Summary of

Acute Spinal Cord Compression

n engl j med 376;14 April 6, 2017

Alexander E. Ropper

Introduction

- The disorders that account for most instances of acute spinal cord compression:
  - Trauma
  - Tumor
  - Epidural abscess
  - Epidural hematoma.
- These disorders affect spinal cord function but also affect stability of the spinal column:
  - damage vertebrae, intervertebral disks, ligaments, facet joints
- Stability is defined by the retention of normal spinal alignment under physiologic conditions (loads) such as standing, walking, bending, or lifting.
- Spinal instability permits subluxation of vertebrae (spondylolisthesis), which narrows the spinal canal.
- Instability that poses a risk of cord damage generally requires surgical fixation of the spine, and bony fusion of adjacent vertebrae (spinal fusion) may be necessary for durable stabilization.

Clinical Features

- Relatively symmetric weakness or paralysis of the limbs
- Urinary retention on incontinence
- Circumferential loss of sensation, a “sensory level”
- Hyperreflexia and Babinski signs (characteristic of intrinsic diseases of the spinal cord) may not be evident in cases of acute severe cord compression, especially due to trauma.
- Limbs may be flaccid and areflexic, accompanied by systemic hypotension (spinal shock).
- Localized back or neck pain often present.
- Cauda equina (compression of nerve roots below level L1-L2) causes flaccid paraparesis and early incontinence, BLE pain, areflexia.
- Two exam points commonly omitted:
  - Determine the sensory level even it is above the clavicles
  - Spinal percussion can identify level of a fracture or metastatic lesion

TRAUMATIC SPINAL CORD COMPRESSION

- Results from combinations of:
  - Fractured and retropulsed bone fragments
  - Disk herniation
  - Subluxation of vertebral bodies
  - Minor trauma superimposed on chronic degenerative spondylosis with narrow canal.
- 20% of spinal injuries (especially cervical) affect more than one level.
- Cervical spine especially vulnerable to displacement because:
  - It lacks rib cage support
  - Facet joints are smaller and flatter (axially oriented) so easier to sublux
  - Cranium acts as a load on the fulcrum of the neck

<u>Assessment</u>

- Injury level determined by lowest cord segment with normal motor and sensory

- AIS grades impairment on 5 point scale, even slight sensory preservation of perineum is associated with a better outcome.
- CT is preferred initial imaging study b/c of high sensitivity for fracture and subluxation.
- MRI is a useful complementary study for revealing ligamentous damage, disk herniation, and edema or hemorrhage in the spinal cord

Table 1. Clinical Syndromes of Acute Spinal Cord Compression.

Complete transverse myelopathy (lesion affecting both sides and anterior and posterior spinal cord at one or more segments)
Bilateral paralysis below lowest affected segment of spinal cord
Loss or reduction of all sensation below affected level of spinal cord (sensory level)
Sphincter dysfunction with urinary or bowel urgency, retention, or incontinence
Segmental loss of reflexes at affected level
Hyperreflexia and Babinski signs
Spinal shock (acute destruction of spinal cord at one or more cervical or upper thoracic segments)
Paralysis of limbs below the affected segment of the spinal cord
Hypotonia and areflexia of limbs below the level of the lesion
No Babinski signs
Loss of sphincter function
Reduced autonomic function below affected level
Systemic hypotension
Central cord syndrome (predominant gray-matter damage, typically involving cervical spine, from trauma)
Weakness and reflex loss in arms; less severe weakness or no weakness in legs
Reduced pain and thermal sense in arms, typically with hyperesthesia, sparing sensation of vibration and proprioception in arms and legs
Variable hyperreflexia in legs
Hemicord (Brown–Séquard) syndrome
Paralysis, hyperreflexia, and reduced sensation of vibration on one side of body
Babinski sign on paralyzed side
Loss of pain and thermal sense on opposite side
Conus medullaris syndrome (cord compression at the level of L1–L2 vertebral bodies)
Weakness of feet and legs
Variable reflexes in legs
Early loss of sphincter function
Loss of sensation at sacral and lower lumbar (perineal) dermatomes; sensory level at or below waist
Variable Babinski signs
Cauda equina syndrome (compression between L2 and S1 vertebral bodies)
Sciatic or other radicular pain
Areflexic weakness of feet and legs, depending on level of compression
Sphincter dysfunction
Reduced sensation from saddle region and legs up to groin

<u>Traumatic Spinal Cord Compression Treatment</u>

- Most institutions have abandoned the use of high-dose glucocorticoids for spinal trauma
- Clinical guidelines recommend rapid reversal of hypotension with IV fluids and vasopressors to maintain MAP>85-90.

