longitudinal spinal subdural abscess extending from T12 to S1, the patient was elderly and medically fragile, making extensive multilevel surgery undesirable. Preoperative MRI showed the greatest accumulation of purulent material and the most pronounced compression of the cauda equina at the L1–L3 levels. Therefore, a limited L1–L3 laminectomy was selected with the primary

goal of neural decompression rather than complete exploration of the entire radiographic extent of the abscess.

On day 9, the patient underwent posterior midline exposure of the L1–L3 vertebrae. The spinous processes and laminae of L1–L3 were exposed through a standard posterior approach. Using an ultrasonic bone scalpel, the spinous processes and the majority of the bilateral laminae were removed while preserving the lateral portions of the laminae and both zygapophyseal joints to maintain spinal stability. After adequate exposure of the dura mater, a longitudinal midline durotomy was performed. A schematic illustration of the relevant meningeal compartments and the arachnoid-preserving surgical corridor used for abscess evacuation is shown in Fig. 5.

Following durotomy, a tense abscess cavity was identified within the subdural extra-arachnoid space. Incision of the abscess cavity released abundant purulent yellow fluid. The arachnoid membrane was clearly visualized deep to the abscess and remained intact, pulsatile, and undisturbed throughout the procedure. The subarachnoid space was not entered, and no cerebrospinal fluid (CSF) leakage was observed. These findings confirmed that the lesion was confined to the subdural extra-arachnoid compartment (Fig. 6).

Abundant purulent material was evacuated from the operative field, resulting in satisfactory decompression of the cauda equina and neural elements. Because surgical exposure was intentionally restricted to the L1–L3 levels, complete evacuation of purulent material throughout the entire T12–S1 extent of the lesion could not be confirmed intraoperatively. The procedure was therefore aimed at maximal drainage of the accessible abscess and decompression of the neural structures at the levels of greatest compression. An epidural drain was left in place postoperatively to facilitate continued drainage, and intravenous antibiotic therapy was continued.

On postoperative day 2, the patient developed transient moderate fever and leukocytosis, which resolved spontaneously. Thereafter, he remained afebrile, and gradual improvement was observed in motor and sensory function of the lower extremities and saddle region. Although intraoperative pus culture was negative, Staphylococcus aureus infection was strongly suspected based on the characteristic yellow, thick purulent appearance of the material.

Lumbar MRI performed 8 days postoperatively demonstrated no residual abscess at the operative levels and no evidence of persistent infection within the examined region (Fig. 7). The patient remained clinically stable with continued neurological improvement and was discharged on postoperative day 19. Oral linezolid therapy was continued for an additional 2 months after discharge. At follow-up, the patient achieved complete clinical recovery without evidence of recurrence.

Discussion

Previous cases of spinal Staphylococcus aureus subdural abscesses have been reported, and surgery was recommended, but the patients were all much younger [5–8]. Such a condition is rarely reported in

elderly critically ill patients. Spinal subdural abscess occurring in an elderly critically ill patient with multiple concomitant infections and organ dysfunction remains extremely rare. Furthermore, based on the anatomical relationship and imaging findings, we hypothesize a previously unreported route of infection whereby the iliopsoas abscess may have eroded the epineurium of the lumbosacral nerve roots at the intervertebral foramina and subsequently spread into the spinal subdural space. Therefore, this case provides valuable clinical experience regarding both the pathogenesis and the comprehensive management of similar complex infections.

When investigating the origin of spinal subdural abscess, potential distant infectious foci and host-related predisposing factors should be carefully evaluated. Odontogenic infection has been recognized as a potential source of systemic bacterial dissemination and may contribute to spinal epidural abscess through hematogenous spread [9]. In addition, a history of drug abuse has been reported as an important risk factor for severe spinal infections due to repeated episodes of bacteremia and impaired host defense [10]. In the present case, no evidence of recent dental infection or drug abuse was identified. Instead, imaging findings demonstrated close anatomical continuity between the iliopsoas abscess and the spinal subdural abscess through the lumbosacral intervertebral foramina, supporting local extension as the most plausible mechanism of infection. Although these commonly recognized risk factors were considered unlikely in this patient, they should nevertheless be evaluated during the diagnostic workup of patients presenting with spinal subdural abscess. The patient was of advanced age, and age-related immune dysfunction may have predisposed him to bacterial invasion and dissemination, as previously described in elderly patients with severe S. aureus infections [11].

