GUIDELINES FOR ORTHOPEDIC CONSULTATION AND FOLLOW-UP

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* Neurosurgical consultation and follow-up may be indicated (especially if any neurologic deficit is present)
Wedge (Compression) Fractures

MECHANISM

- Most result from vehicular trauma, falls or jumps
- The anterior column fails under the compressive forces from hyperflexion, lateral bending and/or axial loading
- The vertebral endplate is usually fractured and/or driven into the vertebral body
- Minimal trauma may produce the injury if bony strength has been compromised by infection, malignancy, osteoporosis or metabolic disease
  - Very common in the elderly
  - A young person with a wedge (compression) fracture after a trivial injury must be evaluated for contributory underlying disease
- The injury is stable because only the anterior column fails
  - The middle column acts as a fulcrum
  - The posterior column may experience tension forces but rotational forces must be added to create posterior disruption and resultant instability
  - Suspect posterior column failure if anterior loss of height is > 50%

FINDINGS

- Muscle spasm with focal pain and bony tenderness
- Most common from the mid thoracic region to the upper lumbar segments
- Lateral x-ray reveals "wedging" of the vertebral body with loss of anterior height (the posterior body cortex remains intact with normal height); the intervertebral disc space often appears to be biconvex
- Variable kyphosis (may be segmental)
- No neurologic deficit (unless multiple adjacent segments are involved)

THORACOLUMBAR SPINE
Wedge (Compression) Fractures (Continued)

- Lateral compression fracture
  - From lateral bending and/or asymmetric compression
  - Anteroposterior and lateral x-rays demonstrate variable deformity of the vertebral body with corresponding segmental kypho-scoliosis
  - Associated disc injury (concave side) and transverse process avulsion fracture (convex side) are commonly seen
  - The injury is usually stable (anterior column fails unilaterally; posterior column remains intact; damage to the middle column is variable)
  - Most occur in the lumbar region
  - Spinal cord or nerve root injury is possible but unusual

- CT scanning may be necessary to exclude subtle disruption of the posterior vertebral body cortex (unstable burst fracture)

MANAGEMENT - orthopedic consult

- Symptomatic treatment
  - Initial bedrest with mobilization as soon as tolerated
  - Analgesics

- Hospital admission may be prudent (especially in the elderly) for pain control and observation for potential ileus
- Severe lateral compression injuries may require operative reduction and stabilization

COMPLICATIONS

- Paralytic ileus (contusion or paraspinal hematoma may compress the sympathetic chain)
- Associated injuries (common with jumps or falls)
  - Calcaneal fractures
  - Ankle fractures

- Increasing collapse and deformity over time
- Chronic pain and disability

MANUAL OF EMERGENCY ORTHOPEDICS
Burst Fractures

MECHANISM

- Severe axial loading (from vehicular trauma, falls or jumps)
  - Usually with the spine in neutral position
  - May be combined with flexion and/or rotation
- Disc material or vertebral end plates are driven into the vertebral body, causing it to rupture with resultant failure of both the anterior and middle columns (associated posterior column fractures may also occur)
- Neurological damage occurs secondary to retropulsion of posterior body fragments into the spinal canal
- Ligaments usually remain intact but the injury must be considered unstable (significant risk of increased neurologic compromise)

FINDINGS

- Muscle spasm with localized pain and tenderness
- Most occur from T-12 to L-3
- Neurologic injury is common (40-60%)
  - Complete injury (most common)
  - Anterior cord syndrome (common)
  - Central cord syndrome
  - Brown-Séquard syndrome (uncommon)
- Lateral x-ray shows loss of vertebral body height (anterior and posterior) with widening and protrusion of the posterior cortex
- Anteroposterior view also shows loss of vertebral body height
  - Distance between the pedicles of the involved segment is increased
  - Posterior joints may be splayed
- CT scanning reveals fracture detail and the degree of spinal canal compromise by posterior bony fragments; CT myelography affords excellent detail about cord compression

THORACOLUMBAR SPINE
Scapular Fractures

MECHANISM
- Direct blow (commonly motor vehicle or motorcycle accident)
- Often occurs along with other more serious thoracic injuries (especially if high energy mechanism of injury)

TYPES AND MANAGEMENT: all require orthopedic consult
- Body: sling for comfort (good muscular support) and early range of motion exercises
- Neck (non-articular): sling and early range of motion exercises; may require open reduction with internal fixation if displaced
- Glenoid (articular): surgery usually considered if any displacement is present
- Apophyseal fractures (least common)
  - Acromion
    - Non-displaced: may have negative initial x-rays, manage conservatively (sling, early range of motion exercises)
    - Displaced: may require open reduction with internal fixation
  - Coracoid
    - AP films often normal; axillary view or CT scan helpful
    - May require open reduction with internal fixation