- Surgery
    - Neurologic outcome better if surgical decompression was performed within 24hrs after injury.
    - Surgically stabilizing the spine allows for early mobilization and rehabilitation.
    - Surgical stabilization can involve screws in vertebrae, rods or plates between vertebrae, fusion of vertebrae by decorticating surfaces of adjacent bones and adding autologous or cadaveric bone graft or synthetic material
    - Complications: infection, hardware failure, pseudoarthrosis (failure of fusion).

Table 3. Main Clinical and Imaging Characteristics of Acute Spinal Cord Compression and Treatment Options.*

Variable	Traumatic Cord Compression	Neoplastic Cord Compression	Spinal Epidural Abscess	Spinal Epidural Hematoma
Characteristics				
Temporal evolution	Sudden (at time of injury)	Days or longer	Hours, days, or longer	Sudden
Predisposing factors	High-velocity trauma, narrowed spinal canal (congenital or degenerative)	Systemic cancer with bony metastases, myeloma, lymphoma	Diabetes, cancer, bacteremia, intravenous drug use, recent spinal surgery	Treatment with anticoagulant or antiplatelet agents, coagulopathy, spinal trauma
Typical symptoms and signs	Paraplegia or tetraplegia, sensory level, central cord syndrome, focal spinal pain	Local back pain, nocturnal back pain, radicular pain, paraparesis, sensory level, sphincter dysfunction	Severe midline back pain, fever, paraparesis	Local or regional back pain, paraparesis
Laboratory abnormalities	Resulting from trauma to other organs	Manifestations of metastatic cancer and bony infiltration	Leukocytosis, elevated ESR and hsCRP, positive blood cultures	Elevated INR, prolonged PTT, platelet dysfunction, or thrombocytopenia
CT findings	Fracture of elements of spinal column, subluxation of vertebral bodies	Bony infiltration by neoplasm, multiple sites of metastases, pathologic compression fracture	Osteomyelitis or diskitis, which can cross disk space between adjacent vertebral bodies; paraspinal soft-tissue fluid collections	Hematoma may be evident; spinal fracture may be seen if hematoma is traumatic
MRI findings	High STIR signal in ligaments, cord edema and hemorrhage, subluxation	Enhancing tumor extending into spinal canal from spinal column, with disk space spared; homogeneous signal changes in vertebral body; tumor mass may be evident without gadolinium	Enhancing infectious collection, decreased signal on T_1-weighted images and increased signal on T_2-weighted images, and high STIR signal; osteomyelitis, diskitis, or enhancing paraspinal collection may be seen	Clot that is isointense on T_1-weighted images and hyperintense on T_2-weighted images, becoming hyperintense on T_1-weighted images after 24–36 hr
Treatment options				
Medical treatment	Maintenance of mean arterial blood pressure at 85 to 90 mm Hg, bladder catheterization	High-dose glucocorticoids, radiotherapy or radiosurgery	Antibiotics, including those for *Staphylococcus aureus*, until culture results guide change	Reversal of anticoagulation or platelet dysfunction
Surgical treatment	Decompression of spinal cord, restoration of alignment, internal fixation and fusion	Circumferential removal of tumor, decompression of spinal cord, internal fixation and fusion	Surgical evacuation with irrigation, biopsy, and culture	Surgical evacuation

* ESR denotes erythrocyte sedimentation rate, hsCRP high-sensitivity C-reactive protein, INR international normalized ratio, PTT partial-thromboplastin time, and STIR short T_1-weighted inversion-recovery sequence on MRI.