The route by which infection spread to the spinal subdural space remains incompletely understood, with both hematogenous dissemination and direct local extension being recognized mechanisms. In the present case, serial blood cultures obtained after admission were negative, making persistent hematogenous spread less likely. More importantly, MRI demonstrated anatomical continuity between the iliopsoas abscess and the spinal subdural abscess through the lumbosacral intervertebral foramina. Based on these imaging findings, we hypothesize that the iliopsoas abscess extended along the lumbosacral nerve sheath, eroded the epineurium at the intervertebral foramina, and subsequently spread into the spinal subdural space. Although alternative mechanisms, including transient hematogenous seeding or direct extension from adjacent soft-tissue infection, cannot be completely excluded, the anatomical continuity and consistent radiological findings support local extension from the iliopsoas abscess as the most plausible route of infection.

A similar constellation was described by Ngwenya et al., who reported a patient with a psoas abscess coexisting with epidural and subdural spinal abscesses, which was attributed to hematogenous spread in the context of injection drug use [13]. In contrast, our patient had no history of injection drug use, serial blood cultures obtained after admission remained negative, and MRI demonstrated direct anatomical continuity between the iliopsoas abscess and the subdural collection through the lumbosacral foramina. To our knowledge, foraminal spread of an iliopsoas abscess along the nerve sheath into the spinal subdural space has not been previously described.

From the perspective of neurological recovery, the key to this case's success lies in two aspects: first, targeted antibiotics (linezolid) with excellent spinal tissue penetration effectively cleared MSSA, reducing bacterial toxin-induced neural inflammation—a critical step in preventing irreversible nerve damage; second, arachnoid-sparing surgical drainage not only removed the compressive abscess but also preserved the integrity of the subarachnoid barrier, avoiding secondary central nervous system infection and maintaining a microenvironment conducive to nerve repair. Previous studies have emphasized that careful surgical planning and multidisciplinary management are essential in severe musculoskeletal infections [12]. Additionally, preservation of spinal stability (via zygapophyseal joint protection) may facilitate future rehabilitation and promote neuroplasticity, contributing to the recovery of lower-limb motor function. This aligns with the concept that functional recovery after central nervous system infection requires elimination of injurious factors, preservation of neural structures, and optimization of the microenvironment.

Conclusion

Close monitoring of the patient's condition and dynamic adjustment of treatment strategies are critical in managing complex and severe infections in elderly patients. The proposed route of infection may provide new insights into the pathogenesis of this rare spinal subdural abscess and serve as a useful reference for clinicians in the diagnosis and management of similar cases.

This case underscores two key lessons for clinical practice: 1) individualizing antibiotic regimens based on antimicrobial susceptibility, tissue penetration, and age-related organ dysfunction; and 2) employing a surgical approach involving resection of the spinous processes and bilateral laminae with preservation of the pars interarticularis and zygapophyseal joints to maintain spinal stability, while simultaneously preserving the arachnoid membrane to prevent cerebrospinal fluid contamination and facilitate postoperative recovery in elderly patients.

Abbreviations

BE
Base excess
BMI
Body mass index
BNP
Brain natriuretic peptide
CNS
Central nervous system
CSF
Cerebrospinal fluid
CT
Computed tomography

ICU
Intensive care unit
MRI
Magnetic resonance imaging
MRSA
Methicillin-resistant Staphylococcus aureus
MSSA
Methicillin-susceptible Staphylococcus aureus
PO_2
Partial pressure of oxygen
SSA
Spinal subdural abscess

Declarations

Ethics approval and consent to participate

This study was approved by the Ethics Committee of Panzhihua Municipal Central Hospital (No. PZHZXYY-REC-006). The patient provided written informed consent to participate in this study.

Consent for publication

Written informed consent was obtained from the patient for publication of this case report and any 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

The dataset(s) supporting the conclusions of this article is(are) included within the article (and its additional file(s)).

Competing interests

The authors declare that they have no competing interests.

Funding

This work was supported by the Sichuan Medical Association Project (2023TG21), the Panzhihua Science and Technology Bureau Project (2023ZD-S-5), and the Special Research Project of the Sichuan Association for Medical Science and Technology Innovation (Grant No. 2025YCYM099).

Authors' contributions

G.L. (Gengwu Li) and H.X. conceived and designed the report. G.L. (Guangxin Li) acquired and organized the clinical data. G.L. (Gengwu Li) drafted the manuscript. H.X. critically revised the manuscript for important intellectual content. All authors read and approved the final manuscript.

Acknowledgements

The authors declare that no artificial intelligence tools were used in the preparation of this manuscript.

