Spinal Epidural Hematoma and Epidural Abscess

Definition and Epidemiology

Spinal epidural hematoma (SEH) is a rare, acute collection of blood in the epidural space, causing spinal cord or nerve root compression. Spinal epidural abscess (SEA) is a pyogenic infection in the same space, often bacterial, leading to similar compression. Both are neurosurgical emergencies.

- Prevalence SEH incidence is ~0.1-0.2 per 100,000; SEA is ~2-12 per 100,000, with higher rates in IV drug users (IVDU) and diabetics. Mortality is 5-10% for SEH, 10-20% for SEA if untreated.
- Risk Factors Anticoagulation (SEH), IVDU (SEA), diabetes, spinal surgery, epidural procedures.
- Rare Demographics Pediatric SEH (trauma), immunocompromised SEA (fungal), endemic TB (Pott's disease).

Pathophysiology

- Mechanisms SEH results from venous or arterial bleeding (e.g., epidural venous plexus rupture) due to trauma, anticoagulation, or procedures, forming a hematoma that compresses the spinal cord. SEA arises from hematogenous spread (e.g., S. aureus bacteremia), direct inoculation, or contiguous infection, forming an abscess.
- Effects Compression causes ischemia, edema, and neuronal injury, leading to paresis, sensory loss, or paralysis. SEA's inflammatory cytokines (IL-1β, TNF-α) exacerbate tissue damage.
- Molecular Pathways In SEH, thrombin and fibrin drive clot formation; in SEA, bacterial PAMPs activate TLR4, triggering neutrophil influx and pus formation. Both upregulate VEGF, increasing edema.
- Key Pathway Hematoma/abscess formation → Spinal cord compression → Ischemia and inflammation → Neurological deficits.

Causes

Category	Common Causes	Rare Causes	Notes
Hematoma (SEH)	Anticoagulation (warfarin, DOACs), trauma	Vascular malformation, hemophilia	Warfarin: INR >3 increases risk

Category	Common Causes	Rare Causes	Notes
Abscess (SEA)	S. aureus bacteremia, IVDU	Fungal (Aspergillus), TB (Pott's)	MRSA in 30-50% of SEA
Iatrogenic	Epidural catheter, spinal surgery	Acupuncture, chiropractic	Catheters: 1:10,000 risk of SEA
Systemic	Diabetes, alcoholism	HIV, malignancy	DM: Impaired immune response
Traumatic	Spine fracture, blunt injury	Child abuse (pediatric SEH)	Trauma: Thoracic spine common
Infectious	Endocarditis, skin infections	Brucella, Nocardia	Hematogenous spread in 50% SEA

Clinical Presentation

Symptoms

- Severe back pain, localized or radicular
- Weakness, numbness (progressive, hours to days)
- Fever, chills (SEA, 60-80%)
- Rare Bowel/bladder dysfunction, cauda equina syndrome

Exam

- Focal tenderness, paraspinal muscle spasm
- Motor deficits (paresis, paralysis), sensory loss
- Hyperreflexia (cord compression), positive Babinski
- Rare Hypotension (spinal shock), meningismus (SEA)
- Red Flags Rapid neuro decline (<6h), fever with neuro deficits, INR >3

Labs and Studies

Labs

- CBC Leukocytosis (SEA, 15-20K), anemia (chronic infection)
- ESR/CRP Elevated (>50 mm/h, >10 mg/L, SEA > SEH)
- Coagulation INR, aPTT (SEH, anticoagulation), D-dimer (non-specific)
- Blood Cultures Positive in 60% of SEA (S. aureus, Streptococcus)
- Advanced Procalcitonin (>0.5 ng/mL, SEA), fungal/TB PCR (rare pathogens)

Imaging

- MRI with Gadolinium Gold standard; T2 hyperintensity (edema), mass effect (sensitivity 95%)
- CT Myelography Alternative if MRI contraindicated; shows compression
- X-ray Spine Normal early; osteomyelitis in chronic SEA
- Advanced PET-CT (TB, fungal SEA), intraoperative ultrasound (abscess extent)
- Other
    - CSF Analysis Avoid in SEH/SEA (risk herniation); if done, pleocytosis, high protein (SEA)
    - Blood Glucose HbA1c >7% (DM, SEA risk)
    - Advanced ASO titers (TB), interferon-gamma release assay (Pott's disease)

Diagnosis

Criteria Acute back pain + neurological deficits (weakness, sensory loss) + imaging (MRI) showing epidural hematoma or abscess + confirmatory labs/cultures (SEA).

Differential Spinal cord infarction, transverse myelitis, disc herniation, tumor, Guillain-Barré syndrome.

