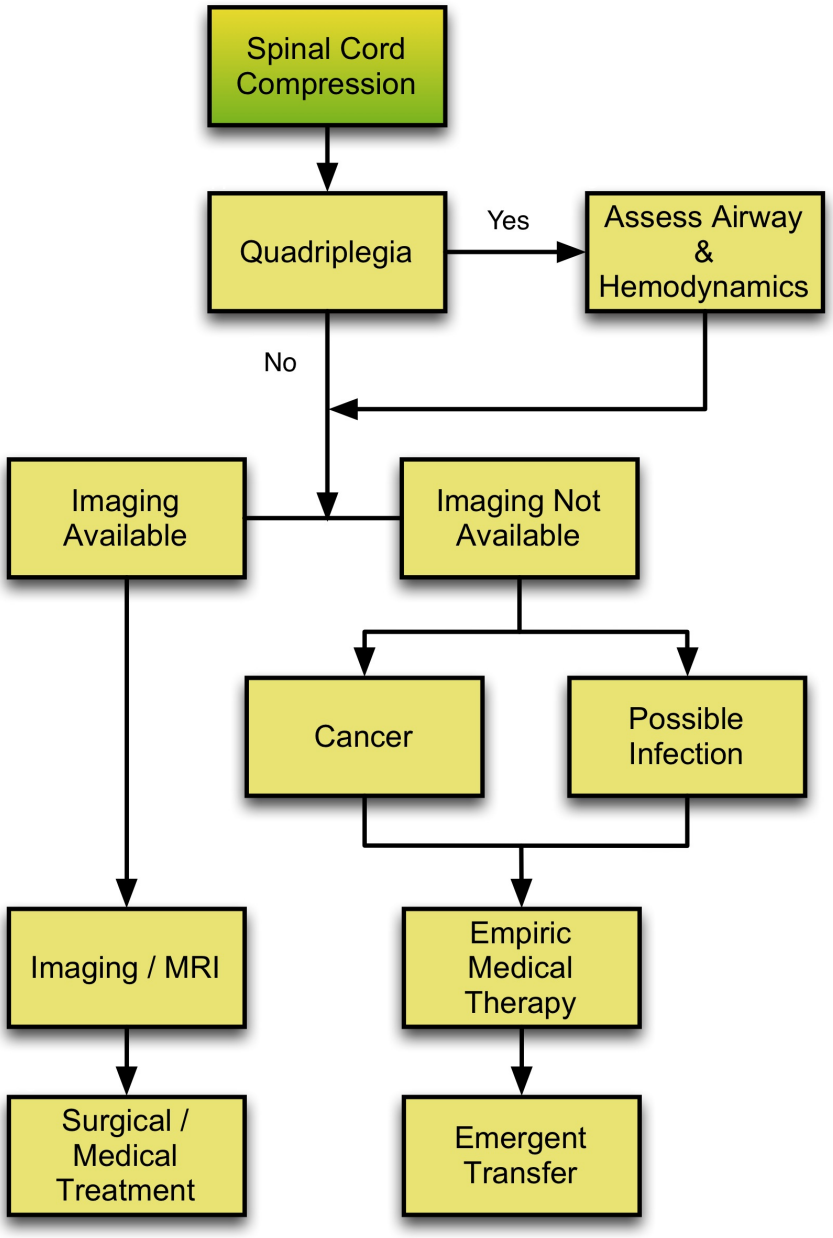
Emergency Neurological Life Support

Spinal Cord Compression

Version: 1.0
Last Updated: 5/23/2013



Checklist & Communication

Flowchart

Checklist

- ☐ Quadriplegia? Ensure proper ventilation
- ☐ Attain emergent spine imaging (MRI unless contraindicated)
- ☐ Alert spine surgeon if indicated
- ☐ Labs: CBC, platelets, PT,PTT
- ☐ NPO if expected to go to OR
- ☐ Suspected metastasis: contact radiation oncology; give steroids if spinal metastasis and cord compression confirmed
- ☐ Suspect epidural infections: ESR, start antibiotics

Communication

- ☐ Airway status
- ☐ Any significantly abnormal vital signs
- ☐ Onset and duration of weakness or numbness, and last neurological exam
- ☐ Bowel or bladder involvement
- ☐ Suspected spinal level
- ☐ Results of spine imaging if available yet
- ☐ Systemic illness like malignancy or infection
- ☐ Any medications started
- ☐ Ask if there is any other therapy they would like started immediately

Flowchart

Arrange for Emergent Transfer

To a facility that has spine imaging available

Arrangement of expedited transfer to a facility with spine imaging may help expedite spinal decompression.

- Clearly communicate the urgency to the receiving physician
- The receiving physician should pre-arrange the imaging study so that valuable time is not lost

Flowchart

Assess Airway and Hemodynamics

Cervical myelopathy may affect diaphragm

Assess ventilatory functions (ABG, simple inspection, EtCO2) and consider airway protection and mechanical ventilation. A bedside Forced Vital Capacity is helpful if available (intubate for FVC < 1 L); having the patient count out loud as fast as possible is also a good screen (normals should be able to exceed 20-30 count).