References

1. Ibarz M, Haas LEM, Ceccato A, et al. The critically ill older patient with sepsis: a narrative review. Ann Intensive Care. 2024;14:6.
2. Yilmaz M, Elaldi N, Balkan İ, et al. Mortality predictors of Staphylococcus aureus bacteremia: a prospective multicenter study. Ann Clin Microbiol Antimicrob. 2016;15:7.
3. van Soest TM, Søndermølle MB, Brouwer MC, et al. Community-acquired Staphylococcus aureus meningitis in adults. J Infect. 2023;86:239–44.
4. Cuervo G, Gasch O, Shaw E, et al. Clinical characteristics, treatment and outcomes of MRSA bacteraemia in the elderly. J Infect. 2016;72:309–16.
5. Abdallah A, Emel E, Abdallah BG, et al. Surgical outcome of spinal subdural abscesses: a report of four consecutive patients and brief review of the literature. J Neurol Surg Cent Eur Neurosurg. 2023;84:77–90.
6. Konovalov NA, Kaprovoy S, Asyutin D, et al. Spinal subdural abscess mimicking an extradural tumor: a case report. Cureus. 2021;13:e19101.
7. Takeuchi T, Shigenobu K. Spinal subdural abscess following food intoxication: a case report. Spine Surg Relat Res. 2019;3:86–90.
8. Coumans JV, Walcott BP. Rapidly progressive lumbar subdural empyema following acromial bursal injection. J Clin Neurosci. 2011;18:1562–3.
9. Ramhmdani S, Bydon A. Streptococcus intermedius: an unusual cause of spinal epidural abscess. J Spine Surg (Hong Kong). 2017;3:243–9.
10. Patel AR, Alton TB, Bransford RJ, et al. Spinal epidural abscesses: risk factors, medical versus surgical management, a retrospective review of 128 cases. Spine J. 2014;14:326–30.
11. Oh SJ, Lee JK, Shin OS. Aging and the immune system: the impact of immunosenescence on viral infection, immunity and vaccine immunogenicity. Immune Netw. 2019;19:e37.
12. Foreman M, Patel A, Nguyen A, et al. Management considerations for total intervertebral disc replacement. World Neurosurg. 2024;181:125–36.
13. Ngwenya LB, Prevedello LM, Youssef PP. Concomitant epidural and subdural spinal abscess: a case report. Spine J. 2016;16:e275–82.

