
CHAPTER 7 – MUSCULOSKELETAL SYSTEM

First Nations and Inuit Health Branch (FNIHB) Clinical Practice Guidelines for Nurses in Primary Care.
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ASSESSMENT OF THE MUSCULOSKELETAL SYSTEM^{1,2}

The following characteristics of each symptom should be elicited and explored:

- Onset (sudden or gradual)
- Acuity or chronicity
- Chronology
- Current situation (improving or deteriorating)
- Location and character
- Severity and extent
- Timing (frequency, duration, intermittent or constant, predilection for time of day)
- Precipitating and aggravating factors
- Relieving factors
- Effects on activities of daily living
- Previous diagnosis of similar episodes
- Previous treatments
- Efficacy of previous treatments
- Associated symptoms (for example, fever, chills, trauma, repetitive activity)

Assess and monitor pain or discomfort using a pain intensity instrument such as the Wong-Baker Faces Pain Scale, the Numeric Rating Scale, or the Comfort Scale (available at: http://painconsortium.nih.gov/pain_scales/). Also assess presence of night pain, radiation or referred pain, and course.

CARDINAL SYMPTOMS

The general characteristics outlined above should be explored for each symptom described below, if applicable.

Bones and Joints

- Pain, swelling, redness, heat, stiffness (duration)
- Time of day when these symptoms are most bothersome (for example, nocturnal awakening because of pain)
- Symmetry of involved joints
- Relation of symptoms to movement and activity
- Limitation of movement
- Deformity (for example, swelling, inflammation, contracture, unusual positioning or appearance)
- Joint locking, instability
- Extra-articular findings (for example, urethritis, pustular rash, tophi, nodules, numbness and tingling)
- Trauma or overuse injury (obtain accurate description of exact mechanism of injury, noises heard, position in, sensations felt, and limb use after injury)

Muscles

- Pain or cramping
- Weakness
- Wasting
- History of previous injuries and treatment received

Neurovascular Structures

- Paresthesia (for example, pins and needles sensation)
- Numbness
- Paresis
- Paralysis (for example bowel or bladder incontinence)
- Skin: rash, changes in colour of limb, or signs of physical abuse (for example, bruises, welts, cigarette burns)

FUNCTIONAL ASSESSMENT

- Self-care deficits (for example, in bathing, dressing, toileting, grooming, eating, communicating)
- Mobility, use of mobility aids (for example, getting up and sitting down, walking up stairs, transferring from shower/tub, inability or refusal to use limb or to bear weight)
- General level of fatigue (quantify)

MEDICAL HISTORY (SPECIFIC TO MUSCULOSKELETAL SYSTEM)

- Previous trauma (for example, to bones, joints, ligaments)
- Arthritis (rheumatoid or osteoarthritis)
- Diabetes mellitus (associated with greater risk of carpal tunnel syndrome)
- Hypothyroidism (associated with greater risk of carpal tunnel syndrome)
- Recent immobilization of an extremity
- Medications (for example, steroids)³
- Allergies
- Congenital problem with orthopedic involvement (for example, developmental dysplasia of the hip)
- Obesity
- Osteoporosis
- Cancer
- Menopause
- Immune deficiency (recent infection)
- Potential exposure to sexually transmitted infection
- Recent infection, such as an upper respiratory tract infection, meningitis or a soft tissue infection

- Recent immunization (specifically if vaccine was administered in affected limb)
- Past surgical history

FAMILY HISTORY (SPECIFIC TO MUSCULOSKELETAL SYSTEM)

- Rheumatoid arthritis
- Psoriatic arthritis
- Reactive arthritis
- Ankylosing spondylitis
- Diabetes mellitus (associated with osteoarthritis)
- Hypothyroidism (associated with greater risk of carpal tunnel syndrome)
- Lupus erythematosus
- Osteoporosis
- Cancer (bone)

PERSONAL AND SOCIAL HISTORY (SPECIFIC TO MUSCULOSKELETAL SYSTEM)

- Absenteeism from work or school (multiple days)
- Occupational hazards (activity involving heavy lifting or repetitive joint motion, for example, kneeling, reaching overhead)
- Sports activities (for example, contact sports or those involving repetitive motion)
- Risk behaviours for injuries (for example, snowmobiling, skateboarding, illicit drug use, injection drug use, alcohol abuse [specifically drinking and driving])
- Dietary calcium and vitamin D intake
- Smoking
- Exercise habits
- If chronic concern, how has illness affected interactions with family and friends, self-concept
- Traditional activities such as hunting and fishing

EXAMINATION OF THE MUSCULOSKELETAL SYSTEM

The purpose of examining the musculoskeletal system is to assess function and performance of activities of daily living, as well as to check for abnormalities. A screening exam is appropriate for most people.

Although the musculoskeletal and neurological systems (*see Chapter 8, “Central Nervous System”*) are discussed separately in this set of guidelines, they are usually examined together.

GENERAL

- Apparent state of health
- Appearance of comfort or distress (for example, often observed related to pain, infection, inflammation, or fracture)
- Attitude (for example, apprehensive, restless)
- Colour (for example, flushed, pale)
- Nutritional status (obese or emaciated)
- Match between appearance and stated age

VITAL SIGNS

- Temperature may be elevated in inflammatory or infectious disease
- Tachycardia from pain or shock if major trauma is involved
- Blood pressure normal, unless in shock from major trauma

MUSCULOSKELETAL SCREENING EXAM

Assess the joint above and below the injury or abnormality. Examine the lumbosacral spine and below if there is a lower limb complaint, and examine the cervical spine and neck if there is a concern with an upper limb. Examine specific joints in the following order, depending on the joints that need to be assessed. Compare corresponding paired joints.

- Temporomandibular joint
- Cervical spine
- Shoulders
- Elbows
- Wrists and hands
- Thoracic spine
- Lumbosacral spine
- Hips
- Knees
- Ankles and feet

INSPECTION

- Mobility
- Gait (for example, Trendelenburg, antalgic) and posture. Examine the patient while rising from a chair, manipulating a small object, rising from supine, and while using mobility aids. Most can be assessed as patient walks into the room; also assess gait without shoes and posture while undressed
- Symmetry of structure and function (for example, shoulders at the same level)
- Note alignment, size (muscle bulk, bone enlargement) and contour of the joint (for example, valgus: deviation or outward angulation of the distal segment of a bone or joint (a > < shape of the two legs is observed); or a varus: deviation or inward angulation of the distal segment of a bone or joint (a < > shape of the two legs is observed)¹
- Inspect skin and tissues over joints and compare corresponding joints and bones for:
 - Colour and extent of area affected (for example, redness implies inflammatory or infectious process, bruising, discoloration)
 - Swelling (for example, around joint area may indicate arthritis or infection; over a bony area may indicate trauma, fracture or tumour; over soft tissue may indicate trauma or infection)
 - Rash, puncture wounds, and scars
 - Masses
 - Deformity (for example, alteration in shape, bony alignment, ingrown toe nail)

Palpation

Palpate each joint, including skin, muscles, bony articulations and area of joint capsule while the patient is as relaxed as possible, for the following features:

- Temperature (for example, heat implies inflammatory process or infection – if an area feels hot to the touch, compared to uninvolved joints or skin)
- Swelling (may indicate joint infection or effusion)
- Induration (for example, tissues feel tense, “boggy”)
- Tenderness
- Nodules, masses
- Lymph node enlargement⁴

Range of Motion

Ask client to demonstrate active range of motion (the patient moves the joint while stabilizing the body area proximal to the joint being moved). This provides information about muscles and bony structures

allowing functional movement.³ Abnormalities result from neurological or mechanical disruption. If you see a limitation, gently attempt passive range of motion (the examiner moves the joint to its limit while also anchoring it) to provide information on joint mobility and stability as well as the limits of the respective tendons and muscles. Note the degree of joint movement achieved (hyper- or hypo-mobile), resistance to movement, crepitus, and/or pain on movement of the joint.

The normal range of active and passive motion is the same.

Ligament Stability Around Joints

- Determine stability of collateral ligaments of ankle (*see the section “Ankle Sprain”*)
- Determine stability of collateral and cruciate ligaments of knee (*see the section “Knee Injury”*)

Neurologic Status

Assess limbs for the following:

- Motor exam: Note the presence of tremors or fasciculations. Assess muscle bulk and tone. Test strength of prime muscle groups (that is, flexors and extensors) for each joint. When possible, test strength with like muscle groups (for example, test finger flexors with your own finger flexors). Muscle strength should be equal bilaterally and should fully resist your opposing force. There is wide variability in normal muscle strength among different people
- Reflexes (grade and symmetry)
- Sensation (including paresthesia)
- Gait and coordination (for example, heel to toe walking)

See “Examination of the Central Nervous System” in Chapter 8, “Central Nervous System”.

Vascular Status

Assess limbs for the following:

- Peripheral pulses
- Pallor
- Limb temperature (especially coolness)

This part of the examination is particularly important if the client has experienced trauma.

DIFFERENTIAL DIAGNOSIS OF MUSCULOSKELETAL CARDINAL SYMPTOMS⁵

SYMPTOMS GROUPED BY POTENTIAL CAUSE

- Inflammatory (for example, pain, erythema, warmth, swelling, morning stiffness for > 30 minutes); *see also Table 1, “Symptoms of Musculoskeletal Injury”*
- Mechanical/degenerative (for example, pain worse at end of day, better with rest, joint locking, clicking, instability); *see also Table 1, “Symptoms of Musculoskeletal Injury”*

- Neoplastic and infectious (constant pain, night pain, fever, weight loss, anorexia, fatigue, weakness, history of cancer)
- Neurologic (for example, paresthesia, tingling, bowel and bladder incontinence, headaches, weakness)

Table 1 presents the symptoms associated with various types of musculoskeletal injury.

Table 1 – Symptoms of Musculoskeletal Injury

Symptom	Fracture	Dislocation	Sprain	Strain
Pain*	Severe	Moderate to severe	Mild to moderate	Mild to moderate
Swelling	Moderate to severe	Mild	Mild to severe	Mild to moderate
Bruising	Mild to severe	Mild to severe	Mild to severe	Mild to severe
Deformity	Variable	Marked	None	None
Function	Loss of function	Loss of function	Limited	Limited
Tenderness	Severe	Moderate to severe	Moderate	Moderate
Crepitus	Present	Absent	Absent	Absent

* Pain level should be used as a guideline as pain threshold may vary considerably

CAUSES OF INFLAMMATORY MUSCULOSKELETAL PAIN

- Tenosynovitis
- Rheumatoid arthritis
- Reactive arthritis
- Psoriatic arthritis
- Viral polyarthritis (for example, hepatitis B virus, Epstein-Barr virus)
- Septic arthritis (for example, *Staphylococcus aureus*, *Streptococcus* species)
- Autoimmune disease (for example, polymyalgia rheumatica)
- Rheumatic fever
- Immune complex arthritis (for example, HIV)
- Polyarthritis associated with systemic diseases (for example, systemic lupus erythematosus, Lyme disease, syphilis, bacterial endocarditis)
- Gout and pseudogout
- Bursitis
- Tendinitis
- Ankylosing spondylitis

CAUSES OF NON-INFLAMMATORY MUSCULOSKELETAL PAIN

- Osteoarthritis
- Metabolic arthropathy
- Tumours
- Mechanical abnormalities (for example, erosion of cartilage and bone)
- Blood dyscrasias
- Sickle cell anemia
- Neuroarthropathy
- Ligament injury
- Fibromyalgia
- Radiculopathy
- Nerve entrapment
- Spondylolysis
- Osteomyelitis
- Stress fracture
- Avascular necrosis

CAUSES OF NECK PAIN^{6,7}

The causes of neck pain are outlined in *Table 2*, “*Causes of Neck Pain and Cervical Spine Disorders.*”

Table 2 – Causes of Neck Pain and Cervical Spine Disorders

Biomechanical	Referred	Rheumatologic	Neoplastic
Neck strain	Thoracic outlet syndrome	Rheumatoid arthritis	Osteoblastoma
Herniated disk	Pancoast's tumour	Ankylosing spondylitis	Osteochondroma
Spondylosis	Esophagitis	Psoriatic arthritis	Giant cell tumour
Myelopathy	Angina or myocardial infarction	Reiter's syndrome	Hemangioma
Whiplash	Vascular dissection (vertebral or carotid artery)	Myelopathy	Metastases
Fracture	Shoulder pain	Enteropathic arthritis	Multiple myeloma
Cervical facet-mediated pain		Polymyalgia rheumatica	Chondrosarcoma
		Fibromyalgia	Chordoma
Infectious	Neurologic	Myofascial pain	Gliomas
Osteomyelitis	Brachial plexitis	Diffuse idiopathic skeletal hypertrophy	Syringomyelia
Diskitis	Peripheral entrapment	Microcrystalline disease	Neurofibroma
Meningitis	Neuropathies	Osteoarthritis	Apical lung tumour
Herpes zoster	Complex regional pain syndrome		Miscellaneous
Lyme disease	Cervical radiculopathy		Paget's disease
Pharyngeal abscess	Cervical spondylotic myelopathy		Sarcoidosis
	Tension headache		Diabetic neuropathy

CAUSES OF SHOULDER PAIN***Intrinsic Disorders***

- Glenohumeral osteoarthritis
- Acromioclavicular syndrome
- Septic arthritis
- Rheumatoid arthritis
- Osteoarthritis
- Gout
- Rotator cuff impingement
- Rotator cuff tear
- Rotator cuff tendinitis
- Bicipital tendinitis
- Biceps tendon rupture
- Subacromial bursitis
- Calcific tendinitis
- Adhesive capsulitis (frozen shoulder)
- Trauma to bony structures (for example, clavicle, acromioclavicular joint, glenohumeral joint)

Extrinsic Disorders (Referred Pain)

- Cervical spine disorders
- Brachial plexus neuropathy
- Myofascial pain
- Thoracic outlet syndrome
- Diaphragmatic irritation
- Neoplastic disease
- Myocardial ischemia
- Gallbladder disease (pain in right shoulder)

Shoulder pain can arise from the bony structures of the shoulder or from the muscles, ligaments, and tendons that support the shoulder. Most shoulder problems are attributable to overuse and trauma.

CAUSES OF ELBOW PAIN

- Fracture
- Lateral epicondylitis (tennis elbow)
- Medial epicondylitis (golfer's elbow)
- Dislocation
- Osteoarthritis
- Rheumatoid arthritis
- Gout⁸
- Olecranon bursitis

CAUSES OF WRIST AND HAND PAIN

- Osteoarthritis
- Rheumatoid arthritis
- Carpal tunnel syndrome
- Fracture
- de Quervain tenosynovitis
- Trigger finger and trigger thumb
- Ganglion cyst
- Gout⁸

CAUSES OF HIP PAIN

- Referred pain (for example, lumbar spine, sacroiliac joint)
- Osteoarthritis
- Fracture
- Trochanteric bursitis
- Iliopsoas bursitis
- Ischiogluteal bursitis
- Adductor tendinitis
- Rheumatoid arthritis

CAUSES OF LOW BACK PAIN***Mechanical Low Back Disorders***

- Lumbosacral strain (mechanical low back pain)
- Degenerative disk disease (osteophytes, disk narrowing)
- Facet joint syndrome
- Spondylolisthesis
- Herniated disk
- Spinal stenosis
- Osteoporosis
- Fracture
- Spondylolysis
- Spondylosis
- Severe kyphosis
- Severe scoliosis
- Lumbar lordosis

Nonmechanical Spine Disease

- Neoplasia (for example, multiple myeloma, lymphoma, spinal cord tumour, metastatic carcinoma)
- Infection (for example, osteomyelitis, septic disk, epidural abscess)

- Inflammatory arthritis
- Ankylosing spondylitis
- Psoriatic spondylitis
- Paget’s disease (tuberculosis of spine)

Referred Pain of Visceral Disease

- Prostatitis
- Endometriosis
- Chronic pelvic inflammatory disease
- Kidney stones
- Pyelonephritis
- Aortic aneurysm
- Pancreatitis
- Cholecystitis
- Penetrating peptic ulcer

CAUSES OF KNEE PAIN

- Bursitis
- Patellar tendinitis (jumper’s knee)
- Patellofemoral syndrome
- Stress fractures of the tibia or fibula
- Osteoarthritis
- Rheumatoid arthritis
- Baker cyst
- Ligament injury
- Cartilage injuries / meniscal tears
- Gout⁸
- Chondromalacia patella

CAUSES OF ANKLE AND FOOT PAIN

- Achilles tendinitis
- Achilles tendon rupture
- Retrocalcaneal bursitis
- Sprain
- Strain
- Fracture
- Gout⁸
- Rheumatoid arthritis
- Osteoarthritis
- Shin splints
- Plantar fasciitis
- Hallux valgus (bunion)⁹

COMMON PROBLEMS OF THE MUSCULOSKELETAL SYSTEM

ACROMIOCLAVICULAR (AC) JOINT INJURIES^{10,11,12}

Shoulder separation due to ligament injury.

TYPES

Type I (sprain): Partial tear or sprain of the acromioclavicular ligaments. Mild acromioclavicular joint pain without joint deformity, although there may be minimal swelling and minimal ligamentous disruption and instability. Range of motion limited by pain.

Type II (subluxation): Complete tear of the acromioclavicular ligaments and a sprain or partial tear of the coracoclavicular ligaments. The acromioclavicular joint is locally tender and painful with motion. It is often very swollen. The distal end of the clavicle may protrude slightly upward.

Type III (dislocation): Complete tear of the acromioclavicular and coracoclavicular ligaments. Significant pain, especially on any attempt at abduction or palpation of the coracoclavicular ligaments; there is an obvious “step-off” deformity on physical examination, although swelling may mask it.

Type IV, V, VI: More severe shoulder injuries that often result from higher energy trauma and require surgery. The distal clavicle is displaced, affecting muscle and/or fascial tissue.

CAUSES

Usually results from a direct blow to or fall on the tip of the shoulder (superior or lateral aspects) with arm adduction, or fall onto an outstretched hand (FOOSH) or elbow.

HISTORY

- Mechanism of injury. The history often involves a fall onto the acromion, usually with the arm in adduction. Severe forces resulting from significant falls are often associated with grade III injuries
- Pain over injured area or superior aspect of shoulder
- Inability to use shoulder
- Night awakening and pain, often when one rolls onto the shoulder
- Previous shoulder injuries or instrumentation

- Neurovascular symptoms
- Cervical spine symptoms

PHYSICAL FINDINGS

- There may be a “step-off” deformity of the acromioclavicular joint
- Note the position of the clavicle (type III deformities have a prominent distal clavicle), any swelling or bruising
- Tenderness on palpation of the acromioclavicular joint
- Palpate all of the following structures for tenderness to rule out other injuries: sternoclavicular joint, clavicle, acromion, spine of scapula, coracoclavicular ligaments, coracoid process, humerus
- Decreased shoulder range of motion; pain with arm abduction
- Pain at rest or elicited with movement
- Pain increases with severity of injury
- Cross body adduction test positive (elevation of affected arm to 90 degrees then holding the elbow and passively adducting the arm elicits pain); only perform if injury is not severe and acromioclavicular joint injury diagnosis is not clear

Perform a careful neurovascular assessment of brachial-plexus motor and sensory function, because associated injuries, though rare, can occur. Additionally perform a cervical spine examination (*see section “Cervical Spine and Spinal Cord Trauma” in Chapter 14, “General Emergencies and Major Trauma”*).

RheumInfo, a Canadian website, describes (in a PDF document) and has videos for a very thorough physical examination of the shoulder. *See RheumInfo’s “The Shoulder Examination”*, available at: <http://rheuminfo.com/physician-tools/shoulder-examination>.

The Nicholas Institute of Sports Medicine and Athletic Trauma of Lenox Hill Hospital website describes and has pictures for some specific physical examination techniques for the shoulder (available at: <http://www.nismat.org/orthocor/exam/shoulder.html>).

DIFFERENTIAL DIAGNOSIS

- Clavicle fracture
- Rotator cuff injury
- Shoulder dislocation
- Shoulder impingement syndrome

COMPLICATIONS

- Instability of the shoulder and/or clavicle
- Loss of mobility
- Chronic pain
- Arthritis

DIAGNOSTIC TESTS

- A single AP view x-ray of both acromioclavicular joints with the patient's arm internally rotated may be advisable to determine extent of injury, especially in younger people with significant symptoms; if this is not adequate, an AP view of the glenoid or a Zanca view can be taken. Stress x-rays (where the patient holds weights) are no longer recommended

MANAGEMENT**Appropriate Consultation**

Consult a physician for all type II and higher injuries as soon as possible.