NEOPLASTIC EPIDURAL SPINAL CORD COMPRESSION

- Spinal metastases cause spinal cord compression when they extend from the bone into the epidural space.
- Aching back pain and tenderness on percussion over the affected site are typical and may precede neurologic features by several weeks.
- Pain may be worse when the patient is supine and causes awakening from sleep.
- The spinal cord syndrome evolves over a period of hours or days
- Includes hyperreflexia and Babinski signs but is infrequently characterized by sphincter dysfunction alone.
- With bony destruction and pathologic vertebral compression fracture, the spinal column becomes unstable, leading to more severe back pain.
- Common primary cancers that metastasize:
    - Prostate, Breast, Kidney, non-Hodgkin's lymphoma, Myeloma
- Imaging of the entire spine reveals multiple levels of compression in up to a third of cases.
- Survival in patients with multiple spinal metastases and cord compression is generally less than 6 months, but a retained ability to walk before treatment is associated with longer survival.

Assessment

- Compression of the spinal cord by epidural tumor is detected by imaging, foremost MRI, preferably with the administration of gadolinium. MRI has been reported to be 100% in detecting spinal cord compression.
- Imaging of the entire spine is recommended to catch all lesions.
- **Tumor can be detected in many cases without the use of gadolinium, so MRI should not be withheld if the patient has a risk factor, such as allergy, for administration of the agent.**
- CT Myelography is an alternative in patients who cannot undergo MRI.
- CT without myeloraphy will show vertebral infiltration from tumor but won't detect cord compression.

Treatment

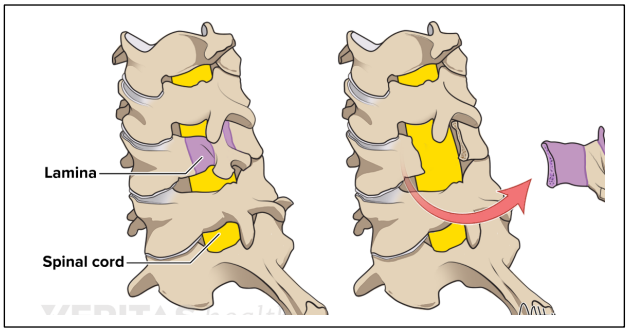
- Vertebral infiltration with tumor that does not compress the cord is treated with radiation if the spinal column is stable.
- **Steroids reduce impairment and pain.**
- Dexamethasone 100mg commonly used but 10mg IV followed by 4mg q6hrs is another common regimen.
- Radiotherapy- lymphoma and myeloma highly sensitive to radiation therapy.
- Non–small-cell lung cancer and renal, thyroid, and gastrointestinal cancers, as well as sarcoma and melanoma, are relatively radioresistant and are generally treated with surgery
- An influential trial comparing surgical decompression followed by radiother-apy with radiotherapy alone for radioresistant tumors at a single level showed that surgery pre-served ambulation for a longer time, even in some patients who were unable to walk in the 48 hours before treatment.
- In summary, spinal surgery is the most rapid method for relief of acute spinal cord compression and is necessary if there is spinal instability. Radiation is usually administered after surgical decompression. If radiotherapy can be delivered expeditiously, it can be used to treat cord compression due to hematologic tumors. Patients who are not expected to survive longer than the time required for recovery from the operation (generally 2 to 3 months) are treated with palliative radiotherapy.

SPINAL EPIDURAL ABSCESS

- The thoracic spine is most often affected, and abscesses usually oc-cupy several contiguous or noncontiguous levels of the spine.
- Bacterial infection at a site distant from the spine is found in only half of affected patients, and one fourth have no primary infection, even at autopsy.
- Diabetes, in particular, but also cancer, immunosuppression, renal failure, and intravenous drug and alcohol abuse are underlying conditions.

Assessment

- MRI with gadolinium
- LP should be avoided
- Leukocytosis and elevated Sed rate and CRP seen



Treatment

- Surgical evacuation more successful than abx alone.
- Decompression by means of laminectomy (see pic)
- more effective if performed before severe weakness occurs,
- Longitudinally long extensive abscess treated with decompression at maximal collection with irrigation above and below that level.
- paralysis for 48 hours is a poor prognostic sign
- antibiotics may be adequate for an abscess that is not causing weakness, however surgery is often required later.

SPINAL EPIDURAL HEMATOMA

- Can occur after spinal surgery
- Can occur spontaneously with the use of anticoagulant or antiplatelet meds and in patients with coagulopathies.
- Surgical evacuation usually necessary if there is cord compression.