Figures

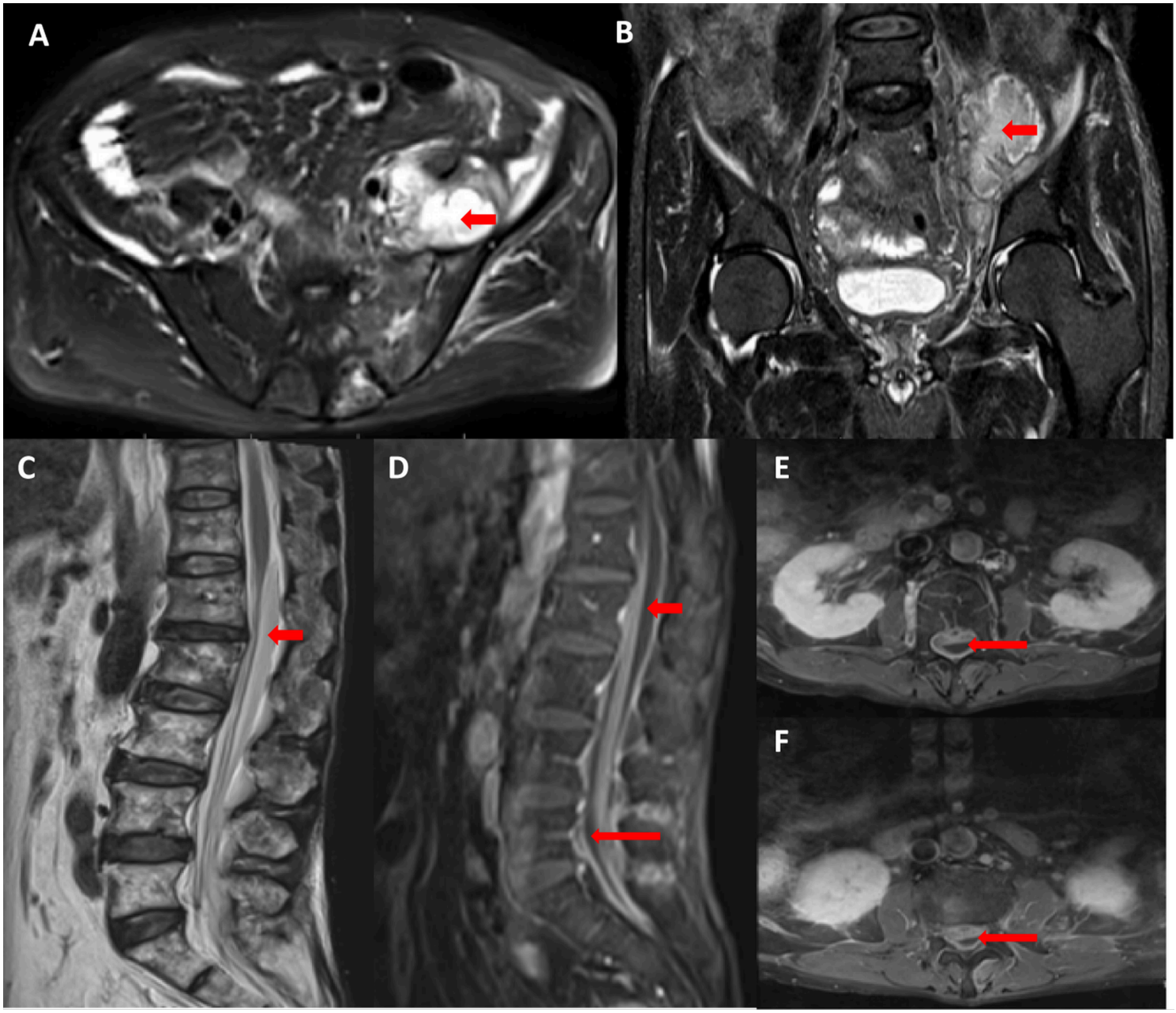


Figure 1

Preoperative MRI demonstrating iliopsoas and spinal subdural abscesses.

Panels A–C show T2-weighted magnetic resonance imaging (MRI), while panels D–F show T1-weighted contrast-enhanced MRI. Red arrows indicate the locations of the abscesses. Panels A and B demonstrate iliopsoas abscesses, and panels C–F demonstrate lumbar spinal subdural abscesses.