Nonpharmacologic Interventions

Rest Injured Limb

Type and period of rest varies according to severity of injury.

- Avoid aggravating positions and activities
- *Type I:* Sling in acute injury stage for very brief period (3–5 days), then discontinue. They heal within a few weeks. Start range-of-motion and strengthening exercises as soon as tolerable, with the patient experiencing mild pain at the most. Many are able to return to their usual activities within 3 days to 2 weeks, although this is dependent on pain
- *Type II:* Immobilize and protect in an arm sling for 3–7 days. Subluxation requires a longer period of immobilization (7–21 days). Start range-of-motion and strengthening exercises as soon as tolerable, with the patient experiencing mild pain at the most. Many are able to return to their usual activities after 2–4 weeks once full range of motion and strength are regained, but there is a risk of re-injury for up to 10 weeks after injury

- *Type III:* Immobilize and protect in an arm sling for 2–3 weeks. Start range-of-motion and strengthening exercises as soon as tolerable, with the patient experiencing mild pain at the most. Many are able to return to their usual activities after 6–12 weeks once full range of motion and strength are regained

Ice Pack Locally to Reduce Pain and Swelling

For all grades of acromioclavicular injuries, ice packs may be used:

- Apply ice to area for a maximum of 15 minutes qid
- If soft-tissue injury is severe, apply q2–3h
- Use ice as long as swelling and pain are present
- Heat is contraindicated in acute soft-tissue injury

Client Education

- While resting shoulder avoid reaching overhead or across the torso, lifting objects, leaning on elbows and sleeping on the shoulder

Pharmacologic Interventions

Nonsteroidal anti-inflammatory drugs (NSAIDs) to reduce pain and swelling:

ibuprofen (Advil, Motrin, generics), 200 mg, 1–2 tabs
PO tid-qid prn

or

naproxen (Naprosyn, generics), 250 mg, 1–2 tabs
PO bid-tid prn

Do not use if there are contraindications to the use of aspirin or NSAIDs (such as a history of allergy to aspirin or NSAIDs or peptic ulcer disease). Instead, use:

acetaminophen (Tylenol), 325 mg, 1–2 tabs PO
q4–6h prn

or

acetaminophen with codeine (Tylenol #3), 1–2 tabs
q4–6h prn

Monitoring and Follow-Up

- Arrange follow-up at 1–2 days and at 14 days
- Start range-of-motion exercises within pain-free range as soon as tolerable. This should start with small arm circles with the arm in a pendulum position
- Advise client to begin stretching and strengthening program when range of motion is regained

- Exercise progression: passive range of motion, active assisted range of motion, isometrics, active stretching exercises, and late stretching and strengthening exercises
- Exercises are best done in multiple short sessions, not long ones
- Exercise should be preceded by application of moist heat for 10–15 minutes and should be followed by icing for a maximum of 15 minutes
- Any exercise that causes pain should be temporarily omitted

As range of motion, flexibility and strength improve, so will shoulder function

Referral

Consider transfer of clients with type III injuries, depending on the severity of the clinical picture. Transfer all clients with type IV–VI injuries to a physician for consultation as soon as possible.¹³ Type IV–VI injuries require an orthopedic consultation and likely surgery.¹³

If pain is still present after 12 weeks or returns when the patient's activities are increased, in type III injuries, consult a physician regarding the need for an orthopedic consultation.

ADHESIVE CAPSULITIS (FROZEN SHOULDER)^{14,15}

A reversible syndrome of painful glenohumeral joint capsule contracture that restricts active and passive shoulder movement and results from an uncertain cause. The process leads to a progressive increase in pain that lasts approximately 1–2 years before decreasing and the global restriction in the glenohumeral joint improves. Approximately 10% have long-term limitations in movement.

CAUSES

There are two types of capsulitis:

- *Primary adhesive capsulitis*: Idiopathic (unknown), unrelated to any injury. It occurs more frequently in people in their 40s to 60s, in women, and in people with diabetes mellitus. Approximately 15 percent of those affected will develop bilateral disease

- *Secondary adhesive capsulitis*: Occurs secondary to another pathologic process that causes disuse, such as bursitis or tendinitis of the shoulder or a contributing event (for example, prolonged immobilization following a stroke with upper limb paralysis, brachial plexus injury, cervical radiculopathy, humeral fracture, Parkinson's disease)

HISTORY AND PHYSICAL FINDINGS

- Trauma which may have contributed to secondary adhesive capsulitis
- Initially pain occurs at night with no known cause and there is no limitation of range of motion
- Shoulder pain and limitation of passive movement in all directions, with pain occurring at the limits of motion; limited range of motion may only start months after the start of pain
- Pain progresses over many weeks to occurring constantly at rest and is aggravated by repetitive motion, stress, cold, vibration, and weather changes
- Stiffness of shoulder limits movement more than pain: Inability to passively abduct the shoulder in a 90° arc while the examiner stabilizes the scapula; greater loss of passive external rotation than abduction and internal rotation (at least a 50% decrease in shoulder range of motion – both active and passive)
- Pain caused by combining abduction and external rotation or extension and internal rotation (stretching of the capsule)
- Later, pain decreases and range of motion increases over time; pain subsides after 1–2 years
- Other findings are relatively unremarkable
- Musculoskeletal and integumentary examination
- Neurologic exam of the arms and neck to rule out other potential causes (for example, cervical radiculopathy, Parkinson's disease)
- Thyroid gland assessment to rule out disease as a cause

RheumInfo, a Canadian website, describes (in a PDF document) and has videos for a very thorough physical examination of the shoulder. See *RheumInfo's "The Shoulder Examination"* (available at: <http://rheuminfo.com/physician-tools/shoulder-examination>).

The Nicholas Institute of Sports Medicine and Athletic Trauma of Lenox Hill Hospital website describes and has pictures for some specific physical examination techniques for the shoulder (available at: <http://www.nismat.org/orthocor/exam/shoulder.html>).

DIFFERENTIAL DIAGNOSES

- Biceps rupture or tendinopathy
- Brachial neuritis
- Cervical disk disease
- Cervical spondylosis
- Cervical sprain or strain
- Neoplastic brachial plexopathy
- Parkinson's disease
- Rheumatoid arthritis
- Rotator cuff dysfunction
- Traumatic brachial plexopathy

COMPLICATIONS

- Chronic pain
- Permanent loss of shoulder mobility
- Instability of the shoulder
- Recurrence of adhesive capsulitis

DIAGNOSTIC TESTS

- Fasting blood sugar (to rule out diabetes mellitus, if the person is not diabetic)

MANAGEMENT**Goals of Treatment**

- Relieve pain and inflammation
- Maintain function of shoulder by restoring normal range of motion
- Prevent complications
- Treat any underlying condition (for example, diabetes mellitus)

Nonpharmacologic Interventions

- Mobilize the shoulder as early as possible
- Avoid aggravating positions and activities (for example, overhead arm movements, repetitive movements)
- Heat can be used for chronic stiffness and discomfort
- Start range-of-motion exercises with the patient using light handheld weights within the pain-free range. This should start with small arm circles with the arm in a pendulum position
- After the pendulum range-of-motion exercise, passive stretching in all directions should be done to a point of tension, but not pain; do not abduct higher than the shoulder
- Exercise progression: passive range of motion, active assisted range of motion, isometrics, active articular stretching, and late stretching and strengthening exercises once range of motion improves

- Home exercises (for example, stretching and maintaining strength) are best done in multiple short sessions (for example, 5 minutes), not long ones
- Exercise should be preceded by the application of moist heat for 15 minutes, and should be followed by icing for a maximum of 15 minutes
- Any exercise that causes pain should be avoided
- Educate patients about the disease course (full recovery may take up to 18 months) and prevention (for example, avoid repetitive movement, sources of vibration)

As range of motion, flexibility and strength improve, so will shoulder function.

Pharmacologic Interventions

Analgesics to reduce pain for 2–3 weeks:

acetaminophen (Tylenol, generics), 325 mg,
1–2 tabs PO q4–6h prn

or

ibuprofen (Advil, Motrin, generics), 200 mg, 1–2 tabs
PO tid-qid prn

or

naproxen (Naprosyn, generics), 250 mg PO bid-tid
for 2 weeks or longer prn

Do not use ibuprofen or naproxen if there are contraindications to NSAIDs (such as a history of allergy to aspirin or NSAIDs or peptic ulcer disease).

Consult a physician when the above measures do not work for pain control and/or when there is pain at rest and/or night pain.

Monitoring and Follow-Up

Arrange follow-up in 1–2 weeks and then monthly until normal range of motion is achieved for the patient.

Referral

Refer to a physician as soon as possible. An early physiotherapy consultation (if available) is especially important for adhesive capsulitis because optimal treatment of this condition involves physical therapy and therapeutic exercises. However, it should be combined with intra-articular corticosteroid injections administered by a physician. The combination of physiotherapy and a corticosteroid injection improves function and range of motion faster than an injection alone.

ANKLE SPRAIN^{16,17}

Stretching (beyond the normal range) or tearing injury to the ligaments supporting the ankle. The sprain location is dependent on the mechanism of injury.

Medial sprain: Sprain of the medial ligament complex (deltoid ligament) resulting from an eversion type of injury. It usually avulses medial or posterior malleolus and strains the syndesmosis.

Lateral sprain: Sprain of the lateral ligament complex (which includes the anterior talofibular, calcaneofibular and posterior talofibular ligaments) usually resulting from an inversion injury that occurs while the ankle is plantar flexed. The anterior talofibular ligament is often the first and the most severely injured.

Syndesmotoc sprain: Sprain of the syndesmotoc ligament complex (which includes the anterior tibiofibular, posterior tibiofibular, and transverse tibiofibular ligaments and the interosseous membrane) usually resulting from dorsiflexion and/or eversion type of injury. These sprains result in chronic ankle instability.

- *First-degree sprain:* Ligament is stretched and joint is stable
- *Second-degree sprain:* More severe; significant partial tearing or rupture of the ligament(s), joint is mildly to moderately unstable, but there is abnormal laxity in certain movements
- *Third-degree sprain:* Complete tear of ligament(s), joint is unstable

CAUSES

- Trauma
- Physical activity
- Step on an uneven surface or step down at an angle
- Predisposing laxity of ligaments

HISTORY

- Mechanism of injury – often sudden twisting motion of foot and lateral ankle – most commonly forced inversion of foot and ankle causing injury to the lateral collateral ligament with eversion-type injury to the deltoid ligament being the second most common type of sprain (*see sprain location descriptions based on mechanism of injury, under the title in this section*)
- Depending upon extent of injury and degree of ligament injury, symptoms vary in severity
- Acute pain

- Swelling
- Bruising
- Inability to walk after the injury (depending on degree of sprain)
- Sounds heard (for example, “pop”)
- Previous injury

PHYSICAL FINDINGS

- Affected limb may be unable to bear weight
- Swelling evident (extent depends on severity of sprain; for example, first-degree sprain has minimal tenderness and swelling, and the patient can weight bear with minimal pain; second-degree sprain has moderate tenderness and swelling and decreased range of motion, and the patient can weight bear with pain; third-degree sprain has severe tenderness and swelling and very decreased range of motion, and the patient is unable to weight bear)
- Bruising present in moderate and severe sprains
- Anterolateral aspect of ankle joint tender
- Posterolateral aspect of ankle joint may be tender
- In severe sprains, anterior aspect of ankle also tender
- Lateral ligament may show laxity
- Tenderness over either malleolus
- Passive range of motion (dorsiflexion, plantar flexion, inversion, eversion) may be limited because of pain; increased pain on eversion signals a medial sprain and increased pain on inversion signals a lateral sprain
- Palpate whole fibula, distal tibia, foot and Achilles tendon for tenderness and integrity to rule out other injuries
- Squeeze test: at mid-calf level squeeze fibula against tibia; pain in anterior tibiofibular ligament (anterolateral and proximal ankle) area indicates syndesmotoc sprain
- Thompson test¹⁸: Have the patient lying prone with the knees flexed at 90°. Squeeze the patient’s calf. The ipsilateral ankle should plantarflex if the Achilles tendon is intact. With an Achilles tendon rupture, the force will not be transmitted and the ankle will not plantarflex

DIFFERENTIAL DIAGNOSIS

- Fracture
- Avulsion fracture of the proximal 5th metatarsal
- Tendon rupture (for example, Achilles, peroneal, posterior tibial)
- Dislocation or subluxation
- Penetrating wound

COMPLICATIONS

- Chronic laxity of ligaments, instability, and recurrent injury to ankle
- Chronic pain
- Neurovascular compromise (for example, abnormal proprioception)

DIAGNOSTIC TESTS

X-ray of ankle and/or foot (according to Ottawa Ankle Rules, below) to rule out a fracture if indicated.

Ottawa Ankle Rules¹⁹

Order ankle x-rays only if there is:

- Pain on palpation near the malleoli (either malleolus and for 6 cm proximal to it) AND
- Pain on palpation of the posterior edge or tip of the lateral malleolus OR
- Pain on palpation of the posterior edge or tip of the medial malleolus OR
- Can't weight bear both immediately after the injury and for four steps at the time of examination

Order foot x-rays only if there is:

- Pain on palpation in the midfoot area AND
- Pain on palpation at the base of the 5th metatarsal OR
- Pain on palpation at the navicular OR
- Can't weight bear both immediately after the injury and for four steps at the time of examination

See the teaching program for the Ottawa Ankle Rules, available at: http://www.ohri.ca/emerg/cdr/ankle_rule_flash.html. A poster is also available at: http://www.ohri.ca/emerg/cdr/docs/cdr_ankle_card.pdf.

MANAGEMENT

Goals of Treatment

- Reduce pain and swelling
- Maintain range of motion
- Rehabilitate ankle strength
- Prevent further injury

Appropriate Consultation

Consult a physician if joint instability is present at initial examination. Also, consult a physician if there is no improvement after 2 weeks of conservative therapy.

Nonpharmacologic Interventions

Rest the Joint

Type and period of rest varies according to severity of injury.

- For second- and third-degree sprains, no weight-bearing or partial weight-bearing with crutches, limited weight-bearing activities
- For first-degree sprains, weight-bearing can occur as tolerated
- A gradual increase in weight-bearing is recommended, beginning as soon as pain and stability allow; this promotes healing and proprioception
- Continue use of crutches until able to walk with a normal gait

Ice to Reduce Swelling and Pain

- Apply ice as soon as possible to lateral aspect of ankle for a maximum of 20 minutes q3–4h for 48 hours (longer if swelling continues)
- If sprain is severe, apply ice q2h
- Use ice as long as swelling and pain are present
- Heat is contraindicated for the acutely injured ankle
- Never use heat in acute or subacute phases of recovery
- Heat may be used for chronic swelling

Compression and Elevation to Reduce Swelling and Pain

- Tensor bandage should be worn for the first 2–3 days for first-degree sprains, longer for second-degree sprains
- Ankle should not be wrapped too tightly, but should support it
- When possible, ankle should be elevated above level of heart for first 48 hours
- A physician might recommend second-degree sprains be immobilized with a removable air boot or splint in addition to a tensor bandage
- Third-degree sprains should be immobilized with a cast or have a stabilization device applied and ensure they are not weight bearing, depending on physician recommendation
- During movement, the ankle should have a lace-up ankle brace applied, if possible, or a tensor bandage to help prevent re-injury

Exercises

- Start gentle range-of-motion exercises for dorsiflexion, plantar flexion and foot circles both ways within 24–48 hours or when there is mild pain and swelling for first- and second-degree sprains, as tolerated
- Encourage Achilles tendon stretching as tolerated
- Instruct client to draw letters of alphabet with big toe in the air

Plantar flexion, inversion and eversion should be avoided in the very early stages of rehabilitation (start after 1–2 weeks).

Muscle-strengthening exercises should be started when range of motion is regained. Instruct client about the following exercises:

- Inversion, eversion, toe curls, marble pickups
- Toe and heel raises on inclined surface, holding end position for 4–6 seconds (10–20 repetitions)
- Toe raises on flat surface, holding end position for 4–6 seconds (10–20 repetitions)
- Heel and toe walking
- Balancing on one foot (for proprioception)
- Walking on different surfaces (for proprioception)

Client Education

- Counsel client about the importance of rest, ice, compression, and elevation
- Healing takes 4–6 weeks
- Teach client to use crutches to prevent full weight-bearing until they can walk with a normal gait
- Teach client the proper application of tensor bandage
- Counsel client about appropriate use of medications (dose, frequency, side effects)
- Teach client exercises to restore range of motion and build strength and encourage them to continue until their activities are pain free
- Educate clients about need to gradually return to activities that do not require ankle turning or twisting and then progression to those activities that do require these movements
- Counsel client about strategies to prevent further injuries to ankle (for example, doing warm-up exercises before physical activities such as sports; wearing high-top, lace-up shoes and/or external ankle supports for walking and running, watching surfaces that one is ambulating on, maintaining strength, balance and flexibility)

Pharmacologic Interventions

Nonsteroidal anti-inflammatory drugs to reduce pain and swelling:

ibuprofen (Advil, Motrin, generics), 200 mg, 1–2 tabs
PO tid-qid prn

or

naproxen (Naprosyn, generics), 250 mg, 1–2 tabs
PO bid-tid prn

Do not use if there are contraindications to the use of aspirin or NSAIDs (such as a history of allergy to aspirin or NSAIDs or peptic ulcer disease).

Instead, use:

acetaminophen (Tylenol), 325 mg, 1–2 tabs PO
q4–6h prn

For moderate to severe pain, stronger analgesics may be needed in addition to NSAIDs in the first 24–48 hours; use:

acetaminophen with codeine (Tylenol #3), 1–2 tabs
PO q4–6h prn

Monitoring and Follow-Up

Follow up in clinic at 48 hours and again in 2 weeks, or sooner if pain and swelling persist.

Referral

Arrange physiotherapy (if readily available) if symptoms persist for more than 2–3 weeks, or if it is a second- or third-degree sprain.

Consult a physician for all second-degree sprains, as an immobilization device (for example, air boot) or a splint may be recommended.

Refer all third-degree sprains to a physician; they often require a below-knee walking cast for 2–3 weeks and/or surgery.

CARPAL TUNNEL SYNDROME^{20,21,22}

The symptoms and signs are a result of compression of the median nerve within the carpal tunnel. Tends to affect the dominant hand but may be bilateral.

CAUSES

- Increased pressure on the carpal tunnel

Risk Factors

- Obesity
- Occupation involving repetitive and prolonged wrist flexion and extension or the prolonged use of vibratory handheld devices²³
- Pregnancy
- Female gender
- Diabetes mellitus
- Rheumatoid arthritis
- Hypothyroidism
- Connective tissue disorders
- Pre-existing median mononeuropathy
- Aromatase inhibitor use (for example, breast cancer treatment)
- Predisposing genetics

HISTORY

Symptoms usually affect the thumb, index and middle finger and half of the ring finger. However, it can affect the wrist, the entire hand and/or radiate as high as the shoulder.

- Tingling, numbness, or pricking sensation in the fingers or hand
- Dull aching pain in the fingers, hand or forearm
- Symptoms often worse at night and may awaken patients from sleep
- Symptoms provoked by flexion or extension of wrist, repetitive hand or wrist actions, or elevation of the arms
- Relief of symptoms afforded by shaking, wringing, or rubbing the hand, or stopping aggravating activities
- Occasionally motor weakness in the affected hand
- May be periods of remission and exacerbation and/or progression from intermittent to persistent
- Assess for risk factors listed above (*see “Risk Factors”*)

PHYSICAL FINDINGS

- Sensory loss over the palmar aspect of the thumb, index, middle, and radial aspect of the ring fingers, and over the thenar eminence (for example, 2-point discrimination)²⁴
- Tinel’s sign: painful sensation and/or paresthesia of the median-nerve innervated fingers induced by percussion of the median nerve at the level of the palmar wrist
- Phalen’s sign: keeping both wrists in a full palmar-flexed position for one minute may reproduce symptoms (for example, pain and/or paresthesia of the median nerve innervated fingers)
- Carpal compression test²⁵: Apply direct pressure over the carpal tunnel (palmar wrist). A positive test occurs when numbness and tingling result from the application of pressure. This test is more sensitive and specific than Tinel’s and Phalen’s signs
- Weakness of the hand while performing tasks (for example, opening jars, thumb abduction and opposition [late sign])
- Muscle wasting of the thenar eminence (late sign)

Occasionally carpal tunnel syndrome will be present without these sensory and motor deficits. Consult a physician if this situation is suspected.