COMPLICATIONS
- Overlooked associated injuries (pulmonary injury, clavicular fractures, rib fractures, acromioclavicular injuries, brachial plexus injuries, vascular injuries)
- Delayed diagnosis secondary to the severity of coexisting injuries

MANUAL OF EMERGENCY ORTHOPEDICS
Burst Fractures (Continued)

MANAGEMENT - orthopedic or neurosurgical consultation

- Secure spinal immobilization while arranging consultation
- Consider high dose steroids if spinal cord injury is present (see cervical spinal cord injury)
- Surgical decompression and stabilization may be required

COMPLICATIONS

- Progressive neurologic injury (most common if the midsagittal diameter of the spinal canal has been reduced to less than 50% of normal)
  - Any movement (especially axial compression) may push the posterior fragments further into the cord
  - Great care must be taken when moving the patient

- Chronic pain and disability

MANUAL OF EMERGENCY ORTHOPEDICS
Flexion–Distraction Injuries

MECHANISM

- The vast majority of these injuries result from vehicular trauma in which the passenger experiences sudden deceleration while wearing a lap seatbelt
- All three columns fall in tension generated by distraction and flexion
  - The axis of flexion is usually anterior to the anterior longitudinal ligament
  - Occasionally the flexion axis is within the anterior column which may create a component of compressive failure anterior to the fulcrum
  - All types are unstable
- Rotational and/or translational forces may also be active (which creates a higher risk of displacement)
- Neurologic damage is proportional to the amount of translation (anteriorly or laterally) of the injured segment
- Most occur from T-11 to L-4

TYPES

- Chance fracture - distracted horizontal fracture through the vertebral body, pedicles, laminae and spinous process (pure bony injury)
- Pure ligamentous disruption without fracture
  - Anterior longitudinal ligament usually remains intact (as a hinge)
  - Posterior longitudinal ligament, capsular ligaments, ligamentum flavum, interspinous and supraspinous ligaments are all torn
- Combination injuries
  - Anterior longitudinal ligament usually remains intact
  - Variable patterns of ligamentous tearing, fractures in the middle column and/or disruption of the intervertebral disc

THORACOLUMBAR SPINE
Flexion–Distraction Injuries (Continued)

FINDINGS

- Pain and tenderness at the involved segment; increased interspinous distance may be palpated
- Variable neurologic findings (usually neurologically intact unless translational displacement is present)
- Commonly occurs in the context of multiple trauma; lap belt ecchymosis is frequently seen
- Lateral x-ray is usually the most helpful
  - Horizontal separation of bony fragments
  - Increased interspinous distance
  - Segmental kyphosis
- Subtle anteroposterior x-ray findings
  - Increased interspinous distance
  - Horizontal splitting of the spinous process and pedicles (Chance fracture)
- Lateral tomography affords better detail than CT scanning

MANAGEMENT - orthopedic or neurosurgical consult

- Secure spinal immobilization while arranging consult
- Consider high dose steroid therapy if spinal cord injury is present (see cervical spinal cord injury)
- Resuscitation and evaluation for associated injuries (especially intra-abdominal injuries)
- Non-displaced bony injuries (chance fractures) may be managed with a body cast
- Displacement, neurologic injury or significant ligamentous disruption may require surgical therapy

COMPlications

- Associated intra-abdominal injuries are common
- Instability creates the risk of progressive deformity and/or neurologic damage

MANUAL OF EMERGENCY ORTHOPEDICS
Dislocations and Fracture–Dislocations

MECHANISM

- Most are produced by vehicular trauma, falls, jumps or a severe blow to the back (shear force)
- Combined forces result in the failure of all three columns with displacement (extremely unstable injuries)
  - Some degree of rotational force is almost always involved
  - Axial forces may be compressive or distractive
  - Shear force may produce severe translational deformity
  - Flexion (common), lateral bending (uncommon) or extension (rare) may contribute to the disruption of ligamentous and bony structures
- High probability of serious neurologic injury (60-80%)
- Most occur either in the mid-thoracic region or near the thoraco-lumbar junction