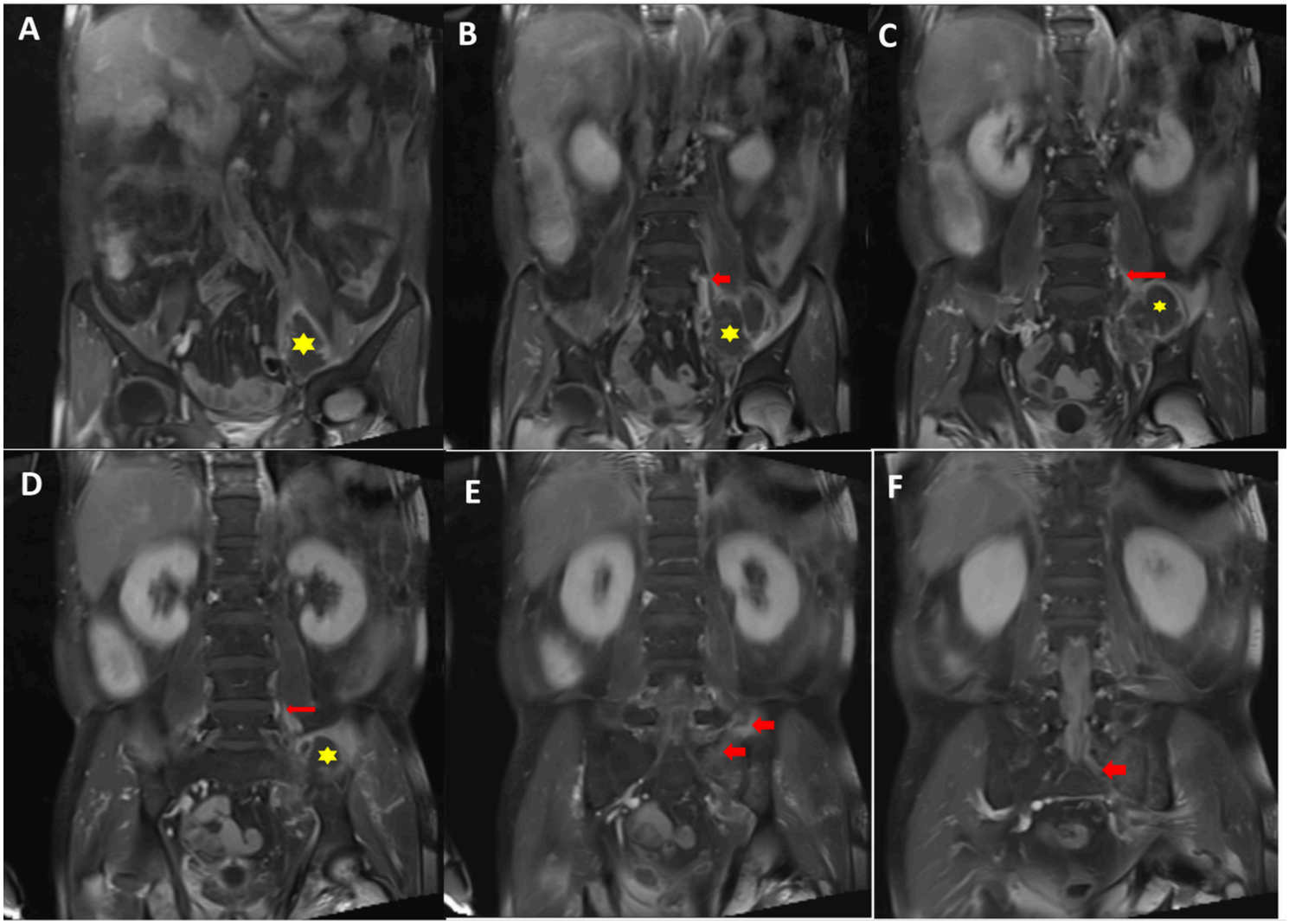


Figure 2

Coronal contrast-enhanced MRI showing continuous infection spread.

Panels A–F show fat-suppressed T1-weighted contrast-enhanced MRI in the coronal plane acquired from anterior to posterior. Yellow asterisks indicate abscesses, and red arrows indicate surrounding infectious lesions.



Figure 3

Pelvic CT showing iliopsoas abscess and drainage catheter.

Pelvic computed tomography (CT) image demonstrating an iliopsoas abscess (yellow asterisk). The red arrow indicates a drainage catheter placed following CT-guided aspiration.