DIFFERENTIAL DIAGNOSIS

- Cervical spine spondylosis
- Peripheral neuropathy
- Brachial plexus lesion

COMPLICATIONS

Without treatment, permanent injury to the nerve may eventually occur.

DIAGNOSTIC TESTS

None.

MANAGEMENT

Goals of Treatment

- Relieve symptoms
- Prevent complications

Appropriate Consultation

Consult a physician if there is evidence of muscle weakness, wasting of the thenar eminence, constant paresthesias, patient is over 50 years old, impaired 2-point discrimination (> 6 mm), positive Phalen's sign, or if symptoms have been present for more than 10 months when the patient initially visits. Otherwise, treat conservatively and follow closely.

Nonpharmacologic Interventions

- Avoid aggravating activities, especially repetitive motion activity
- Splint with the wrist in neutral position of extension at nighttime; it can be worn continuously to decrease symptom severity
- Encourage patient to do yoga exercises to stretch and strengthen the upper body joints. This can help decrease pain
- If carpal tunnel syndrome develops during pregnancy, educate the patient that often the symptoms slowly resolve after delivery

Pharmacologic Interventions

NSAIDs are no better than placebo for treatment of carpal tunnel syndrome according to the results of a Cochrane systematic review.²⁶

Injectable corticosteroids are less effective than surgery over the long term.²⁷

Short-term treatment with oral corticosteroids may be helpful (consult a physician).²⁶

Monitoring and Follow-Up

- Follow up in 2 weeks to see if there is response to treatment
- If improving, continue to see every 2 weeks until resolved or until 6 weeks has passed

Referral

Refer to a physician if the carpal tunnel symptoms do not improve within 6 weeks of consistent effort with conservative measures described above (see “Nonpharmacologic Interventions”) as surgery and/or treatment with oral or injectable corticosteroids may be warranted. If there is evidence of thenar muscle weakness or atrophy, referral should take place immediately.

EPICONDYLITIS: LATERAL (TENNIS ELBOW) AND MEDIAL (GOLFER'S ELBOW)^{28,29,30}

Lateral epicondylitis (tennis elbow) is a chronic inflammatory process occurring at the wrist extensor origin of the lateral epicondyle. Medial epicondylitis (golfer's elbow) is a chronic inflammatory process occurring at the wrist flexor origin of the medial epicondyle. Tennis elbow is 5 times more common than golfer's elbow.

CAUSES

- Usually secondary to overuse or repetitive use (> 2 hours daily)

Risk Factors

- Populations at risk: athletes and manual labourers
- Smokers
- Obese individuals
- 45–54 year olds
- Lifting loads > 20 kg more than 10 times per day
- Repetitive or fast athletic motions with poor technique
- Repetitive movement with the wrist not straight for more than 2 hours a day
- Use of tools > 1 kg at work
- Repetitive wrist extension and/or supination (lateral epicondylitis)

HISTORY

- Pain at the lateral or medial epicondyle (extra-articular); may vary from minimal effect on work to affecting sleep
- Pain exacerbated by repetitive wrist and elbow movements
- Referred pain to the extensor surface of the forearm (lateral epicondylitis)
- Referred pain to the extensor surface of the forearm (medial epicondylitis)
- Risk factors as described above (see “Risk Factors”)

PHYSICAL FINDINGS

- Swelling (mild)
- Warmth
- Redness (mild)
- Pain may increase with elbow in full extension and resisted wrist pronation (medial epicondylitis) or supination (lateral epicondylitis)

Lateral Epicondylitis

- Tenderness over lateral epicondyle and proximal wrist extensor muscles (just distal to the lateral epicondyle)
- Pain exacerbated by resisted extension of the wrist or passive wrist flexion to the end point when elbow is fully extended

Medial Epicondylitis

- Tenderness over medial epicondyle and proximal wrist flexor muscles (just distal to the medial epicondyle)
- Pain exacerbated by resisted flexion of the wrist or passive wrist extension to the end point when elbow is fully extended

RheumInfo, a Canadian website, describes (in a PDF document) a very thorough physical examination of the elbow. See *RheumInfo's "Examination of the Elbow"*, available at: <http://rheuminfo.com/physician-tools/elbow-examination>.

DIFFERENTIAL DIAGNOSIS

- Avulsion injury of the tendon
- Bursitis
- Septic tenosynovitis
- Compression of the median or interosseous nerves
- Fracture
- Osteoarthritis
- Osteochondritis dissecans of the capitellum
- Cervical radiculopathy

COMPLICATIONS

- Tendon rupture
- Recurrent episodes

DIAGNOSTIC TESTS

None.

MANAGEMENT**Goals of Treatment**

- Relieve pain
- Reduce inflammation
- Prevent complications

Nonpharmacologic Interventions

Rest the Limb

- Client should avoid exacerbating activities

- A constrictive band can be placed on the proximal forearm area approximately 10 cm distal to the elbow for the first 6 weeks (commercial “tennis elbow” bands are available)

Ice Locally to Reduce Pain and Swelling

- Apply ice to elbow for a maximum of 15 minutes qid
- Use ice as long as swelling and pain present
- Heat is contraindicated in acute-phase soft tissue injury

Physical Therapy

- Progressive strengthening and flexibility training

Pharmacologic Interventions

Nonsteroidal anti-inflammatory drugs (NSAIDs) to reduce pain and swelling:

ibuprofen (Advil, Motrin, generics), 200 mg, 1–2 tabs PO tid-qid prn

or

naproxen (Naprosyn, generics), 250 mg, 1–2 tabs PO bid-tid prn

NSAIDs should be prescribed for short-term use (for example, 5–7 days) in this situation because of the potential for long-term side effects.³¹

Do not use if there are contraindications to the use of aspirin or NSAIDs (such as a history of allergy to aspirin or NSAIDs or peptic ulcer disease).

Instead, use:

acetaminophen (Tylenol), 325 mg, 1–2 tabs PO q4–6h prn

Monitoring and Follow-Up

- Arrange follow-up at 1–2 days and at 14 days
- Start gentle range-of-motion exercises within pain-free range in 2–3 days
- Advise client to begin stretching and strengthening program when range of motion is regained and the elbow is pain free
- Exercise progression: passive range of motion, active assisted range of motion, isometrics, active stretching exercises, and late stretching and strengthening exercises
- Exercises are best done in multiple short sessions, not long ones
- Proper body mechanics must be demonstrated before return to sport or work

Referral

In most clients, the problem subsides with conservative treatment. Refer to a physician if there is failure to respond to treatment (for example, persistent or worsening pain or dysfunction) within 4 months. Diagnostic tests and/or orthopedic referral may be warranted.

GLENOHUMERAL (SHOULDER) DISLOCATIONS^{32,33}

Dislocation of the humeral head from the glenohumeral joint socket.

CAUSES

Trauma (usually blunt).

- > 95% are anterior dislocations: usual mechanism is forced abduction and external rotation of an extended arm (for example, fall on an outstretched arm)
- Posterior dislocation: anterior shoulder trauma, forced adduction and internal rotation of the arm
- Inferior dislocation: forces transferred to a fully abducted arm or forced hyperabduction of the arm

HISTORY

- Severe pain
- Loss of mobility of shoulder
- Past history of shoulder dislocation (more frequent if patient is < 40 years old)

PHYSICAL FINDINGS**Anterior Dislocation**

- Shoulder appears flattened laterally (squared instead of rounded) and prominent anteriorly
- Arm in slight abduction and external rotation
- Resistance to movement
- The acromion process is prominent in thin clients

Posterior Dislocation

- Shoulder appears flattened anteriorly with a prominent posterior shoulder and coracoid process
- Arm in adduction and internal rotation
- Not able to externally rotate

Inferior Dislocation

- Arm held above head and patient not able to adduct it

- Forearm pronation
- Frequently have associated injuries

Check for associated injuries with all potential dislocations:

- Proximal humeral, acromial, scapular, coracoid and glenoid fractures
- Avulsion or tear of the rotator cuff
- Injuries to the adjacent neurovascular structures; axillary nerve injury is most common and is often associated with decreased active contraction of the deltoid muscle and numbness over the deltoid area (do a neurovascular examination, including motor and sensory function in this area)
- Arterial injury (check for radial pulses bilaterally)

RheumInfo, a Canadian website, describes (in a PDF document) and has videos for a very thorough physical examination of the shoulder. See *RheumInfo's "The Shoulder Examination"*, available at: <http://rheuminfo.com/physician-tools/shoulder-examination>.

The Nicholas Institute of Sports Medicine and Athletic Trauma of Lenox Hill Hospital website describes and has pictures for some specific physical examination techniques for the shoulder, available at: <http://www.nismat.org/orthocor/exam/shoulder.html>.

DIFFERENTIAL DIAGNOSIS

- Soft tissue injury (for example, rotator cuff avulsion or tear)
- Clavicle or humerus fracture
- Acromioclavicular joint separation or injury

COMPLICATIONS

- Neurovascular compromise
- Recurrent dislocation or subluxation

DIAGNOSTIC TESTS

X-ray (if available) is necessary before reduction; obtain images in two planes (anteroposterior [AP] and scapular "Y" or axillary view) to confirm the dislocation and to rule out a fracture if the mechanism of injury is suggestive. Posterior dislocations are often difficult to detect on an AP view.

MANAGEMENT**Goals of Treatment**

- Relieve pain
- Reduce dislocation
- Prevent complications

Appropriate Consultation

Consult a physician. The dislocation should be reduced as soon as possible.

Nonpharmacologic Interventions

Immobilize the client's arm in a sling-and-swathe (using a pillow and/or padding if required) dressing in the position of most comfort.

Pharmacologic Interventions

Analgesia is needed:

morphine 5–10 mg IM or SC

Monitoring and Follow-Up

Monitor pain and neurovascular status frequently until transfer.

Referral

Medevac to hospital for reduction.

GOUT^{34,35,36,37,38}

Inflammatory disease of peripheral joints associated with high serum concentrations of uric acid and deposition of urate crystals in synovial fluid and other tissues.³⁹

CAUSES

Hyperuricemia is due to high levels of uric acid resulting from either increased urate production or decreased renal excretion of uric acid.

- *Primary gout*: Idiopathic hyperuricemia; usually lasts for lifetime
- *Secondary gout*: Hyperuricemia resulting from comorbid diseases (for example, hypertension, renal failure, hemolytic anemia, psoriasis, renal insufficiency) drugs, dietary products, or toxins

Risk Factors

- 30–50 year old male
- Postmenopausal females (estrogen has a urocosuric [protective] effect)
- Obesity
- Hypertension
- Lead intoxication
- Trauma
- Medications including low-dose aspirin, thiazide and loop diuretics, pyrazinamide, cyclosporine, and nicotinic acid can cause hyperuricemia by reducing uric acid secretion. Cytotoxic drugs may cause hyperuricemia by precipitating tumour lysis syndrome
- Alcohol abuse (especially binge-drinking)
- Increased intake of dietary purines (particularly in meat and seafood)⁴⁰
- Daily intake of fructose-sweetened beverages in women (for example, sugar-sweetened soda or orange juice)⁴¹
- Other risk factors: family history, hyperlipidemia, atherosclerosis, diabetes mellitus, chronic renal failure, hypothyroidism, hemolytic anemia, psoriasis

HISTORY

- Sudden onset of moderate-to-severe pain in a joint; joint is “on fire”
- Great toe (first metatarsophalangeal joint) most commonly affected initially
- Instep, ankle, knee, hands, wrist and elbow may be affected
- Almost all attacks are monoarticular (involving only one joint)
- Widespread joint involvement occurs rarely, may be accompanied by fever, chills and general malaise
- Pain usually occurs spontaneously, is severe (for example, weight of sheet feels too much), throbbing and continuous; worst pain is often in the first 24 hours
- First attack begins during the night or early morning
- May be precipitated by trauma, alcohol binging, administration of certain medications (for example, diuretics), surgery, serious medical illnesses (stroke, myocardial infarction) or other risk factors as listed above (*see* “Risk Factors”)
- Attacks are recurrent (if untreated) with asymptomatic periods after resolution of an acute gouty arthritis attack

PHYSICAL FINDINGS**Acute Gouty Arthritis**

- Temperature usually normal
- Temperature may be mildly elevated if more than one joint is involved
- Heart rate may be elevated
- Client appears in acute distress
- Difficulty walking or inability to bear weight on affected limb
- Metatarsophalangeal or interphalangeal joint of great toe shows the following characteristics (or other involved joint): redness and swelling; overlying skin tense and shiny; range of motion reduced and accompanied by pain; joint acutely tender and feels warm or hot

Recurrent Gouty Arthritis

- Acute attacks occurring after an asymptomatic period (the asymptomatic periods get shorter)
- Increasing length of symptoms, amount of disability, and number of joints affected
- Often fever is present
- Chronic gouty arthropathy (asymmetrical bony erosions and deformities, including tophi) may develop leading to no asymptomatic periods

Chronic Tophaceous Gout

- Joint deformity may be present with inflammation larger than a single joint
- Tophi (chalky subcutaneous nodules) visible and/or palpable in connective tissues or bone (for example, pinnae of ear, olecranon bursa, dorsum of hands, ulnar surface of forearms, Achilles tendon and joints of hands and feet). They are usually not painful or tender

Clinical diagnosis of gout requires diagnostic and laboratory investigations. The following will provide evidence to confirm a diagnosis:

- History of an episode or more of monoarticular arthritis followed by a symptom-free period
- Inflammation greatest within 24 hours
- First metatarsophalangeal joint affected unilaterally
- A lesion is visible or palpable and likely to be a tophus (for example, they are common on the pinnae)
- Synovitis resolves quickly after pharmacologic treatment with colchicine
- Tests listed under “Diagnostic Tests” below (see “Diagnostic Tests”)

DIFFERENTIAL DIAGNOSIS⁴²

- Septic arthritis
- Trauma (for example, stress fracture)
- Pseudogout (can be coexistent)
- Infection (bacterial, mycobacterial, fungal)
- Lyme disease
- Bursitis
- Cellulitis
- Osteomyelitis
- Degenerative arthritis with acute inflammation
- Osteoarthritis
- Rheumatoid arthritis
- Acute rheumatic fever

COMPLICATIONS

- Recurrent attacks
- Joint deformity and reduced mobility
- Chronic pain
- Renal calculi (nephrolithiasis, if chronic hyperuricemia)
- Tophi (deposition of uric acid crystals in soft tissues)
- Nephropathy (may take years to develop with chronic hyperuricemia)

DIAGNOSTIC TESTS

- Measure serum uric acid (elevated if > 425 mmol/L)
- X-ray of affected area useful to investigation for erosion, tophi, and other changes associated with chronic gout (not usually present during first attack)
- Obtain sample for white blood cell (WBC) count (elevated in acute phase)
- Determine erythrocyte sedimentation rate (ESR) (elevated in acute phase)
- Determine the following to rule out associated diseases and obtain baseline (given possible sequelae of gout and its treatment)³⁸: creatinine, urinalysis, CBC, liver function tests, and lipid profile

The gold standard test is joint fluid analysis for urate crystals; however, this test is often not available and must be done by a physician.

MANAGEMENT

Goals of Treatment

- Relieve symptoms
- Prevent recurrence
- Prevent complications

Appropriate Consultation

Consult a physician if the client is acutely ill or febrile on initial presentation. Consult a physician if no response to therapy in 24–48 hours.

Nonpharmacologic Interventions

- Bed rest during acute phase; no weight-bearing (for example, use of a cane or crutches)
- Immobilize the joint until hyperacute symptoms are controlled
- Increase fluid intake to > 3 litres/day during attack (output of 2 L /day or more), particularly when starting a medication⁴³
- Client should discontinue alcohol consumption
- Low fat and sugar diet (to reduce risk for gout)
- Low protein and purine (for example, limit organ meat, beer, peas, beans, lentils, oatmeal, spinach, asparagus; increase low-fat dairy products) diet only if intake is excessive³⁶
- Weight reduction (to an ideal body weight) will help an obese client in the long term
- Test for and manage comorbid states that may be present (*see “Causes” and “Risk factors”*)

Client Education

- Explain chronic nature and course of the disease; chronic tophaceous gout may be prevented if urate-lowering treatment is started early and there is excellent adherence to it and the patient avoids risk factors (*see “Risk Factors”*)
- Counsel client about appropriate use of medications (dose, frequency, side effects, adherence to regimen between attacks to prevent future attacks)
- Advise client to avoid known precipitating factors and/or reversible causes (*see “Risk Factors”*)
- Explain how to prevent irritation (for example, proper-fitting footwear, not going barefoot in the house)
- Advise client to return to clinic at first sign of recurrence
- Advise client to begin anti-inflammatory medications at the first sign of an acute attack

Pharmacologic Interventions

Acute Gouty Arthritis

For acute gout (including those on antihyperuricemic agents), relieve pain and inflammation as soon as possible with anti-inflammatory medications (ideally within 24 hours of symptoms, otherwise a longer course of treatment may be needed).

NSAIDs:

ibuprofen (Advil, Motrin, generics), 200 mg, 2–3 tabs PO tid-qid until acute symptoms subside, then taper drug to discontinue in another 72 hours

or

naproxen (Naprosyn, generics), 500 mg PO bid for 5 days maximum; reduce to once daily after objective and subjective improvement occurs; discontinue after the attack resolves

Short courses of oral corticosteroids (prednisone 30–50 mg/day for one or two days then tapered over 7–10 days) may be used in patients who cannot take NSAIDs because of contraindications or intolerance.³⁵

Recurrent Gouty Arthritis

Use an agent to control recurrent hyperuricemia; *see “Referral” and “Prevention” below*

Monitoring and Follow-Up

- Follow up in 24 hours to ensure response to therapy
- Follow up in 1 month to evaluate status
- For client with chronic gout, measure uric acid levels annually and assess adherence to prophylaxis

Referral

Refer to a physician regarding prophylactic therapy for clients with recurrent episodes.

Prevention⁴⁴

Most patients including those with tophaceous gout will experience another episode of gout within 2 years if they are not treated preventatively.

Indications for Prophylaxis

- 24-hour urinary uric acid secretion > 1000 mg (in men < 25 years old or premenopausal women)
- > 2 attacks per year
- Severe, persistent hyperuricemia > 720 µmol/L³⁸
- Presence of tophi
- Chronic gouty arthritis (clinical or radiological signs)

- History of recurrent renal calculi
- Renal insufficiency
- Uric acid nephropathy
- Allergy to uricosurics

Nonpharmacologic Preventative Measures

- Lifestyle changes as indicated above under “Nonpharmacologic Interventions” (see “Nonpharmacologic Interventions”)
- Educate that urate-lowering medication is often taken indefinitely (see below) and the importance of adhering to treatment even if asymptomatic
- Educate clients receiving prophylaxis that prophylactic therapy does not treat an acute gouty arthritis attack. Therefore, if an acute attack occurs they should continue their prophylactic medication and consult their care provider as soon as possible to treat the acute attack. It is treated the same way as any acute gouty arthritis attack. Additionally, urate-lowering medication should not be started until an acute gout episode had resolved
- Educate client about gout (see “Client Education”)

Gout Prophylaxis (Urate-Lowering Medication)

Gout prophylaxis is nurse practitioner or physician initiated and may include the following:

Xanthine oxidase inhibitors: prevent gout by reducing uric acid production.

Allopurinol 100 mg PO od initially, titrated upward at 2–3 week intervals to achieve a serum uric acid level < 357 $\mu\text{mol/L}$. Febuxostat (Uloric) is a newer agent used to prevent gout.

Colchicine (0.6 mg PO bid) for prophylaxis against gout when urate-lowering medication is started (for a maximum of 6 months after serum urate levels are normal). Colchicine is very toxic (fatal) in overdose so patients with prescriptions should be counselled to ensure that it is stored out of reach of children.

KNEE INJURY (LIGAMENTOUS AND MENISCAL)^{45,46,47,48,49}

The knee is the joint most susceptible to injury. Most knee injuries in adults involve the ligaments and cartilage.

TYPES

Ligament Injuries

All grades of sprains involve pain.

Grade I sprain: Microtear of the ligament with inflammation; increase in joint opening < 5 mm (0.2 inch) for valgus stresses; no instability.

Grade II sprain: Partial macrotear of the ligament accompanied by significant increase in joint opening (with an end point) and some instability.

Grade III sprain: Complete tear of the ligament, with no end point distinguishable on examination and knee instability.