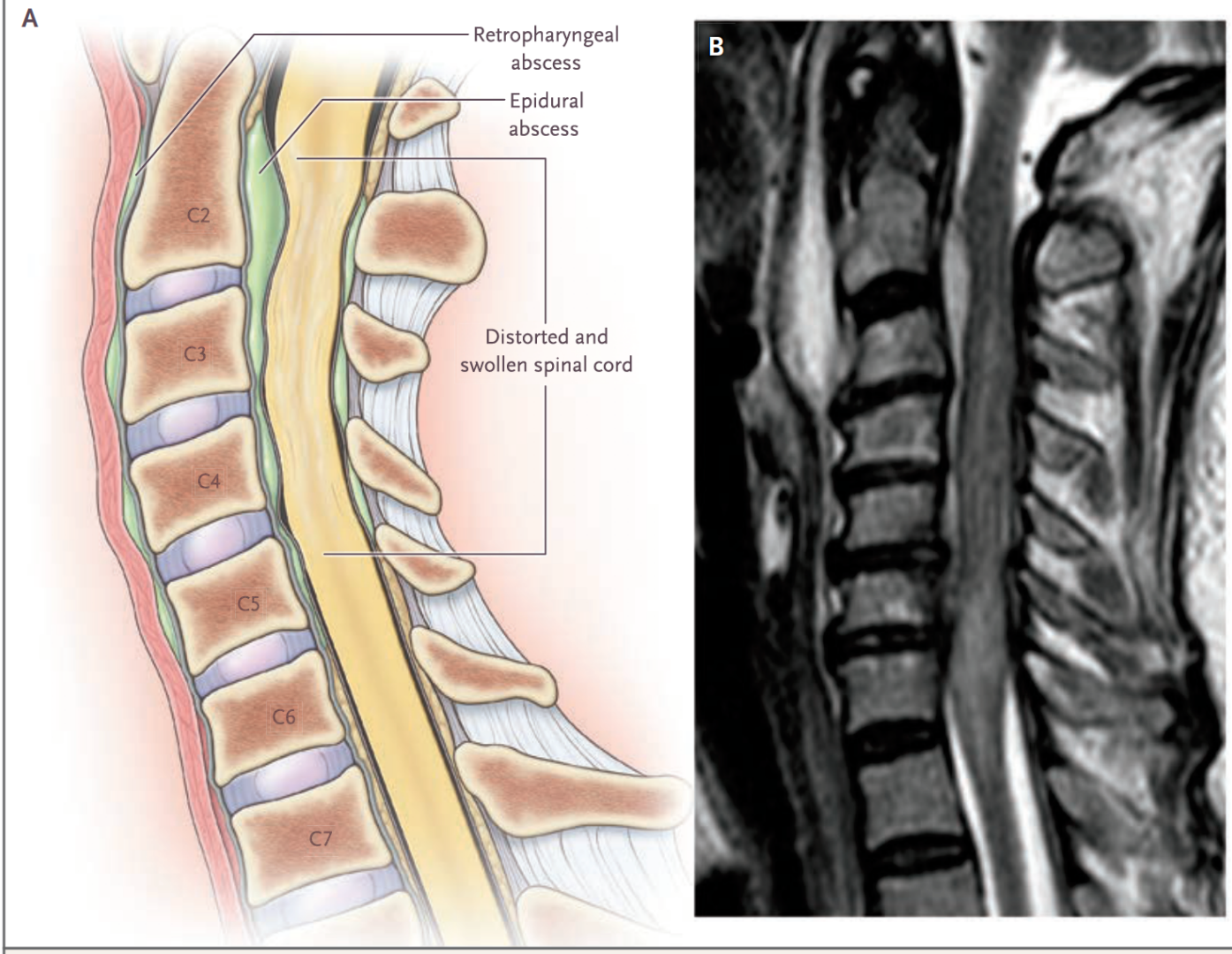


Figure 3. Acute Cervical Cord Compression Due to Epidural Abscess.

A sagittal view of the epidural abscess (Panel A) shows swelling and deformity of the cord due to the epidural pyogenic collection. A sagittal T_2-weighted MRI (Panel B) shows that the abscess is ventral to the upper cervical and midcervical segments and is causing compression, swelling, and displacement of the cord. The abscess is bright on T_2-weighted sequences. A prevertebral, retropharyngeal abscess is also shown, which may be the origin of an epidural abscess.