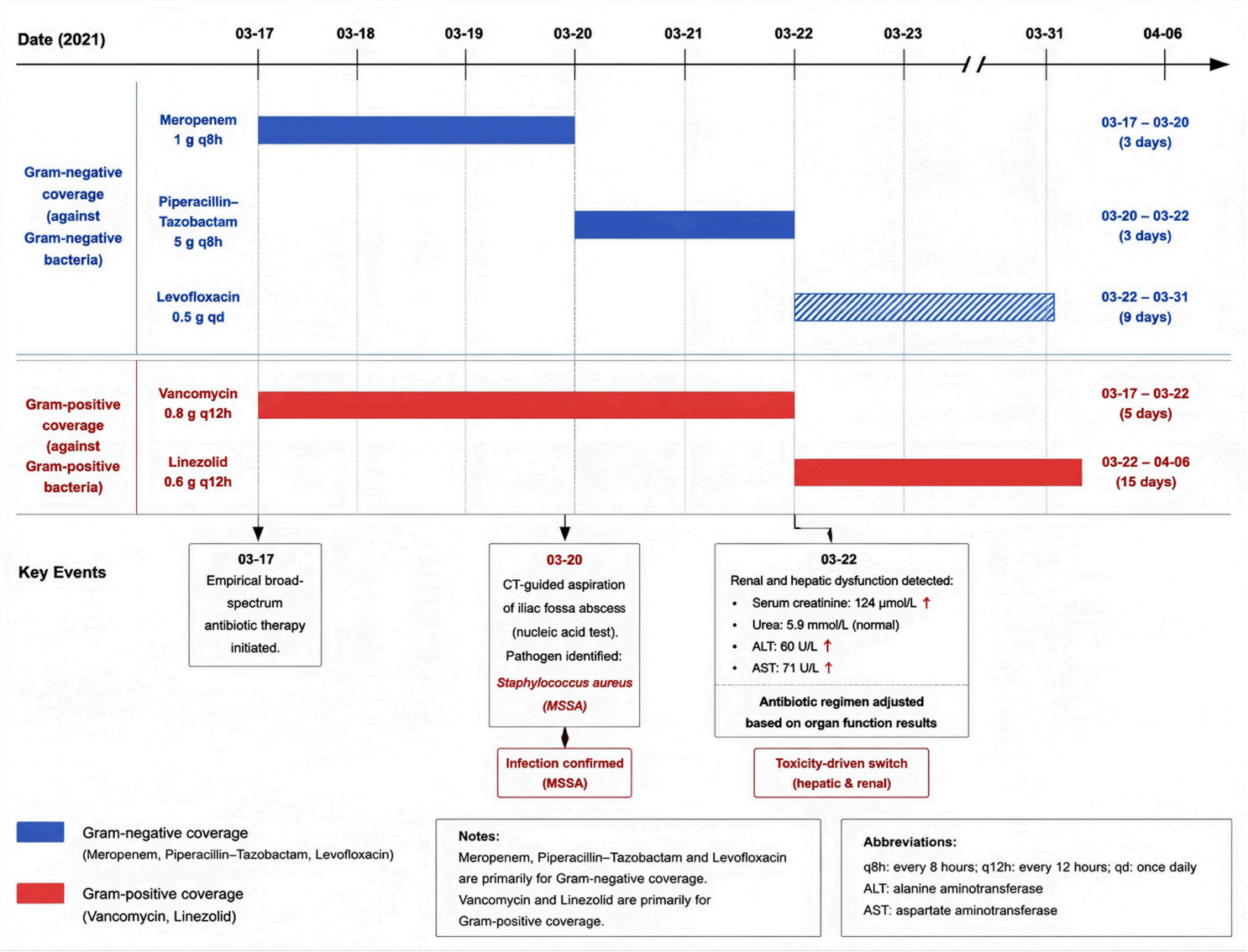


Figure 4

Timeline of antimicrobial therapy during hospitalization.

Evolution of antimicrobial therapy during hospitalization guided by microbiological identification and laboratory evidence. All antibiotics were administered intravenously.