- Patients with total body weakness (unable to move the face and arms and legs) either has a generalized neuromuscular disorder, or perhaps a stroke of the brainstem (locked in). Secure the airway first then pursue the ENLS protocol Acute Weakness, or ENLS protocol Acute Ischemic Stroke . Once ventilation has been assessed, move on to acute imaging, but for those patients who are not intubated, anticipate progression of weakness and ensure continuous monitoring of ventilation as the work-up continues.

Flowchart

Empiric Medical Therapy

Steroids, Antibiotics

If suspicion for an epidural abscess is present then consider stating empiric antibiotics.

- recommended antibiotics

Administration of steroids (dose) may rapidly shrink the tumor preventing spinal cord damage for several hours.

- Consider solumedrol 1 gm IV now

Empirical Treatment for Presumed Infectious Cause

Patients with evidence of infection such as fever, leukocytosis, intravenous (IV) drug use, or a known infectious source should be started on empiric antibiotics after blood cultures are drawn. Anti-microbial coverage should include staphylococcus, streptococcus, and methicillin resistant staphylococcus aureus (MRSA). If there is a history of a recent neurosurgical procedure, coverage for gram negative organisms should be added. These empiric therapies may be coordinated with the accepting facility's physicians.

Empirical Treatment if Cancer is Suspected

Steroids are often given to rapidly shrink edema and reduce the chance of cord venous infarction. Methylprednisolone may be given at 30 mg/kg IV bolus followed by 5.4 mg/kg/hr by 23 hours.

Flowchart

Evidence of Infection

Consider epidural abscess

Suspicion for an infectious cause (epidural abscess) rises if the following are present:

- Fever
- Elevated WBC count
- History of intravenous drug use
- Known infectious source- current or past endocarditis, sepsis, chronic infection like osteomyelitis
- Any of the above with focal spine tenderness elicited by percussion (reflex hammer striking your finger placed over the vertebral spinous process

Flowchart

Hemorrhage

Epidural hemorrhage or other

Bleeding in the epidural space may be spontaneous or from underlying coagulopathy.

- Contact a spine surgeon immediately and present to key features listed in communication
- Rule out coagulopathy
- Labs: PT/PTT, platelets, consider DIC screen and blood smear for red cell analysis
- Reverse warfarin associated coagulopathy (see ENLS protocol Intracerebral Hemorrhage discussion on reversal of coagulopathy)
- Intramedullary bleeding (bleeding into the spinal cord) may be due to an underlying vascular malformation and will likely require additional imaging studies if the etiology is not otherwise apparent (repeat MRI, spinal angiography)

Flowchart

History of Cancer

Possible metastasis

Consider spinal metastasis with spinal cord compression if there is a history of cancer, or new suspicion of cancer.

Flowchart

Imaging is Available

MRI or CT

Emergent MRI with gadolinium is preferred in most cases.

- CT with contrast and or CT myelogram is an alternative if MRI is contraindicated or not available.

Flowchart

Imaging Negative

Likely intrinsic cord pathology

Flowchart

Imaging Not Available

No MRI or CT

Without imaging, one needs to consider presumptive treatments that can be put in place to temporize until imaging can be made available.

- If there is a history suggesting infection so that epidural abscess is a possibility then one should consider empiric antibiotics
- If there is a history of cancer so that spinal metastasis and cord compression is a possibility, one should consider empirical steroids
- If neither is present, an expedited transfer to a facility with imaging capability is warranted.

Flowchart

Imaging with MRI or CT

Imaging is used to rule out any compressive etiology of the spinal cord like tumor, infection, or intervertebral disc herniation. It is important to communicate the neurological findings to your radiologist so that the proper location(s) of relevance are imaged.

- Quadriplegic patients should have the C-Spine imaged. Entire spine imaging (including the conus) may also be appropriate especially if the patient has known cancer.
- Paraplegic patients (if there are no symptoms in the arms) should have both the T-spine and LS spine imaged. Reflexes are likely unreliable in this context in guiding whether to include T-spine imaging; i.e. rapid compression of the T-spine can cause hyporeflexia in the lower extremities acutely, so an areflexic paraplegia is not necessarily a cauda equina syndrome (which localizes to the LS spine on imaging). A discussion with the radiologist is important to image the proper level, and to expedite the imaging so that treatments can be provided efficiently and quickly.

It is also important to notify a spine surgeon at this point to alert them that your patient may have a myelopathy that will need surgical decompression, and when their spine imaging will be completed.

Flowchart

Infection

Epidural abscess

Imaging reveals a likely abscess:

- Contact a spine surgeon immediately and present to key features listed in comunication
- Start empirical antibiotics based on the patient's risk factors; discuss this with your consultant as this may reduce the likelihood to get positive culture results
- Labs: ESR, blood cultures, UA, urine culture (prior to any antibiotics)
- 12- lead ECG looking for PR prolongation (could indicated endocardial abscess); if prolonged consider cardiology consult
- Consider echocardiogram looking for valvular vegetations
- Use of steroids is controversial; discuss with your consultant
- Spinal cord decompression is possible but often not done emergently to give time to observe a response to antibiotics. Document the neurological exam (primarily strength testing) well to establish a good baseline from which to make this decision.