Flowsheet

- Step 1 History/Exam Back pain, neuro deficits, fever (SEA), anticoagulation (SEH)
- Step 2 Labs ESR/CRP, blood cultures, INR; rule out sepsis (lactate)
- Step 3 Imaging Urgent MRI (within 6h), CT if MRI unavailable
- Step 4 Biopsy/Culture Aspiration or surgical culture (SEA); avoid in SEH
- Step 5 Differential Rule out tumor (biopsy), myelitis (CSF oligoclonal bands)

Treatment

General Principles Decompress spinal cord urgently, eradicate infection (SEA), and reverse coagulopathy (SEH).

- Pain Management Morphine 2-5 mg IV q4h, avoid NSAIDs (bleeding risk)
- Neurological Monitoring Motor/sensory exams q1-2h
- Anticoagulation Reversal Vitamin K 10 mg IV, PCC 25-50 units/kg (SEH, INR >1.5)
- Specific Therapies
    - SEH Emergent laminectomy (within 6-12h), evacuate hematoma; FFP if INR >1.5
    - SEA Vancomycin 15 mg/kg IV q12h + ceftriaxone 2 g IV q24h (empiric); surgical drainage (laminectomy, abscess evacuation)

    - Antibiotics (SEA) 6-8 weeks IV (e.g., nafcillin 2 g IV q4h for MSSA); rifampin 600 mg PO daily for MRSA
- Advanced
    - Hyperbaric oxygen (SEA, refractory), antifungal (voriconazole 6 mg/kg IV q12h, Aspergillus)
- Rare Causes TB (RIPE therapy, 9-12 months), Brucella (doxycycline + rifampin)

Monitoring

- Daily neuro exams, ESR/CRP q3-5 days (SEA)
- MRI q2-4 weeks (persistent symptoms)
- Blood cultures until negative, monitor renal function

Complications

Acute

- Paralysis Permanent if surgery delayed >12h (10-20% of cases)
- Sepsis Bacteremia, multi-organ failure (SEA, 10-15%)
- Cauda Equina Syndrome Bladder/bowel dysfunction (5-10%)

Long-Term

- Chronic Pain Neuropathic, post-laminectomy syndrome
- Spinal Deformity Kyphosis (TB, chronic SEA)
- Rare Osteomyelitis (SEA extension), amyloidosis (chronic inflammation)

Clinical Scenarios

Case 1 Spinal Epidural Hematoma

Presentation 70 y/o M on warfarin (INR 3.5) presents with acute back pain, leg weakness. Vitals BP 140/80, HR 90, SpO2 96%, RR 16. Exam Paraparesis, sensory loss T10.

Labs/Studies MRI Thoracic SEH, cord compression. INR 3.8, Hgb 10 g/dL.

Interpretation SEH, anticoagulation-induced.

Management Vitamin K 10 mg IV, PCC 50 units/kg, urgent laminectomy. Neuro monitoring q1h. Full recovery by week 4, warfarin adjusted.

Case 2 Spinal Epidural Abscess

Presentation 45 y/o M with IVDU, fever, back pain, leg numbness. Vitals BP 110/70, HR 100, SpO2 94%, RR 18. Exam L3 tenderness, weak foot dorsiflexion.

Labs/Studies ESR 90 mm/h, CRP 15 mg/L, blood culture MRSA. MRI L3-L4 abscess.

Interpretation SEA, IVDU-related.

Management Vancomycin 15 mg/kg IV q12h, rifampin 600 mg PO daily, laminectomy. Antibiotics x 8 weeks. Partial recovery by month 3.

Case 3 TB-Related SEA (Rare)

Presentation 50 y/o F from endemic area with back pain, weight loss, paraplegia. Vitals BP 100/60, HR 95, SpO2 96%, RR 16. Exam Kyphosis, T12 sensory loss.

Labs/Studies MRI T12 abscess, osteomyelitis. Quantiferon-TB positive, AFB culture pending.

Interpretation SEA, Pott's disease.

Management RIPE therapy (isoniazid, rifampin, pyrazinamide, ethambutol), laminectomy, spinal fusion. Antibiotics x 12 months. Neuro improvement by month 6.

Expert Tips

- Order MRI within 6h of neuro symptoms; delay >12h risks permanent paralysis
- Start empiric vancomycin + ceftriaxone in SEA; tailor to culture, add rifampin for MRSA
- Reverse anticoagulation immediately in SEH; PCC faster than FFP
- Suspect TB in endemic areas or immigrants; Quantiferon, AFB critical
- Monitor neuro status q1h pre-op; post-op deficits may improve with rehab
- Pitfall Missing SEA in IVDU; fever + back pain warrants MRI
- Advanced Intraoperative ultrasound guides abscess drainage; PET-CT for TB extent

Key Pearls

- SEH and SEA are neurosurgical emergencies; MRI is diagnostic
- Back pain + neuro deficits + fever (SEA) or anticoagulation (SEH) are red flags
- Surgery (laminectomy) is urgent; antibiotics for 6-8 weeks in SEA
- S. aureus is most common in SEA; TB (Pott's) in endemic areas
- Rare pediatric SEH or fungal SEA require specialized workup

References

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