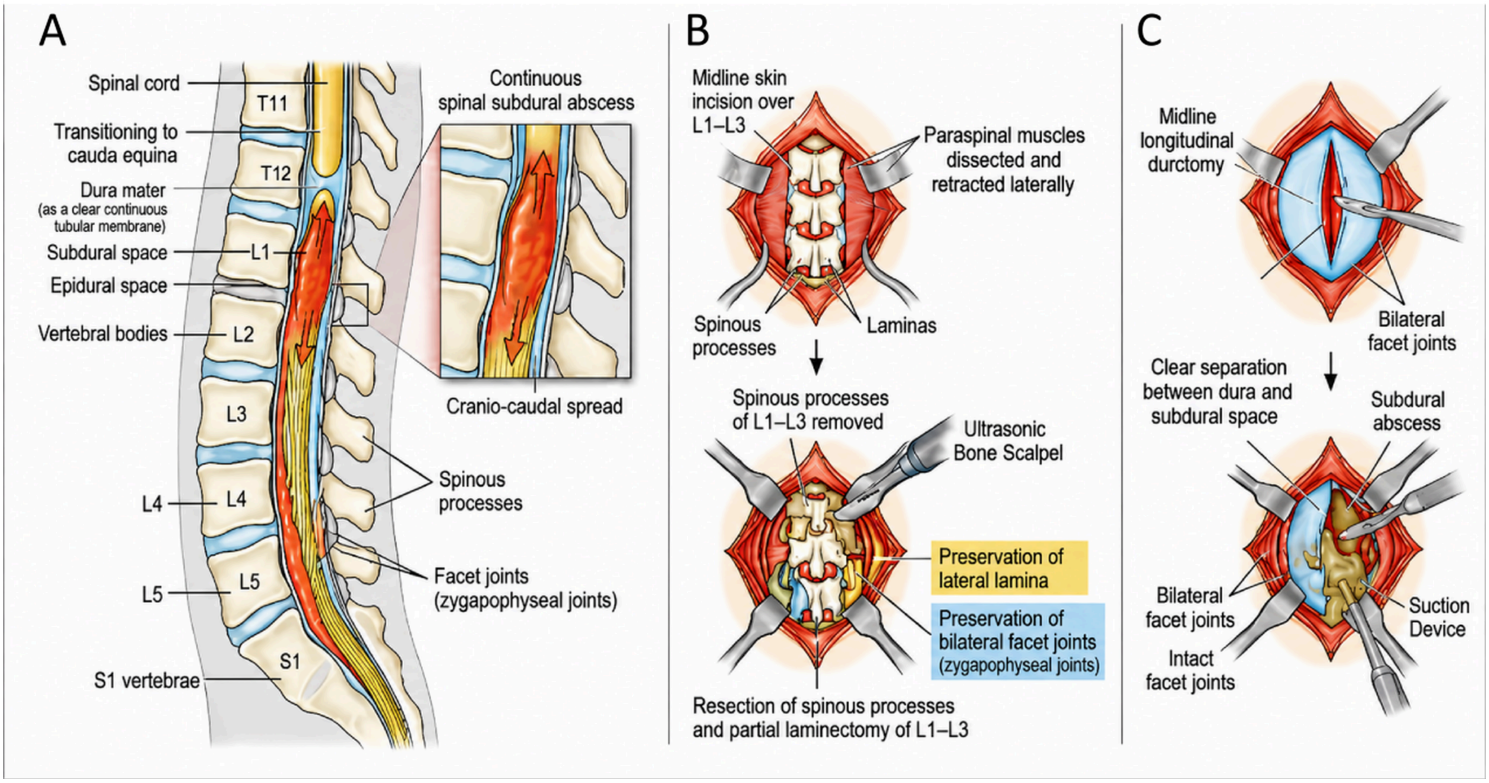


Figure 5

Schematic of the arachnoid-preserving surgical approach.

Anatomical location of the spinal subdural abscess and schematic illustration of the arachnoid-preserving surgical approach. A: T12–S1 spinal subdural abscess anatomy; B: posterior midline surgical exposure (L1–L3); C: dural opening and subdural abscess evacuation.

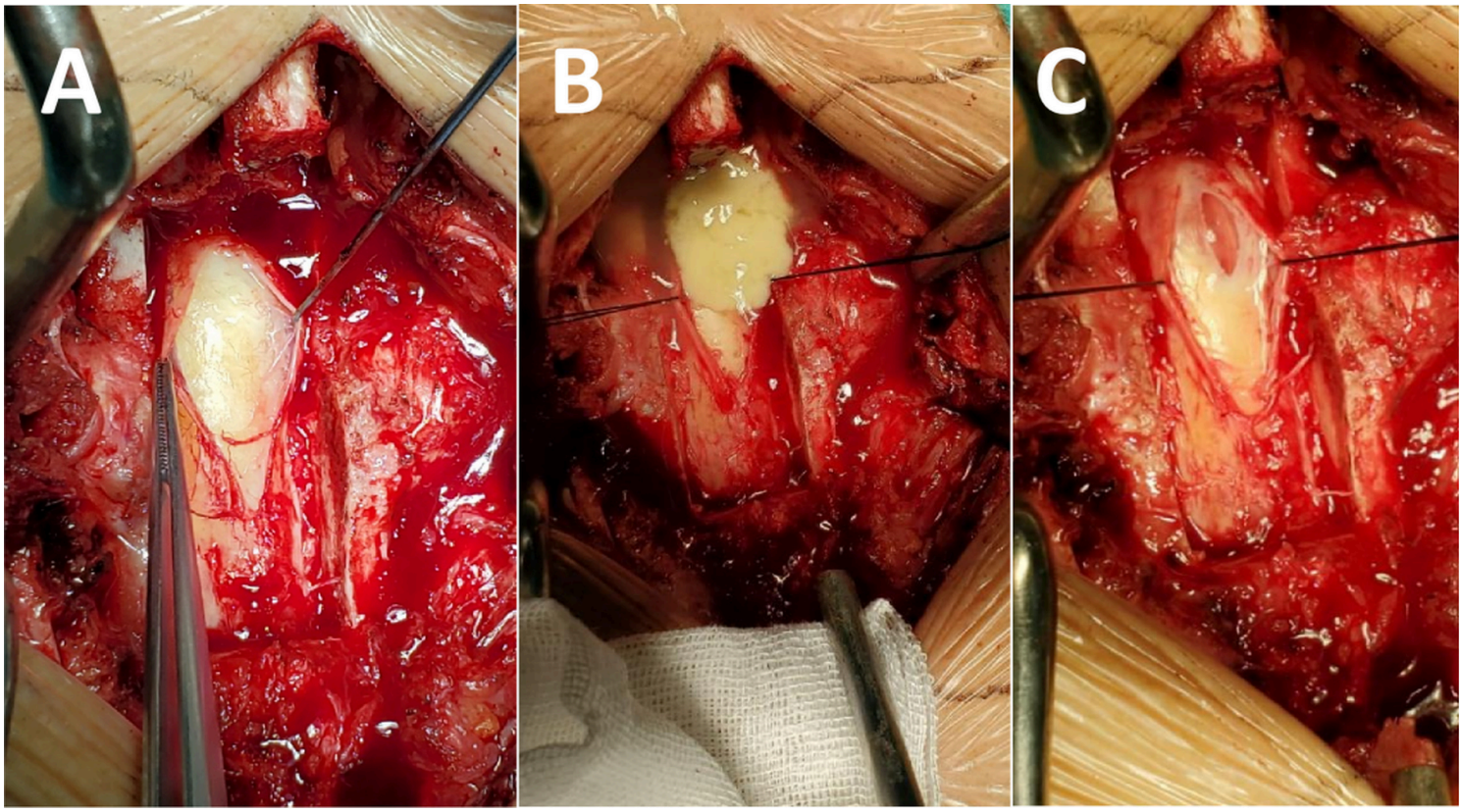


Figure 6

Intraoperative findings of the subdural extra-arachnoid abscess.