FINDINGS

- Local pain and tenderness; palpable step-off or deformity is common
- Variable neurologic deficit (many will have complete paraplegia)
- Associated multiple trauma is common
- X-rays will reveal a variety of fractures and malalignments
  - Horizontal fracture through the vertebral body (Slicce fracture)
  - Articular process fractures
  - Posterior element fractures
  - Altered interspinous distances
  - Rotational deformities (malaligned spinous processes)
  - Translational deformities
  - Segmental angular deformities
- Additional studies (tomography, myelography, CT or MRI scanning) will usually be required for detailed evaluation

THORACOLUMBAR SPINE
Dislocations and Fracture–Dislocations (Continued)

MANAGEMENT - orthopedic or neurosurgical consult

- Secure spinal immobilization while arranging consult
- Consider high dose steroid therapy if spinal cord injury is present (see cervical spinal cord injury)
- Surgical stabilization with or without decompression will generally be required

COMPLICATIONS

- Associated injuries from multiple trauma
- Permanent neurologic deficit
- Instability creates the risk of progressive deformity and/or neurologic injury
- Spontaneous realignment may render x-ray findings subtle (especially problematic in the setting of complete ligamentous disruption without fracture)
Transverse Process Fracture

MECHANISM
- Direct blow to the back (requires significant force)
- Avulsion fracture
  - Avulsed by psoas muscle contraction
  - Contralateral to lateral compression fracture

FINDINGS
- Localized pain and tenderness with associated muscle spasm
- Best seen on the anteroposterior x-ray

MANAGEMENT
- Initial bedrest followed by activity as tolerated
- Analgesics
- Spinal orthosis may aid in symptomatic management
- Associated injuries must be ruled out
- Follow-up: primary care - one week

COMPLICATIONS
- Neurologic injury
  - Unusual with isolated transverse process fracture
  - Brachial plexus (T-1 or T-2) or lumbo-sacral plexus (L-4 or L-5) injuries may occur
  - Ileus from sympathetic chain injury
- Associated thoracic injuries are common (rib fractures, hemopneumothorax, pulmonary or myocardial contusion, great vessel injuries)
- Associated abdominal injuries (ruptured spleen, liver laceration, bowel injury)
- Associated pelvic, spinal or long bone fractures

THORACOLUMBAR SPINE
Transverse Process Fracture (Continued)

- Associated urologic injuries are very common
  - About half will have hematuria (usually microscopic)
  - Gross hematuria is frequently associated with urinary tract disruption
Acute Low Back Pain

MECHANISM

- Most common musculoskeletal complaint in primary care
- Mechananical low back pain
  - Results from minor or micro trauma to soft tissue structures (vast majority)
  - Injury may be from acute event or chronic repetitive stress
  - Mild associated inflammatory response probably contributes to the pain
  - Affected structures may include: ligaments, paraspinal muscles, facet joint capsules and/or outer fibers of the disc (annulus fibrosis)
  - Secondary muscle spasm is frequently present
  - Multiple risk factors (see Table TL-1)

- Acute disc herniation
  - Most occur in the context of degenerative disease of the lumbosacral spine
  - Most common in patients 30 to 50 years old
  - Annulus fibrosis ruptures allowing the nucleus pulposus to extrude
    - Hemiation through the end plate into the vertebral body (Schmorl's node or limbus vertebra)
    - Hemiation posterolaterally (most common)
    - Nerve root compression (usually unilateral)
    - Involved root is usually L-5 (L-4/L-5 space) or S-1 root (L-5/S-1 space)
    - Elderly patients occasionally herniate at the L-4 root level
    - Massive posterocentral herniation through the posterior longitudinal ligament (rare): acute cauda equina compression

THORACOLUMBAR SPINE
Acute Low Back Pain (Continued)

RISK FACTORS FOR ACUTE LOW BACK PAIN

Activity related
  Lifting (acute or repetitive) with forward flexion and rotation
  Exposure to chronic vibration (industrial or vehicular)

Biomechanical
  Obesity
  Pregnancy
  Poor conditioning
  Excessive lordosis

Degenerative changes
  Bony
  Facet joints
  Ligaments or disc (spondylosis)

Psychosocial factors
  Depression
  Anxiety
  Hyst eria
  Hypochondrasis
  Alcoholism
  Compensation neurosis

TABLE TL-1

MANUAL OF EMERGENCY ORTHOPEDICS
Acute Low Back Pain (Continued)