Collateral Ligament Injury

- Usually caused by direct trauma to the contralateral side of the knee or excessive indirect force to the knee in a varus or valgus manner; medial collateral ligament injuries also occur often in those who play sports and make sudden changes of direction and speed
- Pain and a sensation of tearing may be noted at the time of injury
- Medial collateral ligament injury may have tenderness along the distal femur extending to the joint line. They also have medial joint pain and usually difficulty walking, twisting, and turning
- Pain below the medial joint line suggests a low-grade sprain
- Lateral collateral ligament injuries are uncommon but have lateral joint line pain
- Valgus and varus stress testing shows increased laxity in grade II or III sprains (see “Physical Findings”)
- Medial collateral ligament injuries are the most common and are often associated with meniscal tears and injury to other ligaments

Anterior Cruciate Ligament Injury

- History of a twisting injury, noncontact sudden stopping and changing direction or pivoting, valgus knee stress, or knee hyperextension, accompanied by a pop or a tearing feeling
- More common in women playing pivoting sports
- Effusion within hours of the injury
- Hemarthrosis found in 75% of cases
- Knee feels unstable (for example, “loose,” “giving out”)
- Difficulty going down stairs, squatting and side stepping
- Laxity on Lachman test or anterior drawer sign (see “Physical Findings”)
- Most common knee ligament injured
- Frequently associated with injury to a medial collateral ligament and/or meniscus

Posterior Cruciate Ligament Injury

- Most injuries result from direct trauma to proximal tibia when the flexed knee is decelerated rapidly, as in a dashboard injury
- Injury results in no to severe impairment
- May have pain with semiflexed positions, starting to run, lifting a weight, and walking long distances
- Acute injury symptoms are often vague, with minimal pain and/or swelling, full range of motion
- Posterior drawer test (*see “Physical Findings”*) and posterior tibial sag demonstrates laxity. *See RheumInfo’s “The Knee Examination”, available at: <http://rheuminfo.com/physician-tools/knee-examination>*
- May be associated with other ligament injuries

Meniscal Tears

- Medial meniscal injury is one of the most common causes of knee-joint pain; medial meniscus is much more susceptible to tears than lateral meniscus
- Injury often occurs due to twisting the knee with a planted foot; older adults may have a tear due to degenerative changes without any trauma
- Client reports pain and sometimes “tearing” or “popping” at time of injury, but often continue to walk; pain and swelling increase over the first day
- Vague symptoms and pain persists and interferes with weight-bearing activity
- Client may present weeks after injury
- Pain often present with activity, in particular twisting or pivoting, but not at rest
- Client often reports that the knee “locks,” “catches,” or does not move properly which may be attributable to pain or a physical inability to extend the knee because the torn meniscus prevents extension
- Most consistent physical finding is tenderness to palpation along the medial joint line; there may also be a small effusion present causing “stiffness,” no smooth passive range of motion and/or no full knee extension
- Clinical tests help identify meniscal injury (for example, McMurray test and Thessaly test, *see “Physical Findings”*); *see RheumInfo’s “The Knee Examination”, available at: <http://rheuminfo.com/physician-tools/knee-examination>*

More than one-third of meniscal injuries are associated with anterior cruciate ligament tear and possibly medial collateral ligament injuries.

HISTORY

- Mechanism of injury (for example, trauma, activity) and when it happened
- Age of patient and comorbidities
- Location where pain started and is currently
- Pain duration
- Noise made when injured (for example, “pop”)
- Timing and location of joint swelling
- Concerns about knee function (for example, weakness, giving out, limping, catching, locking)
- If trauma, amount of energy involved and any knee symptoms prior to traumatic incident
- Ability to function (for example, walk, climb stairs)
- Associated injuries

PHYSICAL FINDINGS

The ability to examine a knee injury may be limited by pain and swelling. A patient may need to return for a complete knee exam at a later date, after being treated symptomatically at the initial visit.

Always compare the uninjured leg with the injured one.

- Observe the knees both while weight bearing and not; look for swelling, bruising, structure and alignment of the knees
- Palpate knee, soft tissues and surrounding bony structures, including joint lines, for tenderness, warmth, and crepitus
- Effusion testing by comparing medial and lateral patellar dimples and looking for a ballottement sign (for example, after milking fluid into the centre of the knee the patella can be forced against the femur to create a tap)
- Test active and passive range of motion; look for smooth movement and range
- Test hamstring and quadriceps strength bilaterally
- Neurovascular examination (sensation, motor, and pulses)
- Observe patient’s gait
- Observe ability to walk on toes and heels, ability to squat and then walk like a duck in the squat position

Perform the following tests with relaxed leg muscles to test knee ligaments:

- **Varus and valgus stress testing** – assess collateral ligaments by applying varus and valgus stresses to the knee with the knee in 30° of flexion (to isolate the collateral ligaments); compare to the opposite knee

- **Lachman test** – assess anterior cruciate ligament by flexing knee to 20 degrees. Push down on thigh with one hand. Grasp proximal tibia and pull anteriorly with the other hand. A torn anterior cruciate ligament has more anterior glide and a vague end point when compared to the other knee
- **Anterior drawer sign** – assess anterior cruciate ligament by flexing knee 90° and then attempt to displace the tibia anteriorly on the femur; often it helps to sit on the foot while attempting to displace the knee anteriorly; any displacement suggests injury; a 1 cm difference when compared to the other knee suggests a complete tear
- **Posterior drawer test** – assess posterior cruciate ligament by flexing knee 90° with feet on the table and then attempt to displace the tibia posteriorly on the femur; any displacement suggests injury
- **Thessaly test** – assess meniscus by having patient hold clinician’s hand and then stand on one leg while flexing knee to 20° and then have patient internally and externally rotate their knee; pain or locking suggests a meniscal tear
- **McMurray test** – assess meniscus by having patient lie supine and passively flexing and extending the knee while internally rotating the tibia and then again while externally rotating the tibia. The clinician holds the heel and the medial knee along the joint line; a painful click along the joint line while extending suggests a meniscal tear

RheumInfo, a Canadian website, describes (in a PDF document) and has videos for a very thorough physical examination of the knee. See *RheumInfo’s “The Knee Examination”*, available at: <http://rheuminfo.com/physician-tools/knee-examination>

DIFFERENTIAL DIAGNOSIS

- Ligament(s) sprain (anterior cruciate, posterior cruciate, medial collateral, lateral collateral, talofibular)
- Knee and/or patellar dislocation
- Osteoarthritis
- Rheumatoid arthritis
- Effusion (for example, synovial, popliteal cyst)
- Bursitis
- Patellar femoral pain syndrome
- Stress fractures of femoral condyles or tibial plateau
- Referred pain from back sacroiliac joint and/or hip

COMPLICATIONS

- Recurrence
- Joint stiffness and/or instability
- Osteoarthritis

DIAGNOSTIC TESTS

Use the Ottawa knee rules to decide whether an x-ray is warranted for acute knee injuries. Most injuries do not warrant an x-ray.

Ottawa Knee Rules⁵⁰

Order knee x-rays only if a patient injured their knee and there is one or more of the following:

- Age greater than or equal to 55 OR
- Pain on palpation of the patella only OR
- Pain on palpation at the head of the fibula OR
- Unable to flex knee to 90 degrees OR
- Can’t weight bear both immediately after the injury and for four steps at the time of examination

A teaching program for the *Ottawa Knee Rules* is available online at: http://www.ohri.ca/emerg/cdr/knee_rule_flash.html. A poster is also available at: http://www.ohri.ca/emerg/cdr/docs/cdr_knee_card.pdf.

MANAGEMENT

Goals of Treatment

- Relieve symptoms
- Restore or maintain knee function
- Prevent complications

Appropriate Consultation

If there are any diagnostic doubts, consult a physician as soon as possible. In particular, consult a physician if the injury was incurred at high speed (for example, a car accident).

Nonpharmacologic Interventions

If pain, swelling and/or muscle spasm prevents a full examination of the knee, treat the patient for their symptoms, and then have them return once the symptoms improve for a more thorough assessment.⁴⁶

Conservative treatment of isolated grade 1 and 2 collateral ligament and minor meniscal injuries involves nonpharmacologic interventions.

Specific treatments:

- Medial collateral and anterior cruciate ligament injuries should never be fully immobilized. A hinged or elasticized brace may be used early in the rehabilitation process to help with pain relief
- Meniscal tears should initially have knee rest where positions and activities that place a lot of pressure on the knee joint are avoided until pain and swelling resolves
- Those with grade 3 posterior cruciate ligament injuries should wear a long leg brace for at least 3 weeks

For all knee injuries:

- Client should rest and elevate knee for first 24–72 hours
- Ice should be applied for a maximum of 15 minutes qid for first 3 days
- Compression, in the form of tensor bandages, may be applied for the first couple of days for comfort
- Client should start ambulating using crutches with weight-bearing as tolerated as soon as ambulation causes only minor pain
- Initiation of gentle range-of-motion exercises within the pain-free zone should begin as soon as pain and swelling subside enough to allow. Start with quadriceps extension. Early movement improves healing and strength. After full active range of motion is pain free, then strengthening can begin:
 - Medial collateral ligament strengthening exercises are isometric quadriceps contractions and then move to partial squats, increasing the range of motion gradually
 - Meniscal tear patients start with straight leg raises held for 5 seconds; initially without weights and then with ankle weights; exercises requiring resisted deep knee bends (for example, stationary bicycle) should be avoided until patient is pain and swelling free
 - Anterior cruciate ligament strengthening exercises start with the hamstring and quadriceps with the feet planted for the first six weeks; it progresses to exercises for proprioception, balance, and core strength
 - Posterior cruciate ligament strengthening exercises start with quadriceps and hip strengthening with the feet planted for the first 2 weeks; stationary bicycling helps improve range of motion and can provide increasing resistance; proprioception and power training are added

Client Education

- Most knee injuries will respond well to conservative management
- Meniscal tears, posterior cruciate ligament, and/or anterior cruciate ligament injury may predispose one to osteoarthritis later in life
- To prevent injuries, athletes should have regular and focused neuromuscular training programs that focus on strength, agility, flexibility, and power

Pharmacologic Interventions

Nonsteroidal anti-inflammatory drugs (NSAIDs) to reduce pain and swelling:

ibuprofen (Advil, Motrin, generics), 200 mg, 1–2 tabs PO tid-qid prn

or

naproxen (Naprosyn, generics), 250 mg, 1–2 tabs PO bid-tid prn

Do not use if there are contraindications to the use of aspirin or NSAIDs (such as a history of allergy to aspirin or NSAIDs or peptic ulcer disease). Instead, use:

acetaminophen (Tylenol), 325 mg, 1–2 tabs PO q4-6h prn

If pain moderate to severe initially, use:

acetaminophen with codeine (Tylenol #3), 1–2 tabs PO q4h prn to maximum of 15 tabs, then switch to plain acetaminophen

Monitoring and Follow-Up

Follow up in 1–2 days to reassess injury. If swelling and pain are reduced, you may be able to examine the knee more thoroughly. It may take up to 6 weeks after injury to fully assess damage to a knee. Re-evaluate the knee every week until you are able to fully assess the knee to ensure there are no other injuries, no need for referral or diagnostic imaging, and to start rehabilitation.

Clients may return to sports or usual work activities after full range of motion and strength have been regained.

Referral

Discuss referral to an orthopedic surgeon with a physician if any of the following are present:

- Knee unstable due to injury to multiple ligaments, or anterior cruciate ligament and a meniscal tear
- Angulated or displaced fracture
- Knee instability continues after conservative treatment

Collateral Ligament Injury

Grade III collateral ligament injuries are almost always treated non-operatively, but a referral to a physician is recommended to ensure there are no other knee injuries that may warrant surgery.

Anterior Cruciate Ligament Injury

Treatment should be supervised by an orthopedist as they can be treated with or without surgery. Treatment of acute injuries depends on the severity.

Clients with associated ligament injury or meniscal injury should be referred immediately to an orthopedist, because surgery is often necessary.

Posterior Cruciate Ligament Injury

Isolated tears should be managed conservatively, but some posterior cruciate ligament injuries may require surgical fixation. Refer a client with a grade III injury to a physician to determine if surgery is warranted.

Meniscal Tears

If the knee remains locked, the patient is unable to squat or if symptoms of pain, giving way (a sense that the knee is going to collapse) and swelling do not improve after 3 weeks of conservative treatment, client should be referred to an orthopedist by a physician for potential surgical intervention. Older adults who have tears due to chronic degeneration are not candidates for surgery.

LOW BACK PAIN^{51,52}

Acute low back pain is one of the most common health problems. Almost everyone experiences it in his or her lifetime to some degree. It is the second most common symptom-related visit to a healthcare professional.

Back structures that can be a source of pain are muscles, ligaments, vertebral bones, facet joints, intervertebral disks, nerve roots, and muscles. Pain usually results from strain or degeneration of these structures, but serious inflammatory, infectious and neoplastic disorders also occur.

Back pain can also result from disorders of the visceral structures immediately anterior to the spine: aorta, kidneys, intestines, pancreas, stomach, gallbladder, prostate, uterus, and ovaries.

TYPES**Lumbosacral Strain
(Mechanical Low Back Pain)**

- Due to stretching or tearing of muscles, tendons, ligaments or fascia of the lower back secondary to trauma or chronic mechanical stress
- May be accompanied by sciatica

Sciatica

- Nerve root irritation (lumbosacral radiculopathy)
- Sharp or burning pain in buttocks or posterior-lateral legs or both, along path of sciatic nerve (usually to foot or ankle); pain below the knee is more likely true radiculopathy
- Numbness or tingling in affected leg
- Increased pain with coughing, sneezing or Valsalva maneuver if due to disk herniation

Lumbar Spinal Stenosis

- Narrowing of the spinal canal, nerve root canals or intervertebral foramina, trapping the nerve root
- Significant stenosis present if back pain relieved with sitting or spinal flexion, intermittent leg tingling, and calf pain induced by walking and relieved with rest (pseudoclaudication), normal arterial pulses
- May be numbness and pain that radiates to the foot

**RED FLAG INDICATORS FOR
POTENTIALLY SERIOUS CONDITIONS****Possible Fracture**

- Major trauma
- Minor trauma in older clients, clients who may have osteoporosis, and/or those who are on chronic corticosteroids

**Possible Cauda Equina Syndrome
(Surgical Emergency)**

- Usually due to a tumour or a large disk herniation
- Saddle anesthesia (for example, loss of sensation in perineal area)
- Bladder dysfunction, bowel dysfunction
- Severe or progressive neurologic dysfunction in the legs
- Laxity of anal sphincter
- Major motor weakness in quadriceps (knee extensors), ankle plantar flexors, evertors and dorsiflexors (foot drop)
- Bilateral sciatica

Possible Tumour or Infection

- Client age < 18 or ≥50 years
- History of cancer (known or unknown) – check breast, prostate and lymph nodes
- Constitutional symptoms such as fever, chills, and/or unexplained weight loss
- Risk factors for spinal infection (for example, recent bacterial infection, injection drug use, indwelling catheter, or immunosuppression)
- Pain that is worse in the supine position or severe nighttime pain
- Pain not better after 1 month of treatment
- Acute neurologic deficits (potentially spinal cord compression) that progress or are severe

Possible Herniated Nucleus Pulposus⁵³

- Straight leg raise positive at < 60 degrees
- Weak dorsiflexion of ankle or great toe
- Decreased ankle reflex
- Decreased light touch in dermatomes of foot/leg (L4, L5, S1)

CAUSES

- Contusions
- Ligamentous strain
- Muscular strain
- Muscular tension related to mechanical stress
- Osteoarthritis of spine
- Protruding intervertebral disk

Risk Factors

- Aging
- Prolonged periods of standing or sitting
- Poor posture
- Pregnancy
- Smoking
- Obesity
- Females
- Improper lifting techniques
- Family history
- Osteoporosis
- Past trauma
- Psychologically or physically strenuous work
- Little education
- Job dissatisfaction
- Psychological conditions (for example, depression, anxiety)

HISTORY

Obtain a detailed history, with a precise description of the pain (for example, location, duration, severity, radiation) and events surrounding its onset (for example, activity at the time).

- Pain localized in low lumbar area
- Pain may radiate into buttock or to below the knee (for example, sciatica)
- Aching pain may be accompanied by intense, sharp muscle spasm
- Sitting increases pain
- Supine posture decreases pain
- Rest decreases pain
- Motion increases pain
- Focal motor weakness
- Sensory changes (numbness, tingling, pins and needles)
- Interference with daily activities
- Interference with performance of job-related activities
- Occupation involving bending or heavy lifting
- History of recent or previous trauma or back pain and its treatment, if applicable
- Other underlying spinal disk, bone or joint disease (for example, spinal stenosis, osteoarthritis)
- Social or psychological distress contributing to chronic pain (for example, screen for depression)
- History of substance abuse
- Evaluate for red flag indicators for potentially serious conditions (*see “Red Flag Indicators for Potentially Serious Conditions”*)

PHYSICAL FINDINGS

- Client appears in mild-to-severe distress
- Abnormal posture (tilting to one side)
- Difficulty walking
- May be unable to stand or sit up straight (observe client change positions)
- Spinal deformities may be present (for example, scoliosis, kyphosis)
- Bruising or soft tissue swelling may be present
- Spasm of paraspinal muscles may be present
- Intervertebral disk space may be tender in lumbar area and along paravertebral muscles
- Range-of-motion maneuvers (flexion, extension, rotation, side bending) may be limited (especially forward flexion)

- Straight leg-raise test – while supine, passively elevate an extended leg with the ankle dorsiflexed; positive if pain reproduced between 10 and 60 degrees; may be limited because of muscle tightness, muscle spasm or nerve root irritation (sciatica)
- Reflexes normal in cases of soft tissue injury, but may be abnormal in cases of impingement on nerve root
- Palpate peripheral pulses
- Weakness with heel or toe walking may be present (in cases of impingement on nerve root)
- Sensory deficits may be present (in cases of impingement on nerve root)
- Motor deficits may be present (for example, ankle and great toe dorsiflexion, plantar flexion)
- Bowstring test may be positive (in cases of impingement on nerve root)
- Evaluate for red flag indicators for potentially serious conditions (*see “Red Flag Indicators for Potentially Serious Conditions”*)

DIFFERENTIAL DIAGNOSIS

See “Causes of Low Back Pain”.

COMPLICATIONS

- Chronic or recurrent back pain
- Absenteeism from work
- Dependency on or abuse of opioid analgesics
- Occupational disability

DIAGNOSTIC TESTS

In the absence of any red flag indicators above (*see “Red Flag Indicators for Potentially Serious Conditions”*), no investigations are needed within the first 4 weeks of acute mechanical low back pain from lumbar strain.

MANAGEMENT^{54,55,56,57}

Treat clients with uncomplicated acute low back pain conservatively and follow them closely if there are no red flag indicators (even if sciatica is present).

Goals of Treatment

- Relieve pain
- Promote rapid recovery and prevent chronicity
- Prevent further injury
- Prevent or reduce work absence
- Educate and reassure the client

Appropriate Consultation

Consult physician for moderate to severe back pain, especially if the client is > 50 years of age, has neurologic abnormalities, has a psychological comorbidity, or if you suspect an underlying organic cause for the back pain. Consult a physician to discuss the potential for a medevac if any of the red flag indicators above are present (*see “Red Flag Indicators for Potentially Serious Conditions”*).

Nonpharmacologic Interventions

- If the initial assessment indicates no serious condition or red flag indicators (*see “Red Flag Indicators for Potentially Serious Conditions”*), assure the client that there is no evidence of a dangerous problem and that a full, quick recovery can be expected
- Clients with sciatica (usually from a herniated disk) may have a longer expected recovery time than clients with nonspecific back symptoms and thus may need more education and reassurance
- Bed rest should be discouraged as it may actually increase pain and slow recovery; patients should be encouraged to continue activities of daily living as soon as possible and be reassured that pain on ambulation is not related to permanent damage
- Return to work as soon as feasible (for example, office workers may be able to return sooner than manual labourers); arrange return to modified duties if available and/or necessary
- Heavy physical activity should be reduced for 2 weeks; otherwise activity as tolerated
- No heavy lifting (> 11 kg [25 lb])
- Do not suggest an exercise therapy program until after subsidence of initial pain; exercise can help prevent recurrences after the acute pain has decreased
- Use a heating pad or hot water bottle to reduce muscle stiffness, pain, and spasm (20 minutes qid prn if pain < 3 months)
- Provide advice about nutrition and weight loss if client is overweight
- Client may require note for time off work; time off should be brief; goal is to keep client active; discuss and arrange work modification, if possible, with client’s supervisor

To be avoided:

- Prolonged standing
- Prolonged sitting
- Bed rest
- Lifting > 11 kg (25 lb)
- Lifting and twisting motions
- Slumping posture

To be encouraged:

- Lumbar support
- Frequent positional changes
- Maintenance of normal spine alignment when sitting or standing
- Proper lifting techniques

Client Education

The need for education will vary among clients at different stages of care; an obviously apprehensive client may need a more detailed explanation. Provide information about causes of low back pain, its good prognosis, the minimal information diagnostic tests usually provide, activity and work suggestions, and when to return to the clinic (if a red flag indicator occurs, *see “Red Flag Indicators for Potentially Serious Conditions”*).