A: An intact abscess capsule was identified following longitudinal durotomy. B: Incision of the abscess capsule resulted in drainage of purulent yellow fluid. C: After partial evacuation of the purulent collection, the intact arachnoid membrane deep to the abscess was clearly visualized and remained visibly pulsatile.

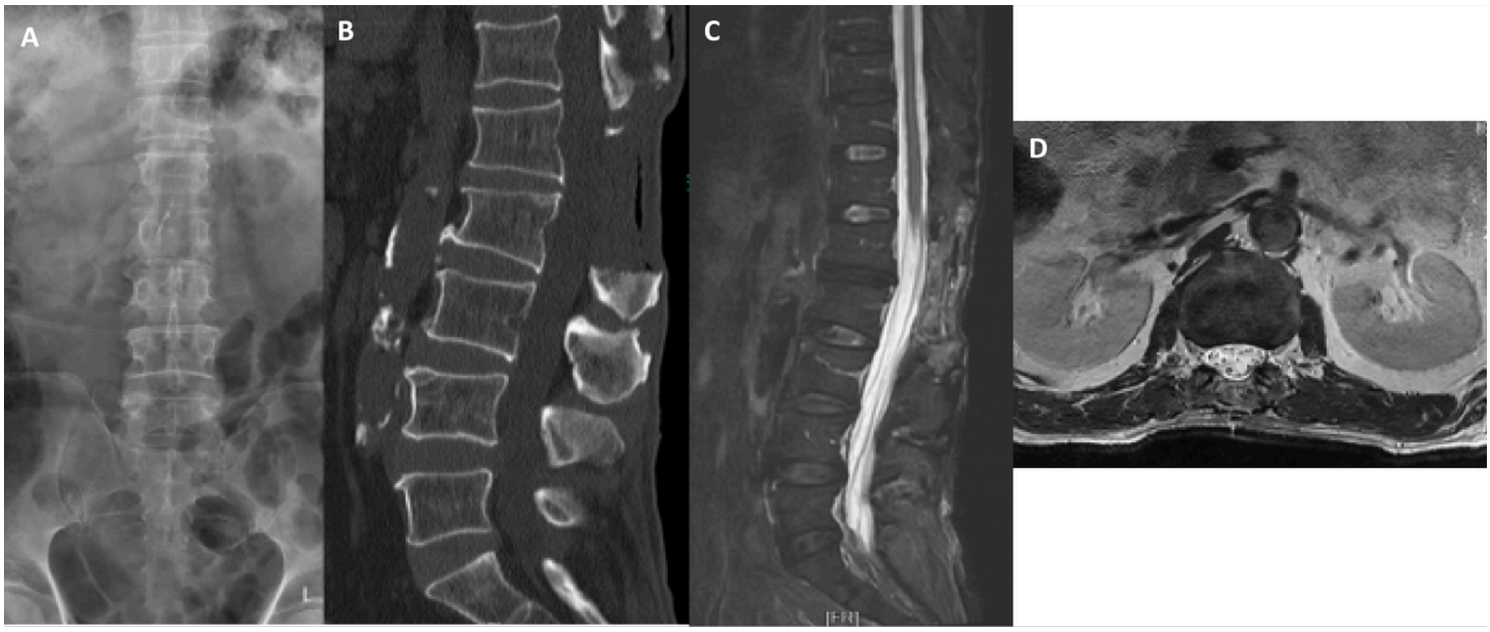


Figure 7

Postoperative imaging showing decompression without residual abscess.

Panel A shows X-ray images, panel B shows CT images, and panels C–D show T2-weighted MRI, with panel D representing the axial view at L2. Panels A and B demonstrate that the laminae and spinous processes of L1–L2, as well as part of the L3 lamina, were neatly resected using an ultrasonic bone scalpel. Panels C and D show complete drainage of the abscess and adequate neural decompression.

Supplementary Files

This is a list of supplementary files associated with this preprint. Click to download.

- Additionalfile1.docx