- Spinal stenosis (anatomic and physiologic narrowing of the spinal canal)
  - Degenerative (facet joint hypertrophy, disc disease, ligamentum flavum infolding)
  - Spinal instability (spondylolisthesis)
  - Neoplastic (tumor compression)
  - Congenital narrowing
  - Infection (intradural or epidural abscess)
  - Post-lumbar fusion

- Spondylolysis
  - Defect in the pars interarticularis
    - Congenital dysplasia (unusual)
    - Degenerative (often secondary to degeneration of facet joints)
    - Traumatic fracture (may occur with other posterior element fractures)
    - Pathologic fracture (malignancy or primary bone disease)
    - Stress fracture (usually seen in adolescent football players or gymnasts)
  - Most involve L-4 or L-5
  - Spondylolisthesis may occur
    - Complete bilateral separation allows forward slippage of the affected vertebra over the fixed inferior vertebra
    - Found in 5% of the population (many are asymptomatic)

- Osteoporosis and wedge compression fractures
Acute Low Back Pain (Continued)

- Neoplastic disease (benign or malignant; primary or metastatic)
- Spinal arthritis
  - Inflammatory disease
    - Rheumatoid arthritis (mainly sacroiliac joints)
    - Ankylosing spondylitis (sacroiliac joints and lumbar periarticular structures)
  - Degenerative disease (osteoarthritis)
    - Very common in middle age and beyond
- Infections
  - Osteomyelitis
    - Any organism may be responsible but staphylococcus aureus is most common
    - Usually from hematogenous seeding (skin, respiratory tract, urinary tract or intravenous drug abuse)
    - Vertebral body is the most common site (often multiple)
  - Intervertebral disc infection (rare)
    - May occur post-surgically or after lumbar puncture
  - Epidural abscess
- Referred (non-musculoskeletal) pain (see Table TL-2)
Acute Low Back Pain (Continued)

CAUSES OF REFERRED (NON-MUSCULOSKELETAL) LOW BACK PAIN

Gastrointestinal

- Malignancy (colorectal, pancreatic)
- Appendicitis (pelvic or retrocecal)
- Pancreatitis
- Diverticulitis
- Peptic ulcer disease
- Bowel obstruction
- Irritable bowel syndrome

Retroperitoneal

- Aortic dissection
- Aortic aneurysm
- Retroperitoneal mass (tumor, abscess, hematoma)

Gynecologic

- Pelvic malignancy
- Pregnancy (intrauterine or ectopic)
- Uterine fibroids
- Endometriosis
- Pelvic inflammatory disease
- Ovarian cyst or torsion
- Menstruation

Urologic

- Malignancy (renal, bladder, prostatic)
- Urinary tract infection
- Prostatitis
- Renal/ureteral calculus

TABLE TL-2

THORACOLUMBAR SPINE
Acute Low Back Pain (Continued)

FINDINGS

- Mechanical low back pain
  - History usually reveals a precipitating event or activity
  - Pain is localized to the low back area; muscular pain may spread to the buttocks or thighs (but not below the knees)
  - Pain exacerbates with mechanical stress (walking, bending, back exam) and is improved with rest
  - Paraspinal muscles may be in spasm and/or tender to palpation
  - Bony palpation or percussion does not increase the pain
  - Neurologic examination is normal
  - Traction test for nerve root involvement (e.g., straight leg raising) is negative

- Low back pain with radicular radiation (sciatica)
  - Present in about 1% of patients with low back pain; nearly all result from posterolateral disc herniation
  - Discomfort in the low back may be similar to mechanical back pain but is associated with a distinctive unilateral radiating pain (sharp, shooting, tingling or electric-like) that corresponds to the distribution of the sensory dermatome of the involved nerve root
  - The radicular pain may be initiated or exacerbated by coughing, sneezing or Valsalva
  - Functional compromise of the involved nerve root will often result in associated corresponding sensory disturbance, motor weakness and/or diminished deep tendon reflexes
  - Traction test (e.g., straight leg raising) usually reproduces the radicular pain
    - Production or exacerbation of only the localized low back pain is non-diagnostic
    - Reproduction of ipsilateral radicular pain by raising the contralateral leg is highly correlated with nerve root compression

MANUAL OF EMERGENCY ORTHOPEDICS
Acute Low Back Pain (Continued)

- Acute cauda equina syndrome
  - Large central disc herniation results in bilateral nerve root compression (frequently multiple roots are involved); compression from tumor or abscess may occasionally cause this syndrome
  - Pain involves the low back, both buttocks, perineal area and both legs
  - Neurologic deficits vary with involved roots but may be profound
    - Bilateral leg weakness
    - Widespread loss of reflexes
    - Saddle (perineal) anesthesia is common
    - Disturbances of bowel and bladder control