Any client who does not recover within 2 weeks may need more extensive education about back problems, the reassurance that recovery usually takes place and that special tests may be considered if recovery is slow.

- Educate about the importance of maintaining as much activity as possible and to not use bed rest unless there is a period of severe symptoms
- Discuss the aim to help them return to productive function at home and work (even if the pain is not completely resolved)
- Counsel client about appropriate use of medications (dose, frequency, abuse, overuse)
- Teach the client core and back-strengthening and stretching exercises that can be done at home; aerobic exercise, stretching and strengthening should be a part of the routine; there should be a gradual increase in the frequency and intensity of the exercises
- Yoga, pilates, acupuncture, spinal manipulation, and massage therapy may be helpful for patients interested and with access to these modalities
- Advise client not to start exercises until acute symptoms have subsided, or after 4 weeks of symptoms; after this time exercise improves pain relief and function

Pharmacologic Interventions

Analgesics to relieve back pain:

ibuprofen (Advil, Motrin, generics), 200 mg, 1–2 tabs
PO tid-qid prn (for a maximum of 2–4 weeks)

or

naproxen (Naprosyn, generics), 250 mg, 1–2 tabs
PO bid-tid prn (for a maximum of 2–4 weeks)

or

acetaminophen (Tylenol), 325 mg, 1–2 tabs PO
q4-6h prn

Do not use ibuprofen or naproxen if there are contraindications to the use of aspirin or NSAIDs (such as a history of allergy to aspirin or NSAIDs or peptic ulcer disease).

If pain is moderate to severe, or if first-line agents are contraindicated, poorly tolerated or fail to control discomfort:

acetaminophen with codeine (Tylenol #3), 1–2 tabs
PO q4–6h prn – *may be used in addition to NSAIDs.*

Monitoring and Follow-Up

Arrange follow-up at 1–2 days, and then every 2 weeks until client has recovered. Assess compliance with exercise and medications. Reassess for red flag conditions and any psychological comorbidities at 4 weeks (*see “Red Flag Indicators for Potentially Serious Conditions”*).

Referral

- Refer to a physician if symptoms persist after 4 weeks, or sooner if symptoms are worsening despite conservative treatment
- Arrange referral to a physiotherapist (if readily available) after 3 weeks of pain
- Arrange a medevac, after speaking to a physician, if any of the red flag indicators above are present or suspected (*see “Red Flag Indicators for Potentially Serious Conditions”*)

Prevention

Exercise programs can prevent low back pain and decrease recurrence (if initiated after the pain has resolved).

NECK PAIN^{58,59,60,61,62}

Neck pain, acute and chronic, is commonly seen in the primary care practice setting. Degenerative changes of the cervical spine are the most common cause.

Few patients with neck pain are absent from work and < 1% develop neurologic dysfunction.

Organic diseases affecting the cervical spine are rare but important causes of pain; certain symptoms and signs help to identify the more serious clinical conditions.

For patients who have recently experienced a major fall or trauma that may have resulted in cervical spine and/or spinal cord trauma *see the section “Cervical Spine and Spinal Cord Trauma” in the chapter “General Emergencies and Major Trauma” and the Canadian C-Spine Rules, available at: http://www.ohri.ca/emerg/cdr/docs/cdr_cspine_poster.pdf.*

TYPES

Myofascial Pain

Myofascial pain is the most common type of acute and chronic neck pain. The upper trapezius and levator scapulae are the muscles most frequently involved in myofascial pain of the neck, head, and upper back. The pain is often described as dull, aching or burning and is referred from active myofascial trigger points (hyper-irritable spot within a taut band of skeletal muscle or muscle fascia) that are tender on compression.

Neuropathic Pain

Disease and injury of the neck may involve nerves or nerve roots lying along the transverse processes or the paravertebral region of the spinal cord. This produces neuropathic pain felt in the occipital region, the back, the posterior ear and ear lobe, and the anterior neck.

A history of significant trauma, cervical arthritis, prior herniated disk or herpes zoster infection, along with typical neuralgic pain and sensory disturbances, should suggest a neuropathic process.

Neuropathic pain is usually described as sharp, burning or aching and often follows the distribution of the affected nerve segment. The pain is worsened by movements that stretch the involved nerve or nerve roots. It is frequently accompanied by sensory and motor disturbances such as hyperesthesia, paresthesia, hypalgesia, and a decrease in muscle strength. Disk herniation with radicular pain is one example of neuropathic disease.

RED FLAGS

- Severe trauma
- Impaired consciousness
- Loss of reflexes
- Sensory and motor deficits; for example, weakness, gait disturbance (cervical spondylotic myelopathy)
- Loss of bowel or bladder function, sexual dysfunction (cervical spondylotic myelopathy)
- Headache, shoulder or hip pain, and/or visual changes in an older adult (rheumatologic diseases)
- Constitutional symptoms such as fever, chills, and/or unexplained weight loss along with immunosuppression, cancer, or intravenous drug use (tumour, infection)

CAUSES

Biomechanical disorders that occur secondary to overuse, trauma or deformity constitute the most common cause of neck pain. Typically, these disorders are characterized by correlating exacerbation or alleviation of symptoms with certain physical activities.

The causes of biomechanical disorders include neck strain, herniated disk, spondylosis and myelopathy.

Most biomechanical disorders of the cervical spine without nerve compression have a natural history of improvement. Most patients with mild to moderate pain without nerve compression will improve within 2–3 weeks.

Biomechanical Neck Problems Without Nerve Compression

Clients with pain only in the cervical area, trapezii and shoulders may have one of many disorders, of which cervical strain, cervical facet syndrome and cervical discogenic pain are the most common.

Cervical strain

- Injury to cervical paraspinal muscles and ligaments
- May be related to posture and sleeping habits
- Not a cause of chronic pain

Cervical Facet Syndrome

- Caused by flexion-extension injury (for example, whiplash) or due to an occupation where neck extension is required repeatedly
- Common causes: rear-impact motor vehicle crashes, falls, diving accidents, other sports injuries
- May involve damage to soft tissues, ligaments, nerves, intervertebral disks, and/or bony structures
- Some patients remain symptomatic for years

Cervical Discogenic Pain

- Most common cause of neck pain
- Degeneration in the intervertebral disk

Biomechanical Neck Problems with Spinal Compression

Most often occurs secondary to compression of the spinal cord or nerve roots in the spinal canal. The symptoms are known as cervical radiculopathy. It causes acute and chronic neck pain. In addition, arm pain may be present, with or without sensory and motor deficits.

The location, duration and size of lesions influence the severity and distribution of symptoms. Compression usually results from a combination of osteophyte growth and degenerative disk disease. The C6–C7 levels are the most commonly affected.

Cervical Radiculopathy

- Due to degenerative changes (most common), cervical foraminal stenosis, cervical herniated disk, herpes zoster, Lyme radiculopathy, diabetic radiculopathy

Risk Factors

For whiplash, the factors are:

- Female
- Younger age
- History of neck pain
- Rear end collision with patient in a stationary vehicle
- Patient not at fault
- Repetitive work

HISTORY

- Mechanism of injury or events occurring just prior to pain, if known
- Onset and course of symptoms
- Radiation of pain (shoulders, chest, arm, scapula, occiput, face)
- Neuropathic signs (for example, paresthesia, numbness, weakness)

PHYSICAL FINDINGS

- Inspect neck for bruising, deformities
- Palpate paraspinal and upper trapezius muscles bilaterally for tenderness and spasm
- Observe patient moving and resting the head and neck (including posture)
- Inspect cervical range of motion (forward flexion, lateral flexion, rotation, extension) and shoulder range of motion
- Neurologic testing; *see Table 3, “Characteristics of Cervical Radiculopathy Caused by Compression of Cervical Nerve Root”* for specific changes expected by nerve root:
 - Bilateral reflexes (brachioradialis, biceps, triceps)
 - Motor and sensory testing (muscle strength and tone of shoulder and arm joints against resistance, gait, sensation of arms, hands, shoulders, and neck)
 - Test for upper motor neuron signs (that is, spasticity, weakness, hyperactive reflexes, Babinski reflex, pronator drift)

Neurological findings may not be present with a cervical fracture, so utilize clinical judgment when assessing and deciding whether to consult a physician.

Examination findings can be categorized in many ways. Treatment is based on the more general “Whiplash-Associated Disorders Classification of Neck Pain” *as described below*. Typical examination findings for more specific Biomechanical Neck Problems with (*see Table 4*) and without (*see Table 3*) Nerve Compression are found in tables below.

Whiplash-Associated Disorders Classification of Neck Pain

- Whiplash-Associated Disorders Class I: pain, stiffness or tenderness without any physical changes or restrictions
- Whiplash-Associated Disorders Class II: pain and tenderness with decreased range of motion
- Whiplash-Associated Disorders Class III: pain and neurological signs (sensory, motor, or reflex changes) with no fracture or cervical instability
- Whiplash-Associated Disorders Class IV: fracture or dislocation

Table 3 – History and Physical Examination for Biomechanical Neck Problems without Nerve Compression

Condition	History	Physical Examination
Cervical strain	<p>Pain in middle or lower portion of the posterior neck</p> <p>Pain may be diffuse or localized to both sides of the spine</p> <p>Spasm of cervical and upper back muscles</p> <p>Pain, stiffness, tightness in upper back or shoulder for a maximum of 6 weeks</p>	<p>Local tenderness, stiffness or tightness in paracervical and trapezial muscles, decreased range of motion, loss of cervical lordosis</p> <p>No abnormalities found on neurologic or shoulder examination</p> <p>Spinal x-rays may be normal or reveal loss of lordosis</p>
Cervical Facet Syndrome (whiplash)	<p>Flexion-extension injury (and acceleration-deceleration injury for whiplash) to soft tissue structures</p> <p>Occupation requiring repeated neck extension</p> <p>Sympathetic ganglia may be damaged, resulting in nausea, hoarseness, or dizziness</p> <p>Intervertebral disk injuries occur with severe trauma</p> <p>Stiffness and pain with motion; may also have difficulty swallowing or chewing</p>	<p>May be paracervical muscle contraction and/or occipital headache</p> <p>Neck pain midline or slightly to one side; is more severe than extremity pain</p> <p>Limited neck range of motion</p> <p>May be referred pain to shoulders, periscapular area, occiput, or upper arm</p> <p>Neurologic examination often unremarkable, with the exception of occasional Horner's syndrome</p> <p>X-rays may reveal loss of cervical lordosis</p> <p>In severely injured clients, structural damage identified on x-rays mandates immediate stabilization</p>
Cervical Discogenic Pain	<p>Pain exacerbated by holding head in one position for long periods of time</p> <p>Often muscle tightness and spasms</p>	<p>No abnormalities on neurologic examination</p> <p>Neck pain on range of motion (mechanical neck pain), more severe than extremity pain</p> <p>Limited neck range of motion</p>

Table 4 – Characteristics of Cervical Radiculopathy Caused by Compression of Cervical Nerve Root

- Neck pain, weakness
- Arm pain
- Neurologic changes (reflexes, motor and/or sensory)

Nerve Root	Area of Pain	Location of Sensory Loss	Motor Loss	Reflex Loss
C4	Neck to scapula	Across shoulders	Shoulder elevation	None
C5	Neck to outer shoulder, scapula	Lateral arm	Shoulder abduction, external rotation, elbow flexion, forearm supination	Biceps, brachioradialis
C6	Shoulder, scapula, outer arm to thumb, index finger	Lateral forearm, index finger and thumb	Shoulder abduction, external rotation, elbow flexion, forearm supination and pronation	Biceps, brachioradialis
C7	Shoulder, hand, middle finger	Index and middle fingers, palm	Elbow and wrist extension (radial), forearm pronation, wrist flexion	Triceps
C8	Shoulder, inner forearm to ring and little fingers, medial hand	Inner forearm, medial hand, ring and little fingers	Finger and wrist extension, distal finger flexion, extension, abduction and adduction, distal thumb flexion	None

DIFFERENTIAL DIAGNOSIS OF NECK PAIN

See Table 2, “Causes of Neck Pain and Cervical Spine Disorders”.

COMPLICATIONS

- Permanent nerve damage with compression of nerve root
- Chronic neck pain
- Absenteeism from work
- Disability (long term)

DIAGNOSTIC TESTS^{63,64}

Discuss with a physician before ordering any tests. The Canadian C-Spine Rule may be helpful in discussing the patient who has experienced neck trauma.

The Canadian C-Spine Rule can be used with all trauma patients who may have a cervical spine injury and have a Glasgow Coma Scale of 15 and are stable.

Cervical spine x-rays are warranted only if any one of the following is true:

- Age > 65 years OR
- Having paresthesia in extremities OR
- Was a dangerous mechanism of injury (for example, fall from 3 feet or more/5 stairs, direct force to head, bicycle accident, vehicle rollover or ejection, motorized recreational vehicle accident) OR
- None of the following low-risk factors:
 - Sitting in the clinic OR
 - Able to walk at any time after trauma OR
 - Delayed onset of neck pain OR
 - Pain on palpation of the midline cervical spine OR
 - Simple rear-end motor vehicle accident OR
- Any one of the above low-risk factors AND not able to actively rotate neck 45 degrees to the left and the right

A poster explaining the Canadian C-Spine Rule is available at: http://www.ohri.ca/emerg/cdr/docs/cdr_cspine_poster.pdf.

MANAGEMENT

Goals of Treatment

- Relieve symptoms
- Regain or maintain full range of motion
- Prevent complications

Appropriate Consultation

Consult immediately if there is concern of serious injury (for example, trauma of significant force) or if there is associated neuropathic pain and/or neurological changes. Treat all other injuries conservatively and follow up closely. For patients who have cervical spine and/or spinal cord trauma also see the section “Cervical Spine and Spinal Cord Trauma” in Chapter 14, “General Emergencies and Major Trauma”.

Nonpharmacologic Interventions

Treatment for patients with a Whiplash-Associated Disorders Class I to III (see “Whiplash-Associated Disorders Classification of Neck Pain”):

- Clients without systemic disorders should be treated with non-operative therapy for 3–6 weeks
- Ice for a maximum of 15 minutes qid provides additional analgesia in some cases
- Heat may decrease muscle tightness and improve range of motion
- Posture modification (for example, sitting straight with shoulders back, driving with shoulders slightly shrugged, not carrying over-the-shoulder bags, limiting time sitting in one position), including while sleeping (should have head and neck aligned with body – for example, sleep on back with pillows under thighs)
- Soft cervical collars (to support, but not extend neck) should not be used for long periods of time as they may delay improvement; wear for a maximum of 3 hours at a time, and for a maximum of 2 weeks; they may be most useful at night when there may be increased pain (to help the patient sleep); avoid immobilization if possible
- Educate clients about the good prognosis for recovery and lack of neurological deficits in most cases
- Avoid aggravating activities
- Continue usual activities as soon as possible
- Avoid work absences, if possible
- Home exercises daily once symptoms are controlled (for example, cervical range of motion holding each end range for 5 seconds, stretching, shoulder rolls); 15 repetitions twice daily after applying moist heat to neck; continue exercises every other day after acute pain resolves

Pharmacologic Interventions

Acetaminophen or nonsteroidal anti-inflammatory drugs (NSAIDs) to reduce localized pain:

acetaminophen (Tylenol), 325 mg, 1–2 tabs PO q4-6h prn

or

ibuprofen (Advil, Motrin, generics), 200 mg, 1–2 tabs PO tid-qid prn

or

naproxen (Naprosyn, generics), 250 mg, 1–2 tabs PO bid-tid prn

Do not use NSAIDs if there are contraindications to the use of aspirin or NSAIDs (such as a history of allergy to aspirin or NSAIDs or peptic ulcer disease). Instead, use acetaminophen.

Monitoring and Follow-Up

- Arrange follow-up at 1–2 days, at 7 days and then every 2 weeks to assess response to treatment
- Start range-of-motion exercises within pain-free range once symptoms are controlled
- Advise client to begin stretching and strengthening program when full range of motion is regained

Referral

Most clients, including those with cervical radiculopathy, improve and return to normal activity within 2 months. Clients who are still symptomatic after 4 weeks of non-operative treatment should be referred to a physician for further evaluation.

A physiotherapy consultation or referral would be useful, if one is readily available, particularly if the patient has had neck pain for more than 3 weeks and/or the pain persists despite doing home exercises.

OSTEOARTHRITIS (DEGENERATIVE JOINT DISEASE)^{65,66,67}

Influence of multiple factors on the articular cartilage of movable joints. Variable amounts of synovial inflammation result, new bone forms at joint surfaces (osteophytes).

Primary osteoarthritis typically can be found with many of the following:

- Pain (including aching or stiffness) affecting fingers (DIP and PIP joints), knee, hip, and/or spine most often
- Asymmetric involvement of joints

- Crepitus on active motion of the knee
- Bony tenderness and/or enlargement
- No warmth on palpation
- Stiffness in morning (lasting < 30 minutes) or after inactivity lasting < 30 minutes
- Severe, acute pain is not common
- Age > 50
- Low ESR (< 20 mm/h)
- Low rheumatoid factor (< 1:40)
- Radiologic findings of osteophytes or joint space narrowing (especially for hip and knee); the findings may not correspond to clinical examination

Secondary osteoarthritis is more likely to present atypically. Common risk factors are trauma, gout, other diseases, other bone and joint concerns.

Osteoarthritis usually slowly progresses with a stepwise decline. Patients will have different amounts of disability that may be correlated with the patient's compliance with nonpharmacologic treatments.

CAUSES

Unknown.

Risk Factors⁶⁸

- Older age
- Female
- Obesity (for knee and hand, possibly hip)
- Not having osteoporosis
- Sports activities (for example, regular wrestling, boxing, cycling, cricket, soccer)
- Occupation (physical labourer – type affects risk for specific kinds of osteoarthritis; for example, repetitive knee bending predisposes to knee osteoarthritis)
- Previous joint trauma to knee or hip
- Joint malalignment (for example, varus/valgus knees)
- Developmental joint abnormalities (for example, developmental dysplasia of the hip)
- Muscle weakness (quadriceps and knee osteoarthritis); increased hand strength and hand osteoarthritis
- Proprioceptive deficits (for knee osteoarthritis)
- Genetics
- Acromegaly
- Crystalline deposit disease (for example, gout, pseudogout)

HISTORY⁶⁹

- Family history
- Age > 40 years
- Pain in one or more joints (joints most affected are DIP [distal interphalangeal], PIP [proximal interphalangeal], MCP [metacarpophalangeal], knees, hips, spine [C5, T8, L3 are most common])
- Pain is aching in character
- Pain may worsen with changes in weather
- Pain often increases with activity, is relieved by rest and may progress so it occurs at rest and at night
- Pain may be referred (for example, to knee from hip)
- Localized joint stiffness may be present in the morning (< 30 minutes duration) or after periods of inactivity
- Generalized joint stiffness absent
- Crepitus (a noisy joint) may be present
- Joint enlargement with limited range of motion may be present
- Flare-ups of pain may occur after prolonged, unaccustomed use

PHYSICAL FINDINGS^{69,70}

Extent and pattern of physical findings are variable.

- Difficulty with mobility may be present if spine (cervical or lumbar), hips, feet, or knees are affected
- Joints may appear enlarged and deformed
- Range of motion limited according to extent of joint involvement
- Muscle strength and joint stability (ligament) may be affected
- Osteophyte formation (bony enlargement on peripheral joint)
- DIP and PIP joints may have osteophyte formation (Heberden's and Bouchard's nodes)
- First carpometacarpal and metatarsophalangeal joints commonly affected
- Tenderness may be present on joint palpation
- Crepitations may be felt or heard with movement of joint

The two forms of osteoarthritis are inflammatory and noninflammatory. Those with inflammatory osteoarthritis often have joint swelling, morning stiffness, night pain, joint effusion, and warmth on palpation of the joint. Those with noninflammatory osteoarthritis usually have pain (increased with movement) and disability, with joint tenderness, bony prominence(s) and crepitus.