Flowchart

Medical and Surgical Treatment

Based on what is seen on MRI

Imaging may reveal no evidence of cord compression. If so, other causes of myelopathy need to be considered including transverse myelitis, spinal cord infarction, viral myelitis (West Nile, CMV, HIV, HTLV-1), dural AV fistula, and others. Refer to the ENLS protocol Acute Non-Traumatic Weakness for a discussion of these entities, and especially consider aortic dissection. Spine imaging may reveal several compressive etiologies, including:

- Metastatic disease: metastatic disease to the spine is not an uncommon presentation of some cancers. There is usually spinal tenderness over the regions involved. Treatment with high dose corticosteroids (methylprednisolone 30 mg/kg IV bolus followed by 5.4 mg/kg/hr by 23 hours) can help shrink tumor edema and maintain cord health until surgical decompression is available. STAT involvement of a spine surgeon and radiation oncology is imperative, and facilitation of transfer elsewhere if none is available.
- Spinal hemorrhage: spontaneous epidural bleeding is uncommon but may present in patients without coagulopathy and no other predisposing conditions. Treatment may involve surgical decompression. STAT involvement of a spine surgeon is imperative, and facilitation of transfer elsewhere if none is available. If there is a coagulopathy present, following the ENLS protocol on reversal of coagulopathy.
- Acute disk herniation: disk herniation that compresses the spinal cord or the cauda equine may represent a neurosurgical emergency. Treat with methylprednisolone 30 mg/kg IV bolus followed by 5.4 mg/kg/hr by 23 hours, and STAT involvement of a spine surgeon is imperative, and facilitation of transfer elsewhere if none is available.
- Epidural abscess: pus in the epidural space likely causes myelopathy by venous infarction rather than actual cord compression but the clinical signs and symptoms are identical. STAT involvement of a spine surgeon is imperative, and facilitation of transfer elsewhere if none is available. Draw blood cultures, look for signs of endocarditis, perform a 12-lead ECG (to look for PR prolongation), and consider starting empirical antibiotics in consultation with the surgeon and perhaps infectious disease consultant. Anti-microbial coverage should include staphylococcus, streptococcus, and methicillin resistant staphylococcus aureus (MRSA). If there is a history of a recent neurosurgical procedure, coverage for gram negative organisms should be added.

Flowchart

Neoplasm

Spinal neoplasm

The MRI or CT imaging shows cord compression from tumor

- Emergent decompression may be helpful to this patient so rapid involvement of specialists is key
- Contact a spine surgeon immediately and present to key features listed in communication
- Consult radiation oncology to consider emergent spinal irradiation
- Give glucocorticoids (solumedrol 10-30 mg/kg IV times one); clear this with your consultant first
- Pain management: short acting narcotics, consider airway issues if the process is cervical
- DVT prophylaxis: no heparin yet until surgical decision is complete; pneumatic compression stockings are appropriate
- If the neoplastic process is leptomeningeal (i.e. not directly compressing the cord but encasing the cord), decompression is likely not necessary but spinal fluid assessment is the next step. Consult oncology and consider LP

Flowchart

Quadriplegia

Special airway issues

In the event of sudden or progressive quadriparesis or quadriplegia, the cause may be a cervical cord pathology. This may lead to hypoventilation because of both chest wall and diaphragmatic weakness.

If the patient has paraplegia/paraparesis ventilatory issues are uncommon, so move on to imaging.

Flowchart

Spinal Cord Compression

Suspected myelopathy

Acute signs and symptoms of myelopathy

- Bilateral numbness or weakness that is present at a specific dermatomal level and continues caudally
- Weakness is of upper motor neuron variety (spastic, extensors effected more than flexors, up-going toes)
- Urine retention or spastic bladder
- May have focal back pain identified via percussion of the spineAcute spinal cord compression is an emergency so work-up and intervention should begin immediately.
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If there is severe back pain and leg weakness consider aortic dissection as a cause; typically such patients will have intact joint position sense in the toes but loss of temperature sensation along with marked weakness (anterior spinal artery syndrome).

If the patient is taking anticoagulants, and emergent workup for coagulopathy is warranted. See ENLS protocol on reversal of coagulopathy. See ENLS protocol Approach to Non-Traumatic Weakness for a more formal evaluation of the cause of weakness.

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Flowchart

Spinal Stenosis

Disk or bone encroachment on cord

Imaging reveals compression from disk herniation or from bone/vertebral body encroachment (spinal stenosis)

- Contact a spine surgeon immediately and present to key features listed in communication
- For sudden onset disk herniation with myelopathy, urgent decompression may be necessary; more chronic myelopathy make take a less urgent course
- Discuss use of glucocorticoids with your consultant