- Neurogenic claudication
  - Functional narrowing of the spinal canal (spinal stenosis); usually presents in patients over 55 years old
  - Pain is provoked by walking or hyperextension of the back and relieved by rest or back flexion
  - Pain is unilateral or bilateral and described as dull aching or burning in the thighs, calves and/or feet
  - Neurologic exam is variable because the deficit(s) are intermittent but may reveal weakness, sensation changes, diminished reflexes or bowel/bladder disturbances
Acute Low Back Pain (Continued)

- Radiographic evaluation
  - Plain x-rays are neither helpful nor indicated in mechanical or radicular back pain (note: possible exceptions include compensation issues and low back pain that has failed to improve with 4-6 weeks of conservative therapy)
  - Degenerative findings (osteophytes, narrowed disc spaces and spondylolisthesis) are common but do not correlated with the presence of low back pain or predict its cause
  - Plain x-rays may be useful in the recognition and management of serious occult disease presenting as acute low back pain (malignancy, infection, structural failure)
    - These conditions occur infrequently (0.2% of acute low back pain patients in primary care settings)
    - History and physical exam nearly always identify risk factors that should raise suspicion and prompt the ordering of plain films (see Table TL-3)
  - Radionuclide bone scanning may be useful if an infectious or neoplastic etiology is being considered; it may also be used to identify a stress fracture of the pars interarticularis in an adolescent athlete with back pain and normal x-rays
  - CT scanning, CT myelography or MRI scanning offer the best detail when structural abnormalities are suspected or neurologic signs and symptoms are present.
Acute Low Back Pain (Continued)

RISK FACTORS IN ACUTE LOW BACK PAIN THAT WARRANT RADIOGRAPHIC EVALUATION

Recent significant (high energy) direct trauma

History of malignancy or significant systemic disease potentially affecting the spine (tuberculosis, hyperparathyroidism, etc.)

Recent weight loss (>10% body weight)

History of chronic steroid use

Pain that is severe, unrelenting and not affected by activity, movement or rest

Elderly patient with new onset of acute low back pain

Adolescent athlete with acute low back pain (especially with football and gymnastics)

Bilateral back, buttocks and leg pain

Neurologic deficits that are bilateral, multi-level and/or progressive

Fever > 38°C

Local bony percussion tenderness

Localized mass or swelling over the spine

TABLE TL-3

THORACOLUMBAR SPINE
Acute Low Back Pain (Continued)

MANAGEMENT

- A thorough history and physical exam must identify risk factors for serious spinal disorders as well as raise suspicion for the presence of a non-musculoskeletal (referred) cause of the back pain; evaluation and management should be tailored to the underlying etiology
- The vast majority of low back pain is self limited and resolves regardless of therapy (50% within one week, 80% within 2 weeks, 90% within two months)
- Bedrest is the hallmark of conservative therapy
  - Two days is sufficient in the absence of radiculopathy
  - Radiculopathy may require a longer period of bed rest; 60% to 80% will resolve with conservative therapy
- Symptomatic relief
  - Analgesics (non-steroidal anti-inflammatories or narcotics)
  - Muscle relaxants
  - Applications of heat and/or cold compresses
- Other non-invasive therapies that are controversial or unproven but may help some patients
  - Corsets and braces
  - Ultrasound or diathermy
  - Manipulative techniques (spinal manipulation, mobilization, traction)
- Patient education and activity (or occupational) modification
- Follow-up: primary care - one week
- Orthopedic or neurosurgical consultation (see Table TL-4)
Acute Low Back Pain (Continued)

INDICATIONS FOR ORTHOPEDIC OR NEUROSURGICAL CONSULTATION

Spinal instability (post-traumatic, spondylolisthesis with neurologic deficit or any spondylolisthesis in an adolescent)

Suspected infectious process or destructive lesion involving the spine

Bilateral or progressive neurological deficit

Findings consistent with neurogenic claudication

Radicular findings that fail to improve with conservative therapy (4 to 6 weeks)

TABLE TL-4

THORACOLUMBAR SPINE
References

LOW BACK PAIN


MANUAL OF EMERGENCY ORTHOPEDICS
References (Continued)


THORACOLUMBAR FRACTURES AND DISLOCATIONS


Denis F: Spinal instability as defined by the three-column spine concept in acute spinal trauma. Clin Orthop 1984; 189:65-76.


References (Continued)


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