DIFFERENTIAL DIAGNOSIS

- Gout
- Rheumatoid arthritis
- Infectious monoarticular disease
- Trochanteric bursitis (in clients with hip problems)
- Ligamentous or meniscal problems, local bursitis, loose bodies (in clients with knee problems)

COMPLICATIONS

- Chronic pain
- Progressive joint destruction with increasing loss of function and pain
- Impingement of spinal nerves

DIAGNOSTIC TESTS

- X-rays of affected joint
- Erythrocyte sedimentation rate
- Rheumatoid factor

MANAGEMENT⁷⁰**Goals of Treatment**

- Relieve or modify symptoms
- Preserve joint function
- Minimize disability
- Prevent complications
- Improve quality of life

Management depends upon severity of osteoarthritis and presence of associated reactive inflammation (synovitis) and should be individualized for each person.

Appropriate Consultation

Consult a physician if the client is < 50 years of age, there is multiple or atypical joint involvement, or if nerve dysfunction is suspected. Also consult a physician if a trial of acetaminophen does not reduce the pain and the client has a contraindication to NSAID therapy.

Nonpharmacologic Interventions

- Weight-reduction strategies to reduce stress on joints if client is obese
- Daily exercise program (walking is best, or swimming, bicycling) to maintain joint function and muscle strength, decrease arthritis pain and limit disability; the most benefit is gained early in the disease process
- Range-of-motion exercises, flexibility, muscle-strengthening, and aerobic exercises to target muscle groups that are weak (to help decrease disability and pain)
- Application of moist heat and cold for 20 minutes at a time to reduce joint pain
- Discourage bed rest or inactivity, as this will cause further loss of function and increase immobility
- Rest the affected joint for short periods (maximum 24 hours) if pain develops after prolonged use
- If knee osteoarthritis, patient can try soft, elastic heeled sports shoes, wedged shoe insoles, canes, walkers, and/or a sleeve elastic knee brace
- Physiotherapy

Client Education

- Explain prognosis, process, physical limitations, therapeutic options and expected course of the disease
- Educate about the importance of exercise to decrease pain and disability
- Discuss coping mechanisms (for example, activity avoidance, denial) and potential for depression; encourage patient self-management
- Counsel client about appropriate use of medications (dose, frequency, side effects) and nonpharmacologic interventions
- RheumInfo is a Canadian website with information for patients on the disease, medications, exercise, and heat and cold therapy, available at: <http://www.rheuminfo.com/>
- An online brochure about osteoarthritis is available from The (Canadian) Arthritis Society at: http://www.arthritis.ca/local/files/pdf%20documents/Types%20of%20Arthritis/TAS_OA_eBROCH_ENG.pdf. The Society also offers a patient education program on Arthritis Self-Management, (available at: <http://www.arthritis.ca/splash/default.asp?s=1&returnurl=/asmp/Default.asp>) that patients can be referred to, if available in your community

Pharmacologic Interventions⁷¹

Medications do not prevent progression of joint damage. Therefore, aim to control pain:

acetaminophen (Tylenol), 325 mg, 1–2 tabs PO q4–6h prn (maximum 4 g/day [12 regular strength tablets/day])

If there is insufficient pain control with acetaminophen, discontinue acetaminophen and initiate therapy with an NSAID, if not contraindicated (for example, heart failure, hypertension, renal failure, a history of peptic ulcer).

Start at a low dose and increase after 2–4 weeks if the drug is well tolerated but the pain is not well controlled.

ibuprofen (Advil, Motrin, generics), 200 mg, 1–2 tabs PO qid prn (maximum anti-inflammatory dose is 3.2 g/day)

or

naproxen (Naprosyn), 250 mg bid prn (maximum anti-inflammatory dose is 1.5 g/day)

NSAIDs should be taken continuously if prn use does not control symptoms or if the patient has inflammatory osteoarthritis.

If a 2- to 4-week trial of one NSAID is ineffective, then an alternative NSAID may be tried.

The COX-2 inhibitor celecoxib (Celebrex) may be prescribed by a physician, particularly if a patient has a low cardiovascular risk profile and is at high risk of gastrointestinal bleeding.

- Combination analgesics (for example, acetaminophen with codeine [Tylenol #3]) may also be prescribed to select patients who have insufficient relief with NSAIDs
- Intra-articular corticosteroid injections are sometimes used
- Topical therapies include diclofenac topical solution (Pennsaid) or gel (Voltaren gel) and capsaicin (Zostrix, many generics) topical cream

Monitoring and Follow-Up

Follow up after 2–4 weeks of starting a new medication to assess efficacy. Follow up every 3 months. Clients receiving daily doses of acetaminophen, ASA, or other NSAIDs should undergo regular monitoring as follows (every 6–12 months): blood pressure, complete blood count, creatinine level, electrolyte levels, liver function tests (LFTs), and stool examination (for occult blood). Assess compliance with exercise routine and discuss management issues the patient may be facing.

Referral

Refer to a physician if symptoms are not controlled with conservative treatment within 6 weeks. Arrange for physiotherapy (if readily available). Consider referral to an occupational therapist in cases where activities of daily living are limited by pain (for example, an occupational therapist can provide mobility assistive devices).

OSTEOPOROSIS

For detailed information on the clinical presentation, assessment and management, *see Chapter 10, “Hematology, Metabolism and Endocrinology”*.

PATELLAR FEMORAL SYNDROME

For detailed information on the clinical presentation, assessment and management, *see Chapter 14, “Musculoskeletal System” in the Pediatric Clinical Practice Guidelines*.

RHEUMATOID ARTHRITIS^{72,73,74,75,76,77}

A chronic systemic autoimmune disease characterized by progressive, symmetric and erosive polyarthritis that is inflammatory in origin, and affects primarily the distal joints. It can progress to affect the proximal joints. Certain extra-articular manifestations are common, including rheumatoid nodules, arteritis, peripheral neuropathy, keratoconjunctivitis, pericarditis and splenomegaly. Up to 5% of First Nations individuals have rheumatoid arthritis.

If treatment is not successful, significant disability occurs within 20 years. Joint damage starts early in the disease process of rheumatoid arthritis. The longer that active disease occurs, the less likely one is to respond to treatment. Therefore early and aggressive treatment is warranted, as disease-modifying antirheumatic drugs can slow the damage.

CAUSES

- Largely unknown

Risk Factors

- Female
- 30–55 years of age
- Nulliparity
- Family history
- Native ancestry
- Cigarette smoking
- Genetic factors
- Infectious factors (potential role)
- Rheumatoid factor autoantibody (more likely to have extra-articular disease)
- Occupational exposure to dust and fibres (for example, silica, asbestos, wood and electrical workers)
- Increased birth weight

HISTORY

- Recent systemic illness or trauma (usually for monoarthritis) may have occurred
- Onset of symptoms generally insidious with many joints affected (polyarthritis); other onset patterns include intermittent joint involvement (palindromic), or one joint (usually a large one; monoarthritis)
- Hands, wrists, elbows, shoulders, ankles and feet are the joints most commonly affected; joints exhibit pain, swelling, stiffness, warmth, and/or redness
- Pain and stiffness exacerbated by prolonged rest or strenuous activity
- Joint stiffness (slowness or difficulty moving) for at least 30 minutes to 1 hour upon rising in morning, over a period of more than 6 weeks; improves after moving
- Fatigue, general malaise, low grade fever, depression, and weight loss may be present during acute exacerbations, including onset
- Adversely affects daily routine and quality of life (for example, activities of daily living, employment type and ability to complete tasks)

As disease progresses:

- Morning and resting stiffness lasts for longer periods (an indication of disease progression)
- Disease progresses to involve multiple other joints, including DIP, all arm joints, all foot joints (similar to hand damage), knee, hip, cervical spine, cricoarytenoid joint (hoarseness, inspiratory stridor)
- Progressive joint destruction, deformity

PHYSICAL FINDINGS**Acute Exacerbation**

- Client in moderate distress
- Temperature may be elevated
- Heart rate may be elevated
- Affected joints swollen (bilateral symmetric joint involvement common and diagnostic, especially MCPs, MTPs, and PIPs); may feel “boggy”; may not be equal damage symmetrically
- Affected joints may be red
- Affected joints are warm and tender to pressure or movement
- Range of motion reduced (in particular, finger flexion, wrist and elbow extension, knee flexion)
- Decreased grip strength
- May be thickening of palmar flexor tendons
- Palmar erythema

Functional status can be assessed by the Stanford Health Assessment Questionnaire (HAQ), a self-report questionnaire available at RheumInfo: http://rheuminfo.com/wp-content/uploads/2011/04/Rheumatology_Clinic_HAQ_VAS_V2.pdf.

In addition to the typical signs and symptoms of rheumatoid arthritis, extra-articular disease manifestations may be seen, including but not limited to: anemia of chronic disease, fatigue, pleuropulmonary disease, pericarditis, neuropathy, episcleritis, renal disease, vasculitis, weight loss, fatigue, depression, bilateral carpal tunnel syndrome, osteoporosis.

Chronic Progressive Disease

- Affected joints are enlarged
- Joints become deformed: PIP joints take on fusiform shape (Boutonniere deformity); flexion contractures may occur (for example, swan neck deformity); ulnar deviation of MCP joints; deviation of wrists
- Subcutaneous rheumatoid nodules that are not attached to bone or skin may be present (small seed to marble sized; most common over proximal ulna)
- Progressive weight loss may occur

A definite diagnosis of rheumatoid arthritis (RA) is based on the confirmed presence of:

- Synovitis in at least 1 joint
- Absence of an alternative diagnosis that better explains the synovitis
- A total score ≥ 6 from the 4 domains forming the classification criteria below

Table 5 – Classification Criteria for Rheumatoid Arthritis

Domain	Description	Score
A. Joint involvement (swollen or tender joints on examination)	1 large joint (shoulder, elbow, hip, knee or ankle)	0
	2 to 10 large joints	1
	1 to 3 small joints (with or without involvement of a large joint)	2
	4 to 10 small joints (with or without involvement of a large joint)	3
	> 10 joints (at least 1 small joint)	5
B. Serology (at least 1 test result is required)	Negative rheumatoid factor (RF) and negative anti-citrullinated protein antibody (ACPA)	0
	Low positive RF or low positive ACPA	2
	High positive RF or high positive ACPA	3
C. Acute-phase reactants (at least 1 test result is required)	Normal C-reactive protein (CRP) and normal erythrocyte sedimentation rate (ESR)	0
	Abnormal CRP or abnormal ESR	1
D. Duration of symptoms (self-reported pain, swelling or tenderness)	< 6 weeks	0
	≥ 6 weeks	1

A score $\geq 6/10$ is needed to classify a patient as having definite RA.

Source: American College of Rheumatology/European League Against Rheumatism Collaborative Initiative. 2010 Rheumatoid Arthritis Classification Criteria. *Arthritis & Rheumatism* 2010;62(9):2569-81.

DIFFERENTIAL DIAGNOSIS

- Degenerative osteoarthritis with inflammation (*see the section "Osteoarthritis"*)
- Septic arthritis
- Polymyalgia rheumatica
- Systemic lupus erythematosus
- Gout
- Psoriatic arthritis
- Gonococcal arthritis
- Reiter's syndrome (in men)
- Lyme disease
- Polymyositis
- Inflammatory bowel disease (for example, Crohn's disease, ulcerative colitis)
- Acute viral polyarthritis (for example, due to rubella, parvovirus, hepatitis B virus)
- Sarcoidosis
- Sjogren's syndrome
- Fibromyalgia
- Paraneoplastic disease

COMPLICATIONS

- Chronic pain
- Progressive joint destruction or deformity
- Loss of mobility (due to muscle weakness)
- Hematologic involvement (for example, anemia of chronic disease, neutropenia)
- Pulmonary involvement (for example, pleural effusion, interstitial fibrosis)
- Renal involvement (for example, glomerulonephritis, drug toxicity)
- Dermatitis (for example, subcutaneous rheumatoid nodules, skin ulcers)
- Coronary involvement (for example, pericarditis, coronary artery disease)
- Vascular involvement (for example, vasculitis, peripheral artery disease, stroke)
- Neurologic involvement (for example, neuropathy, carpal tunnel syndrome)
- Eye concerns (for example, episcleritis, scleritis, keratoconjunctivitis sicca, Sjogren's syndrome)
- Depression
- Osteopenia
- Lymphoma

DIAGNOSTIC TESTS

Before medications are started, newly diagnosed clients should undergo some basic laboratory tests: complete blood count, ESR, C-reactive protein, rheumatoid factor (note that only 30% of patients are positive when they first present), anti-nuclear antibody (ANA), anti-citrullinated peptide antibodies, creatinine LFTs. Urinalysis should also be performed before drug treatment starts.

Bilateral x-rays of hands, wrists, and feet to establish a baseline if rheumatoid arthritis is suspected.

MANAGEMENT^{78,79,80}**Goals of Treatment**

- Control pain
- Reduce inflammation
- Preserve joint function
- Prevent long-term disability
- Quickly achieve and maintain control of disease activity (for example, remission or lowest possible amount of disease activity)
- Maintain or improve quality of life

Disease activity (increase or decrease in symptoms) varies due to the natural disease course and the interventions (disease-modifying antirheumatic drugs) used. The goal is clinical remission, yet flares may occur. Clinical remission occurs when disease activity (for example, inflammatory response) is absent, yet does not mean that further erosive changes will not happen and/or that joint pain, swelling, or tenderness will be absent.

Appropriate Consultation

Consult physician as soon as possible for:

- Previously undiagnosed clients (for example, those with early inflammatory arthritis suspected of having rheumatoid arthritis)
- Clients whose disease is not controlled by current therapy (including those with a flare of increased symptoms, physical and laboratory findings of inflammatory synovitis)
- Clients whose disease is progressive
- Clients in whom a complication is developing

Nonpharmacologic Interventions⁸¹

Acute Episode

- Adequate rest and nutrition
- Rest for affected joints when they are inflamed and/or taking a nap when fatigued
- Splint affected joint during acute phase to reduce pain prn
- Ice packs to reduce pain and swelling of affected joints; moist heat applications to reduce pain, muscle spasms and stiffness (15 min QID prn)

Long Term

- Adequate, balanced, nutritious diet, high in fish oil
- Exercise program at least twice a week to maintain joint mobility (range of motion exercises) and muscle strength; should also include regular aerobic exercise (for example, walking, swimming, cycling)
- Maintenance of ideal body weight or loss of weight if obese
- Joint protection (for example, pace self, good body mechanics, enlarged grips, orthotics)
- Bone protection if client is on corticosteroids
- Heart protection (for example, smoking cessation, regular monitoring of blood pressure and lipids, regular exercise)

Client Education

- Explain risk factors for, and the course and prognosis of the disease
- Often improves during pregnancy, but drug use must be discussed with a physician prior to pregnancy
- Counsel client about appropriate use of medications (dose, frequency, side effects, compliance) and nonpharmacologic therapies
- Instruct client to take medications with meals to reduce gastrointestinal upset
- Stress importance of daily exercise in maintaining function and mobility of joints
- Pneumococcal and annual influenza vaccines are important due to immunocompromised state
- Teach the client relaxation exercises that may work for them (for example, guided imagery)
- Assess family support systems and encourage family members to become active in client's treatment program
- Advise client to return to clinic if acute episode occurs

- Rheuminfo is a website with information for patients on the disease, medications, exercise, heat and cold therapy (available at: <http://www.rheuminfo.com/>)
- An online brochure about rheumatoid arthritis is available from The (Canadian) Arthritis Society (available at: http://www.arthritis.ca/local/files/pdf%20documents/Types%20of%20Arthritis/TAS_RA_eBROCH_ENG.pdf). The Society also offers a patient education program on Arthritis Self-Management (available at: <http://www.arthritis.ca/splash/default.asp?s=1&returnurl=/asmp/Default.asp>) that patients could be referred to, if available in your community

Pharmacologic Interventions

A wide range of medications may be used to treat rheumatoid arthritis. Patients with mild disease will often receive an NSAID (for example, ibuprofen, naproxen), if tolerated, to control pain and inflammation. If a patient does not respond to one agent they may respond to another NSAID.

ibuprofen (Advil, Motrin, generics), 200 mg, 2–3 tabs
PO tid-qid

or

naproxen (Naprosyn, generics), 250 mg, 2 tabs PO
bid

Oral corticosteroids (for example, prednisone) are also used to limit inflammation, particularly during flares.

Erosive damage can start within a few months of the onset of rheumatoid arthritis. Therefore, treatment with a disease-modifying antirheumatic drug (DMARD, for example, hydroxychloroquine [Plaquenil], sulfasalazine, methotrexate, leflunomide [Arava]) and/or a biologic agent (TNF inhibitors, for example, infliximab [Remicade], etanercept [Enbrel], adalimumab [Humira]) should start as early as possible).

These drugs must be prescribed by a physician.

Reactivation of latent tuberculosis infection is possible in patients receiving biologic (anti-TNF) therapies. When this complication occurs it tends to be during the first 8 months of treatment; thus, all patients who are candidates for a biologic agent must have a negative tuberculin skin test prior to starting therapy.

Monitoring and Follow-Up

Acute Episode

- Follow up in 48–72 hours to assess response to therapy

Long-Term Surveillance

- Follow up regularly (frequency depends on stage of disease; for example, severely active disease every 2–3 weeks, well-controlled disease every 3–6 months)
- Evaluate C-reactive protein, erythrocyte sedimentation rate to monitor disease activity every 1–2 months (or as guided by a physician); creatinine (every 6 months); urinalysis (yearly); other laboratory evaluations may be necessary depending on the medication(s) the patient is on
- Assess weight, appetite, energy level, sense of well-being
- Joint evaluation (changes, new joints affected, swelling, tenderness, decreased motion, deformity); if hands are involved, examine wrists, elbows, shoulders, knees, MCP and PIP joints
- Functional status can be assessed by the Stanford Health Assessment Questionnaire (HAQ), a self-report questionnaire (available at RheumInfo: http://rheuminfo.com/wp-content/uploads/2011/04/Rheumatology_Clinic_HAQ_VAS_V2.pdf)
- Monitor symptoms and physical changes for progression of disease (for example, complications)
- Determine efficacy of therapy
- Encourage joint mobility through exercise program
- Identify acute exacerbations
- Patients on hydroxychloroquine require annual optometric examination

Referral

Refer any patient with suspected rheumatoid arthritis to a physician. For previously diagnosed rheumatoid arthritis patients, refer if not controlled on their current regimen. Arrange physiotherapy and occupational therapy consult (if readily available).

SHOULDER IMPINGEMENT SYNDROME^{82,83,84,85}

Pain and diminished function of the shoulder secondary to compression of structures surrounding the glenohumeral joint with shoulder elevation. It does not refer to injury of a specific anatomical part (for example, rotator cuff). This results in inflammation and weakness of the muscles of the rotator cuff which results in impingement, rotator cuff tendinopathy, and/or rotator cuff tears (also known as stages 1–3).

The rotator cuff muscles are the supraspinatus (abduction and external rotation), infraspinatus (external rotation and abduction), teres minor (external rotation and abduction) and subscapularis (internal rotation, abduction, adduction), all of which envelop the scapula. These muscles are required for the stability and function of the glenohumeral joint.

Supraspinatus is most often involved in rotator cuff tears. Subscapularis tears can also involve biceps tendon injury.

Stage 1: Usually occurs in people ≤ 25 years of age after strenuous activity; often gradual onset with dull ache in anterolateral shoulder. Swelling and bruising within the shoulder's bursae and tendons has occurred due to impingement.

Stage 2: Usually occurs in people 25–40 years of age who often have had multiple previous episodes; in addition to pain from tendinopathy of the rotator cuff, some permanent fibrosis, thickening or scarring of the bursae and tendons is present; x-rays may reveal calcific deposits within the rotator cuff.

Stage 3: Client usually > 40 years of age; may feel a sudden pop in the shoulder and then suffer severe pain. Client has a rotator cuff tear, biceps tendon rupture and/or a bony change.

CAUSES

Shoulder impingement syndrome: forceful or repetitive motion.

Rotator cuff tear: in addition to the above factors, degeneration, extrinsic structure impingement or tension overload due to throwing motion or traumatic forces.

Risk Factors

- Repetitive movements (in particular overhead movements)
- Older age
- Increased body mass index
- Manual labourer (for example, painter, mechanic)
- Trauma (for rotator cuff tears only)
- Pain in one shoulder predisposes one to problems in the other shoulder

HISTORY AND PHYSICAL FINDINGS⁸⁶

Perform a complete history and physical for the shoulder and neck, as described under “*Assessment of the Musculoskeletal System*” and “*Examination of the Musculoskeletal System*” in this chapter. Enquire about trauma or repetitive injury to the area at work or at leisure and past medical history.

All rotator cuff pathology (including shoulder impingement)⁸⁷:

- The posterior shoulder muscles may be atrophied if impingement present for a long time
- Decreased strength (compared to the opposite and uninjured shoulder) of the rotator cuff muscle(s) that is/are affected if impingement present for a long time
- Active range of motion may be decreased due to pain
- Shoulder pain (often localized to lateral deltoid) worse with overhead movement and often at night (for example, lying on the shoulder)
- Pain is increased with resisted abduction, external rotation
- **Painful arc** (for example, abduction with arms 30 degrees anterior to shoulder) is painful between 60 and 120 degrees
- **Neer test** is done by first stabilizing the scapula, placing the patient’s arm in full pronation and then inducing forced flexion of the shoulder. Pain with this maneuver indicates a positive test and is suggestive of subacromial impingement
- **Hawkins test** (hold the affected shoulder in one hand and then flex the elbow to 90 degrees and internally rotate the shoulder with the other hand). Hawkins is positive when the maneuver reproduces pain

Rotator Cuff Tendinopathy:

- Pain present during activities of daily living
- May be muscle atrophy over scapular fossa if tendinopathy present for a long time
- Asymmetric movement of the affected scapula may be present
- Often tenderness over affected muscle(s)
- Pain with range of motion greater than 90 degrees abduction or on internal rotation
- Weakness in the affected shoulder
- Decreased strength on “empty can” test for supraspinatus strength (available at: <http://www.livestrong.com/article/368202-how-to-test-supraspinatus-strength/>)
- Decreased strength on internal and external rotation (with elbows at 90 degrees and next to thorax)

Rotator Cuff Tear:

- Weakness and stiffness that impairs functional use of the affected shoulder
- Some rotator cuff tears are not painful, particularly in older adults
- Unable to smoothly control shoulder adduction (drop arm sign)
- Decreased strength on external rotation (with elbows at 90 degrees and next to thorax) and abduction
- A full thickness tear can be accurately diagnosed in patients over age 60 with a painful arc, drop arm sign, and external rotation weakness

RheumInfo, a Canadian website, describes (in a PDF document) and has videos for a very thorough physical examination of the shoulder. See RheumInfo’s “The Shoulder Examination” (available at: <http://rheuminfo.com/physician-tools/shoulder-examination>).

The Nicholas Institute of Sports Medicine and Athletic Trauma of Lenox Hill Hospital website describes and has pictures for some specific physical examination techniques for the shoulder (available at: <http://www.nismat.org/orthocor/exam/shoulder.html>).

DIFFERENTIAL DIAGNOSES

- Cervical radiculopathy
- Acromioclavicular osteoarthritis
- Subacromial bursitis
- Bicipital tendinopathy
- Rotator cuff tear
- Glenoid labrum tear
- Adhesive capsulitis

COMPLICATIONS

- Decreased shoulder range of motion
- Chronic pain
- Secondary adhesive capsulitis (loss of mobility)
- Tendon tear
- Decreased muscle strength and endurance

DIAGNOSTIC TESTS

None.

MANAGEMENT**Goals of Treatment**

- Relieve pain and inflammation
- Maintain function of shoulder
- Prevent complications

Appropriate Consultation

Consult a physician immediately about all stage 3 injuries (rotator cuff tears or biceps tendon ruptures). Consult a physician if a stage 1 or 2 injury remains symptomatic for > 4–6 weeks.

Nonpharmacologic Interventions**Rest Affected Limb**

Type and period of rest varies according to type and severity of injury.

- Avoid aggravating positions and activities (for example, all overhead activities)
- *Stage 3:* Place injured limb in sling for comfort⁸⁸

Ice Pack Locally to Reduce Pain and Swelling for Acute Injuries

Apply ice pack as follows:

- Apply ice to area for a maximum of 15 minutes qid
- If soft-tissue injury is severe, apply q2–3h
- Use ice as long as swelling and pain are present
- Heat is contraindicated in acute soft tissue injury
- Never use heat in acute or subacute phases of recovery
- Heat may be used for chronic pain or swelling

Conservative Treatment (Exercises)

Applies to all shoulder impingement, rotator cuff tendinopathy, partial thickness tears, all symptomatic and chronic tears and full thickness tears in patients that are elderly with comorbid conditions. These

measures should be completed for a minimum of 12 weeks before surgical repair is considered for most of these patients.

- Start range-of-motion exercises within pain-free range within 2–3 days, if possible. Stretch shoulder capsule to increase flexibility and keep movement, so range of motion is similar to the other shoulder in all directions (flexion, extension, abduction, adduction, internal and external rotation)
- Avoid aggravating positions and activities to control pain (for example, limit overhead and reaching activities initially; push, pull and lift with the elbows kept close to their side; avoid repetitive activities)
- Advise client to begin strengthening program only after full range of motion is regained. Strengthen the shoulder muscles (rotator cuff, scapular stabilizers and core muscles) with elastic bands and light weights used below shoulder level
- Exercise progression: passive range of motion, active assisted range of motion, isometrics, active stretching, and late stretching and strengthening exercises
- Home exercises are best done in multiple short sessions (for example, 5 minutes), not long ones
- Shoulder strengthening exercises, with instructions and diagrams can be found on the Nicholas Institute of Sports Medicine and Athletic Trauma of Lenox Hill Hospital website (available at: www.nismat.org/orthocor/programs/upperstr.html)
- Exercise should be preceded by application of moist heat for 15 minutes and should be followed by icing for a maximum of 15 minutes
- Any exercise that causes pain should be temporarily omitted

As range of motion, flexibility and strength improve, so will shoulder function. Patients can resume activities gradually after they have noted improvements both in symptoms and shoulder function with weeks of physical therapy.

Client Education

- Educate client about prevention and avoiding aggravating factors (for example, avoid repetitive movement, in particular those overhead; avoid carrying heavy objects)
- Improvement in symptoms and shoulder function requires dedication to exercise program for months

Pharmacologic Interventions

Stages 1–3: Anti-inflammatory analgesics to reduce pain and swelling for 7–10 days and then prn thereafter:

ibuprofen (Advil, Motrin, generics), 200 mg, 1–2 tabs
PO tid-qid prn

or

naproxen (Naprosyn, generics), 250 mg,
PO bid-tid prn

Do not use if there are contraindications to the use of aspirin or NSAIDs (such as a history of allergy to aspirin or NSAIDs or peptic ulcer disease). Instead, use:

acetaminophen (Tylenol), 325 mg, 1–2 tabs PO
q4–6h prn

or

acetaminophen with codeine (Tylenol #3), 1–2 tabs
q4–6h prn

Stage 2 and 3: In addition to the drugs given above, corticosteroids may be injected into the subacromial bursa, by a physician.

Monitoring and Follow-Up

Stages 1 and 2: Clients with this type of acute injury should be monitored as follows:

- Arrange follow-up at 1–2 days and at 10 days and then monthly to evaluate symptoms and function until full range of motion and strength are achieved
- If shoulder function and pain improves after 4–6 weeks of exercises, the patient should continue the exercises and gradually resume their regular activities
- Full range of motion and strength without pain should be present prior to returning to full work duties
- After full shoulder function has been achieved, exercises should be continued to prevent recurrence

Referral

Physiotherapy consultation or referral should be considered if at all possible for all shoulder pathologies.

Stage 1 and 2: If symptoms persist after 4–6 weeks of conservative therapy, refer to physician for evaluation.

Stage 3: Transfer to physician on next scheduled transport. Treatment is usually surgical repair, depending on whether there is significant loss of function and/or partial or full tears. Repair is more

likely in young clients than in elderly clients. Many elderly clients have progressive loss of function of the rotator cuff as a result of aging.

Discuss a referral to an orthopedic surgeon with a physician:

- immediately if there is an acute full thickness rotator cuff tear in a healthy patient
- immediately if there is a pre-existing partial rotator cuff tear with the patient suddenly losing their ability to abduct or flex the shoulder
- after 6–9 months for rotator cuff tendinopathy if the above measures do not significantly provide relief of symptoms and/or improve function
- after 6–12 weeks for partial rotator cuff tears if the above measures do not provide relief of symptoms or improve function

SHOULDER TENDINOPATHY AND BURSITIS^{89,90,91}

Tendinopathy: A disease of a tendon, including tendinitis, tendinosis, and tendon rupture

Tendinitis: Inflammation of a tendon

Tendinosis: damage to a tendon at the cellular level, often due to chronic degeneration

Bicipital tendinitis involving the long head of the biceps tendon is a common cause of shoulder pain.

Rotator cuff tendinopathy most often involves the supraspinatus tendon⁹² (see “Rotator Cuff Tendinopathy”, under “History and Physical Findings”, in the section “Shoulder Impingement Syndrome”).

Bursitis: Inflammation or degeneration of the subacromial bursa; a common cause of shoulder pain.

CAUSES

Tendinitis: Overuse, repetitive strain from repeated motion.

Biceps tendon injury happens more frequently in those who are involved in frequent pulling, lifting, reaching, or throwing. It also occurs due to shoulder injury such as impingement, rotator cuff pathology or instability.

Bursitis: Local trauma, overuse, repetitive trauma, infection, bleeding, related to a systemic disease (for example, rheumatoid arthritis, gout, sepsis, polymyalgia rheumatica), inflammation of the supraspinatus tendon, shoulder impingement.

HISTORY AND PHYSICAL FINDINGS

Perform a complete history and physical for the shoulder and neck, as described under “*Assessment of the Musculoskeletal System*” and “*Examination of the Musculoskeletal System*” in this chapter.

Enquire about trauma or repetitive injury to the area at work or at leisure and past medical history. A fever or recent bacterial infection could indicate septic bursitis. It is often difficult to distinguish, by history and physical exam, a rotator cuff tendinitis or tear and subacromial bursitis.

RheumInfo, a Canadian website, describes (in a PDF document) and has videos for a very thorough physical examination of the shoulder. See RheumInfo’s “The Shoulder Examination” (available at: <http://rheuminfo.com/physician-tools/shoulder-examination>).

The Nicholas Institute of Sports Medicine and Athletic Trauma of Lenox Hill Hospital website describes and illustrates some specific physical examination techniques for the shoulder (available at: <http://www.nismat.org/orthocor/exam/shoulder.html>).

Tendinitis and bursitis: Nonspecific and localized pain and aching (at rest and with movement) of the shoulder with reduced active range of motion.

With *bicipital tendinitis*, the pain is aggravated when the client flexes the forearm as the examiner provides resistance and simultaneously palpates the long head of the biceps muscle in the bicipital groove.

Biceps tendinopathy: Usually the pain is in the anterior shoulder with radiation to the biceps muscle. Increased pain with lifting, pulling and overhead activities. Often present with other shoulder pathology. Tenderness on palpation over the proximal long head of biceps at the bicipital groove (medial to the greater tubercle of the humerus) should be present. The Yergason test can be used to diagnose bicipital tendinitis. In this test, the patient’s shoulder is adducted and the elbow is flexed to 90°. The examiner palpates the bicipital tendon in the bicipital groove while resisting the patient’s attempt at forearm supination. A positive test occurs when there is pain in the bicipital groove, and is indicative of bicipital tendinitis.⁸⁸

Biceps tendon rupture often happens with trauma, and typically involves a proximal rupture of the long head of the biceps while sparing the short head of the biceps. During the injury, the patient will often feel a “pop,” acute onset of pain, bruising, and swelling.

Often, there is a “Popeye” deformity, which consists of the biceps that has retracted into the arm and appears as a mass seen or palpable near the elbow or in the middle of the upper arm.⁹³

With *subacromial bursitis*, pain is felt when the client lies on his or her shoulder and often radiates to the deltoid. Tenderness is elicited when the space on the lateral aspect of the shoulder, just inferior to the acromion, along the deltoid, is palpated. Usually, there is only decreased passive abduction of that arm. Subacromial bursitis may occur in a client with rotator cuff injury, shoulder impingement syndrome or a systemic disease (in this case it is often bilateral).

DIFFERENTIAL DIAGNOSIS

- Rotator cuff injury (for example, tendinopathy or tear, subacromial impingement)
- Glenohumeral arthritis
- Acromioclavicular injury
- Pectoralis minor strain
- Cervical or brachial plexus pain
- Septic bursitis
- Gout or pseudogout
- Rheumatoid arthritis
- Polymyalgia rheumatica

COMPLICATIONS

- Chronic pain
- Secondary adhesive capsulitis (loss of mobility)
- Instability of the shoulder
- Tendon rupture
- Decreased muscle strength and endurance

DIAGNOSTIC TESTS

None.

MANAGEMENT

Goals of Treatment

- Relieve pain and inflammation
- Maintain function of shoulder by restoring normal range of motion and strength
- Prevent complications

Appropriate Consultation

Consult a physician for all biceps tendon ruptures.

Nonpharmacologic Interventions

The treatment is the same for all biceps tendinopathy and subacromial bursitis conditions. Rest, ice, and heat are recommended until pain has decreased.

Rest Affected Limb

- Avoid aggravating positions and activities
- Type and period of rest varies according to severity of symptoms and type of injury or disorder
- Use sling in acute stage for brief period (2–3 days), then discontinue
- Rest the shoulder for 5–7 days

Ice or Cold Pack Locally to Reduce Pain and Swelling

- Ice, for a maximum of 15 minutes q3–4h qid, provides additional analgesia in some cases
- Use ice as long as swelling and pain are present
- Heat is contraindicated in the acute phase of soft-tissue injury
- Heat may be used for chronic stiffness and discomfort

Exercise

Note that the following exercises are not applicable to acute bursitis.

- Start range-of-motion exercises within pain-free range in 2–3 days (in cases of minor injury)
- Avoid aggravating positions and activities (for example, overhead arm movements, repetitive movements)
- Advise client to begin stretching and strengthening program when range of motion is regained
- Exercise progression: passive range of motion, active assisted range of motion, isometrics, active stretching, and late stretching and strengthening exercises
- Home exercises are best done in multiple short sessions (for example, 5 minutes), not long ones
- Exercise should be preceded by application of moist heat for 15 minutes and should be followed by icing for a maximum of 15 minutes

Any exercise that causes pain should be temporarily omitted.

As range of motion, flexibility and strength improve, so will shoulder function.

Client Education

- Educate client about prevention and avoiding aggravating factors (for example, avoid repetitive movement, in particular overhead movement; avoid carrying heavy objects)

Pharmacologic Interventions

Anti-inflammatory analgesics to reduce pain and swelling for 5–7 days:

ibuprofen (Advil, Motrin, generics), 200 mg, 1–2 tabs PO tid-qid prn

or

naproxen (Naprosyn, generics), 500 mg PO bid for 2 weeks or longer prn

Do not use if there are contraindications to the use of aspirin or NSAIDs (such as a history of allergy to aspirin or NSAIDs or peptic ulcer disease). Instead, use:

acetaminophen (Tylenol), 325 mg, 1–2 tabs PO q4–6h prn

Consult a physician when the above measures do not work for pain control and/or when there is rest pain and/or night pain.

Monitoring and Follow-Up

- Arrange follow-up at 14 days, sooner if needed, and then monthly until normal range of motion and strength are achieved
- A step-wise return to activity can occur once range of motion is free of pain

Referral

Refer to a physician if there is no improvement with conservative therapy in 4–6 weeks, if there is continued pain, or if there is a biceps tendon rupture. For subacromial bursitis, consult and refer to a physician if pain is still causing marked disability after 3 days of anti-inflammatory analgesics for a possible steroid injection to that area.

A physiotherapy consultation (if available) is useful to improve strength and flexibility of both the biceps and the shoulder muscles if symptoms are not resolving with initial conservative treatment after 4–6 weeks.

EMERGENCIES OF THE MUSCULOSKELETAL SYSTEM

CLAVICULAR FRACTURE^{94,95,96}

Clavicular fractures are common injuries, accounting for approximately 2.6% of all fractures.⁹⁵ The force required to fracture the clavicle is greater in adults than in children, therefore it occurs more often in children and adolescents. However, the incidence increases in older adults. In addition, healing occurs at a slower rate in adults, and there is a greater risk of complications.

The clavicle is the sole articulation of the shoulder girdle to the trunk. It protects major underlying vessels, the lungs and the brachial plexus. These structures are in close proximity to the clavicle and may be injured by the sharp edges of the broken bone.

Sixty nine percent of clavicle fractures occur in the middle third of the bone (class A), 28% involve the distal or lateral third (class B), and 3% involve the proximal or medial third (class C).⁹⁵

Class B fractures are further classified as:

- *Type I (nondisplaced)*: the supporting ligaments remain intact and there is no significant displacement of the fracture fragments
- *Type II (displaced)*: the coracoclavicular ligament ruptures, with resultant upward displacement of the proximal segment because of the sternocleidomastoid muscle
- *Type III (articular surface)*: the fracture involves the articulating surface of the acromioclavicular joint

CAUSES⁹⁴

- Class A fractures usually result from direct force applied to the lateral aspect of the shoulder due to a fall, sporting injury, or motor vehicle accident
- Class B fractures result from a direct force to the top of the shoulder
- Class C fractures result from a direct force to the anterior chest
- Fall onto shoulder or outstretched upper extremity
- Direct trauma to clavicle area
- Most proximal third fractures are from high energy trauma

Risk Factors

- Male gender
- Age < 30 years
- Older adult

HISTORY

- Fall onto outstretched upper extremity, fall onto the shoulder or direct clavicular trauma
- Pain (moderate to severe), especially with movement of the upper extremity
- Less pain if they are sitting up and supporting their arm (for proximal third clavicle fractures)

PHYSICAL FINDINGS⁹⁵

- Tenderness
- Swelling over fracture site (for example, hematoma)
- Crepitus and/or palpable movement of the bone fragment
- Deformity (usually inferior and anterior displacement of the affected shoulder)
- Tenting of the skin over the fracture
- Ecchymosis, especially when severe displacement causes tenting of skin
- Bleeding due to open fracture (rare) (for example, may appear as a puncture wound)
- Non-use of arm on affected side with affected arm held close to chest wall and supported by other arm

Distal neurovascular examination (for example, peripheral pulses, capillary refill, sensation, strength), head, neck, cardiovascular and lung examination (to clinically exclude pneumothorax) must be performed (see “Assessment of the Respiratory System” in Chapter 3, “Respiratory System”). This is particularly important if a lot of force was involved (for example, motor vehicle collision) or a proximal third clavicle fracture is suspected.

DIFFERENTIAL DIAGNOSIS

- Dislocation
- Shoulder fracture
- Rotator cuff injury
- Sternoclavicular joint injury
- Acromioclavicular joint separation

COMPLICATIONS⁹⁵

- Pneumothorax
- Hemothorax
- Severe internal injuries are often associated with proximal third clavicle fractures
- Intrathoracic injury (as with fracture of the first rib, great force is necessary to cause proximal-third clavicle fractures, and it is imperative to rule out underlying injuries)
- Subclavian artery and vein injury
- Internal jugular vein injury
- Axillary artery injury
- Scapula and/or rib fractures
- Brachial plexus compression may result from hypertrophic callus formation and may cause peripheral neuropathy
- Post-traumatic arthritis
- Delayed union or non-union (especially with distal-third fractures)
- Poor cosmetic appearance

DIAGNOSTIC TESTS

- Routine clavicle x-ray (the fracture is usually seen with an AP view)
- Chest x-ray to rule out pneumothorax

MANAGEMENT**Goals of Treatment**

- Identify and treat associated life-threatening injuries
- Stabilize fracture site
- Relieve pain
- Identify and manage complications

Uncomplicated clavicle fractures may be managed by a primary care provider.

Appropriate Consultation⁹⁵

Consult a physician as soon as the patient is stable for a potentially emergent or urgent referral if there is:

- open fracture
- neurovascular compromise
- respiratory compromise
- intrathoracic injury
- hemodynamic instability
- completely displaced fracture (for example, displacement greater than 1cm if proximal third fracture or greater than the bone width)

- displaced fractures with shortening or comminution (two fracture sites present)
- type II or III distal clavicle fracture
- posterior displacement of proximal third fracture

Nonpharmacologic Interventions⁹⁵

- Employ the ABC (airway, breathing and circulation) approach to evaluation and stabilization
- Perform a careful secondary survey
- Apply a cold pack to site of injury for 20 minutes every 1-3 hours while awake for 72 hours
- Immobilize the upper extremity with a sling until clinical union at the fracture site happens (for example, the site is not tender and the patient can fully move the arm with little discomfort). This usually takes 3-12 weeks in adults

Class A (Middle-Third Fractures)

- Treat with sling immobilization (some prefer a figure-of-eight clavicular splint, especially for displaced fractures)

Class B (Distal-Third Fractures)

- Type I (nondisplaced) and type III (articular surface) fractures of the distal clavicle are treated with sling immobilization
- Type II (displaced) fractures should be immobilized in a sling and swath (so the arm is in an anatomic position) and may require orthopedic surgical fixation

Class C (Proximal-Third Fractures)

- Treat nondisplaced fractures with sling immobilization
- Displaced fractures may require orthopedic referral for surgical reduction

Open Fractures

If the fracture is open, the client should be treated with prophylactic antibiotics, tetanus (Td) vaccination (if needed), sterile irrigation of the skin and placement of a sterile dressing while awaiting urgent orthopedic consultation.

Client Education

- Client should use a sling or shoulder immobilizer
- Alternatively, client may use a figure-of-eight bandage (clavicle strap); educate clients as to proper placement and adjustment techniques; paresthesias or edema in the hands or fingers indicate that the strap is too tight and should be removed and reapplied; purpose of this bandage is to reduce pain by decreasing movement of the fracture fragments, not necessarily to maintain perfect alignment; may be combined with a sling for added comfort
- Patient can use shoulder as much as symptoms allow, but should not participate in strenuous activities
- If using a sling encourage daily elbow range-of-motion exercises to prevent functional decline
- For distal third fractures encourage shoulder range-of-motion exercises as soon as symptoms allow, to prevent a frozen shoulder. A pendulum exercise where the patient gently draws circles with their dangling arm after bending over at the waist is helpful
- After immobilization is removed and the patient is pain free, patients should start shoulder range of motion and strengthening exercises
- Counsel client about injury prevention: adequate protective gear for participation in certain sports, use of seatbelts, drug and alcohol counselling (as needed), early physical therapy (for example, range-of-motion exercises) if indicated
- Avoid strenuous activities and contact sports until at least 4 weeks after clinical union and the client has full range of motion, their usual strength in the shoulder, and no pain with deep palpation over the fracture

Pharmacologic Interventions

Control discomfort with a nonsteroidal anti-inflammatory drug (NSAID).

ibuprofen (Advil, Motrin, generics), 200 mg, 1–2 tabs
PO tid-qid prn for 1–2 weeks

or

naproxen (Naprosyn, generics), 250 mg, 1–2 tabs
PO bid-tid prn for 1–2 weeks

Do not use if there are contraindications to the use of aspirin or NSAIDs (such as a history of allergy to aspirin or NSAIDs or peptic ulcer disease).

If an NSAID is contraindicated, not well tolerated or pain control is unsatisfactory consider use of a narcotic analgesic:

acetaminophen with codeine (Tylenol #3), 1–2 tabs
PO q4–6h prn

Consult a physician for prophylactic antibiotic orders if the client has an open fracture. These individuals also require a tetanus vaccination (if not up to date).

Monitoring and Follow-Up

- Reassess injuries in 48 hours, then follow up weekly until full shoulder mobility has returned
- Arrange orthopedic follow-up if necessary (this will depend on type of initial injury and presence of complications)

Referral

Consult a physician, as indicated under “*Appropriate Consultation*”, above. Medevac to hospital on the recommendation of a physician.

Arrange physiotherapy (if readily available).

LIMB, PELVIC AND HIP FRACTURES⁹⁷

A break in the continuity of the bone.

CAUSES

- Trauma
- Pathological fracture secondary to underlying disease (for example, osteoporosis)

TYPES OF FRACTURES^{97,98}

Descriptions of fractures should include the name of the injured bone, the location of the injury (for example, dorsal or volar) and the following when possible:

Condition of the Overlying Tissues

- *Closed (simple) fracture*: fracture that does not communicate with the external environment
- *Open (compound) fracture*: fracture that communicates with the external environment (for example, puncture wound or laceration of skin by site of fracture)

Fracture Orientation

- *Transverse*: fracture perpendicular to the bone’s long axis
- *Oblique*: fracture diagonally across bone’s long axis

- *Spiral*: fracture line goes in two different directions
- *Segmental*: A fracture that results in a single, large, free floating section of bone between two fracture lines
- *Avulsion fracture*: fracture in which fragment of bone is pulled from its normal position by muscular contraction or resistance of a ligament
- *Buckle fracture*: A fracture where there is bulging (buckling) of the bony cortex, seen almost exclusively in children
- *Greenstick fracture*: incomplete angulated fracture of a long bone, seen most often in children

Fracture Comminution

- *Comminuted fracture*: fracture involving three or more fragments of the same bone

Fracture Angulation or Displacement

- *Nondisplaced fracture*: fractured bone ends stay in alignment
- *Displaced fracture*: fractured bone ends out of alignment (for example, move away from each other)
- *Angulated fracture*: fracture site forms an angle relative to the long axis of the bone

Fracture Shortening

- The amount (in mm or cm), by which the bone's length has been reduced, along the long axis of the bone

HISTORY

- Determine exact mechanism of injury (for example, falling onto an outstretched hand)
- Pain
- Swelling
- Loss of function
- Numbness distal to fracture site (possible)
- Injuries to other parts of the body
- Past medical history (for example, osteoporosis, past injuries or surgeries in the affected area)
- Last meal (if urgent surgery may be required)

HISTORY OF COMMONLY SEEN FRACTURES

- *Fracture of the clavicle*: see the section “Clavicular Fracture”
- *Fracture of radial head (elbow)*^{99,100}: Usually caused by a fall onto an outstretched hand. Client may have difficulty with flexion at the elbow and may not be able to pronate the hand

- *Radial fracture (wrist)*¹⁰¹: In adults, the most common radial fracture is the Colles' fracture, which is extra-articular and occurs 2.5–3 cm (1–1.2 inch) proximal to the articular surface of the distal radius. This fracture occurs with the hand in dorsiflexion; the distal fracture segment is angulated dorsally and may cause a “dinner fork” deformity
- *Scaphoid fracture*¹⁰²: Often found in those who fall onto an outstretched hand and have radial sided wrist pain. Patients who have snuffbox tenderness (over the scaphoid) should be considered to have a scaphoid fracture, until proven otherwise
- *Metacarpal fracture*¹⁰³: Usually from direct trauma. Tenderness is localized to the injured metacarpal bone. A “boxer's fracture” is a fracture of the distal neck of the fifth metacarpal and is one of the most common metacarpal fractures. It is generally the result of punching something with a closed fist (generally a wall or refrigerator)
- *Finger fracture*: Most cause pain in the fractured bone. The three most common types of finger fractures are the following: (1) Distal phalanx fractures are usually crush injuries or direct blow to the tip of the finger which can produce significant soft tissue damage.¹⁰⁴ (2) Middle and proximal phalangeal fractures should be examined for evidence of angulation (by x-ray) or rotation (by clinical examination comparing alignment of the phalanxes bilaterally when the metacarpophalangeal and proximal interphalangeal joints are flexed at 90 degrees), each of which requires reduction by a physician. Most often caused by a direct force to the bone or to the dorsum of the hand^{105,106} (3) Small avulsion fractures of the middle phalangeal base occur with a hyperextension injury¹⁰⁷
- *Pelvic fracture*: Often associated with major trauma and can lead to significant blood loss¹⁰⁸ (see Chapter 14, “General Emergencies and Major Trauma”)
- *Hip fracture*: Common in elderly clients due to falls and osteoporosis. May not be very painful, but often presents as sudden onset of pain and inability to walk. Often presents with externally rotated hip and shortened lower extremity^{109,110}
- *Femur fracture*: Often associated with major trauma and can lead to significant blood loss¹¹¹
- *Tibial and fibular fracture*: Occur with high- and low-impact forces or repetitive use. Fractures of both bones at the same time are unstable and require urgent orthopedic consultation^{112,113}
- *Ankle fracture*: Often from low-impact force. Majority of fractures involve one or more malleoli¹¹⁴

PHYSICAL FINDINGS

- Skin puncture wounds or lacerations near a fracture site with or without protruding bones may be present if fracture is open (compound)
- Bruising and swelling
- Range of motion decreased (avoid assessing until after x-rays have been obtained if a fracture is suspected)
- Affected part may be pale if blood flow to the area is compromised (for example, slow capillary refill)
- Check temperature of area, capillary refill, and presence of pulses distal to site of injury (limb cool, pulses absent and sensation decreased if blood supply has been compromised)
- Test sensory function (to sharp and dull stimuli) and 2-point discrimination distal to site of injury
- Palpate area around fracture (including other bones and one joint above and below) to ensure no other injuries
- Affected area extremely tender
- If bones are displaced, crepitus may be felt

RheumInfo, a Canadian website, describes in a PDF document and/or a video) a very thorough physical examination of the hip, elbow, shoulder, and knee. See “Sources” below and/or RheumInfo’s Arthritis University, available at: <http://www.rheuminfo.com/>.

DIFFERENTIAL DIAGNOSIS¹¹⁵

- Severe sprain
- Severe contusion
- Dislocation
- Abuse
- Pathologic fracture

COMPLICATIONS^{116,117,118,119,120,121}**Immediate (within First Few Hours)**

- Hemorrhage
- Damage to arteries, neurovascular bundle and surrounding soft tissues
- Compartment syndrome (can be seen with both closed and open fractures of the extremities)

Early (within First Few Weeks)

- Wound infection
- Osteomyelitis with compound fracture
- Mal-union
- Pulmonary or fat embolism
- Acute respiratory distress syndrome

- Chest infection
- Disseminated intravascular coagulopathy
- Exacerbation of general illness
- Compartment syndrome may result from casting
- Neurovascular injury
- Joint stiffness
- Muscle atrophy, contracture and/or disuse syndromes
- Thromboembolism
- Integumentary breakdown, including pressure ulcers

Late (Months or Years Later)

- Delayed, non- or mal-union
- Hardware failure (for fractures that have been reduced surgically with internal fixation)
- Persistent pain
- Deformity
- Osteoarthritis of adjacent or distant joints
- Avascular necrosis
- Traumatic chondromalacia
- Complex regional pain syndrome
- Synostosis (union of two neighbouring bones)

DIAGNOSTIC TESTS

X-ray, if available and only if result will affect decision to transfer care to hospital. For these cases, use the Ottawa Ankle Rules to decide whether an x-ray is warranted for ankle and knee injuries.

Ottawa Ankle Rules¹²²

Order ankle x-rays only if there is:

- pain on palpation in the malleolar zone (either malleolus and for 6 cm proximal to it) AND
- pain on palpation of the posterior edge or tip of the lateral malleolus OR
- pain on palpation of the posterior edge or tip of the medial malleolus OR
- inability to bear weight both immediately after the injury and for four steps at the time of examination

Order foot x-rays only if there is:

- pain on palpation in the midfoot zone AND
- pain on palpation at the base of the 5th metatarsal OR
- pain on palpation at the navicular OR
- inability to bear weight both immediately after the injury and for four steps at the time of examination

A teaching program for the Ottawa Ankle Rules is available online at: http://www.ohri.ca/emerg/cdr/ankle_rule_flash.html.

A poster is also available at: http://www.ohri.ca/emerg/cdr/docs/cdr_ankle_card.pdf.

Ottawa Knee Rules¹²³

Order knee x-rays only if a patient injured their knee and there is one or more of the following:

- age greater than or equal to 55 OR
- pain on palpation of the patella only OR
- pain on palpation at the head of the fibula OR
- inability to flex knee to 90 degrees OR
- inability to bear weight both immediately after the injury and for four steps at the time of examination

A teaching program for the Ottawa Knee Rules is available at: http://www.ohri.ca/emerg/cdr/knee_rule_flash.html.

A poster is also available at: http://www.ohri.ca/emerg/cdr/docs/cdr_knee_card.pdf.

MANAGEMENT¹¹⁷

Most bones join in 4–6 weeks; lower limb bones may take longer and fractures in children may take less time. See “Management of Specific Fractures of the Upper Extremity” below for more details.

Goals of Treatment

- Stabilize fracture
- Relieve pain
- Prevent or manage complications

Appropriate Consultation

Consult physician for all suspected or confirmed fractures. All open fractures and many comminuted fractures require surgical management.¹²⁴

Adjuvant Therapy

If hypotension is present in a client with a major fracture (for example, femur, hip, pelvis [see also the section “Pelvic Fracture” in Chapter 14, “General Emergencies and Major Trauma”]) treat for shock:

- Give oxygen – 10–12 L/min or more by mask; keep oxygen saturation > 97% to 98%
- Start two large-bore IVs and administer normal saline or Ringer’s lactate as needed (see the section “Shock” in Chapter 14, “General Emergencies and Major Trauma”)

For management of hypovolemic shock, see the section “Shock” in Chapter 14, “General Emergencies and Major Trauma”.

Nonpharmacologic Interventions¹²⁵

- Employ the ABC (airway, breathing and circulation) approach to evaluation and stabilization
- Recognize potential injuries based on the mechanism of injury
- Perform a careful secondary survey and address acute, life-threatening conditions
- Avoid excessive movement of the fractured bone(s)
- Apply ice and elevate the affected limb above the heart, if possible

Do not cast a fracture.

Do not attempt to reduce a displaced fracture.

- Immobilize and support involved area using splints, a back slab cast or sling (for upper extremities) as appropriate in the current position of the limb unless distal neurovascular function (for example, pulses, motor function, sensation) is not intact. If neurovascular concerns exist, consult a physician prior to splinting. Splinting helps decrease pain
- For client with a suspected displaced fracture or neurovascular compromise, give nothing by mouth because surgery may be needed

Open Fractures

If the fracture is open, the client should be treated with prophylactic antibiotics, tetanus vaccination (if needed), sterile irrigation of the skin and placement of a sterile dressing while awaiting urgent orthopedic consultation.

Client Education

- Counsel client about appropriate use of medications (dose and frequency)
- Advise client to keep limb elevated as much as possible during the first several days to reduce swelling
- If the client has a splint, ice can be applied for the first 72 hours
- Instruct the client about cast and splint care: keep dry, avoid poking objects down the cast, as this may result in damage to the skin

- Advise client to return to the clinic as soon as possible if pain increases or is new, if pressure, numbness or tingling develops, if there is significant damage to the cast or splint, if there is bleeding or discharge from the cast or splint, if the limb becomes cool, if colour changes are noted in the distal limb, or if no longer able to move distal joints or digits
- Teach client how to care for limb after removal of cast: skin should be kept clean and well hydrated with oil or petroleum jelly to prevent drying, cracking and infection; range-of-motion exercises should be done to regain joint mobility (tell the client that these exercises may be painful and that it may take some time to regain full mobility)

Pharmacologic Interventions¹²⁵

Control discomfort with analgesics such as an NSAID:

ibuprofen (Advil, Motrin, generics), 200 mg, 1–2 tabs
PO tid-qid prn

or

naproxen (Naprosyn, generics), 250 mg, 1–2 tabs
PO bid-tid prn

Do not use if there are contraindications to the use of aspirin or NSAIDs (such as a history of allergy to aspirin or NSAIDs or peptic ulcer disease).

If an NSAID is contraindicated, not well tolerated, or pain control is unsatisfactory consider use of a narcotic analgesic:

morphine 5–10 mg IM or SC q4h prn

or

acetaminophen with codeine (Tylenol #3), 1–2 tabs
PO q4–6h prn

Fracture pain may last a couple of days to a week. Pain after this period may signal a complication.

If pain is still not controlled with any of the above measures, consult a physician.

Consult a physician if the client has an open fracture, for prophylactic antibiotic orders if required (for example, open distal phalanx fractures may not require antibiotics).¹²⁶ Individuals with open fractures also require a tetanus vaccination (Td) if they have not received one within the past 10 years. If the primary series for tetanus vaccination is incomplete (< 3 doses of an immunization series) or is undetermined, vaccinate if it has been > 5 years since the last dose.¹²⁷

Monitoring and Follow-Up

- Monitor vital signs and watch for tachycardia and hypotension; shock may occur with major fractures of the pelvis and femur
- Monitor neurovascular status of area distal to the fracture site
- For uncomplicated, stable fractures, client should return to clinic in 3–7 days for neurovascular evaluation, earlier if needed.¹²⁵

Referral

- Medevac to hospital, if indicated, after consultation with a physician
- Medevac clients with open fractures, as immediate orthopedic consultation will be needed
- Refer clients with displaced fractures urgently, as orthopedic consultation is required, and surgical repair may be needed

MANAGEMENT OF SPECIFIC FRACTURES OF THE UPPER EXTREMITY

All of the above management considerations also apply to the following fractures (*see “Management”*).

Fracture of Radial Head^{99,128}

Management of a nondisplaced fracture includes a sling and posterior elbow splint for 1–2 days with range-of-motion exercises initiated as soon as possible. Follow-up weekly for 3 weeks to ensure improvement. X-ray again if there is more pain or no improvement in range of motion to ensure that no displacement has occurred with mobilization (displacement can occur if too much motion is attempted prematurely).

Displaced, open, dislocated, and unstable fractures of the radial head should be referred to an orthopedic surgeon for operative repair. Open (surgical) repair has better functional results for most radial head fractures.¹²⁹

Radial Fracture^{130,131}

If needed, a reduction by traction and manipulation may be performed by a physician. After the fracture is reduced, a plaster short-arm cast or a splint is applied for 5–8 weeks. If the fracture is nondisplaced and was not reduced, casting for 6 weeks is indicated. A follow-up x-ray 2 weeks after injury is done, through the cast, to check alignment. If the fracture was reduced, a follow-up x-ray should also be done

at 6 weeks after the injury, through the cast, to check healing and possible timing for cast removal. Active range of motion should begin immediately after cast removal.

Scaphoid Fracture^{102,132}

Patients who have snuffbox tenderness (over the scaphoid) should be considered to have a scaphoid fracture until proven otherwise. Those with a confirmed nondisplaced scaphoid fracture or with snuffbox tenderness and no apparent fracture on initial x-ray (as initial x-rays may be negative in up to 10%) should be treated by immobilization in a short arm thumb-spica cast or splint. After 7–10 days the x-rays should be repeated to confirm or rule out a fracture. Confirmed nondisplaced fractures are casted for 6–10 weeks. Patients with confirmed displaced scaphoid fractures should be placed in a long arm thumb-spica cast and seen urgently by an orthopedic surgeon.

Metacarpal Fracture^{133,134,135}

Nondisplaced fractures of the metacarpals are initially treated by immobilization in a forearm splint covering the dorsal and palmar aspects of the metacarpal being treated that places all joints in a functional position to allow the swelling to decrease. Displaced fractures should be splinted until they are reduced by a physician. Follow-up x-ray within 7 days is necessary and then the client should be put in a short arm cast or a custom splint by a physician for 4 weeks. Alternatively, metacarpal neck fractures can remain in a forearm splint for 4–6 weeks¹³⁶ and nondisplaced metacarpal head fractures can remain in a forearm splint for 2–3 weeks.¹³⁷ X-rays should be repeated weekly for 3 weeks to ensure the fracture is stable. Early range-of-motion exercises (for example, wrist flexion, extension, and grip strength) should be started as soon as possible after immobilization is removed.

Distal Phalanx Fracture^{126,138}

Protective splinting of the tip, with the distal interphalangeal joint in extension for 3–4 weeks is usually satisfactory. If the fracture is angulated or displaced it will need to be reduced. Open, unstable, comminuted or intra-articular fractures require referral to an orthopedic surgeon.

Middle and Proximal Phalangeal Fracture^{126,139,140}

Nondisplaced, stable, extra-articular fractures can be managed by dynamic splinting with “buddy taping” to the adjacent finger (4th and 5th fingers should be splints for each other) for 4–6 weeks. If pain or swelling is significant, one can start with 1–2 weeks of immobilization in a splint. Do follow-up x-rays in 1 week. Gentle range-of-motion exercises, both active and passive, should be initiated after 2 weeks with “buddy taping” in situ.¹⁴¹ Assess finger and range of motion every 1–2 weeks until finger function is normal.

Large intra-articular or displaced fractures are usually unstable and require orthopedic referral, as do open fractures.

OSTEOMYELITIS^{142,143,144}

Infection of the bone.

CAUSES

Bacterial infection (most common pathogen is *Staphylococcus aureus* [50% of cases], also *Streptococcus spp*, *Enterobacter spp*, *Pseudomonas spp*).

Risk Factors

- Extension of existing soft tissue or joint infection
- Trauma, compound fracture
- Direct introduction of organism into the bone (for example, foot puncture, surgery)
- Hematogenous spread of pre-existing infection

People with diabetes, sickle cell disease, peripheral vascular disease with chronic skin breakdown, immunosuppression, alcoholism, and chronic skin infection are particularly prone to osteomyelitis.

HISTORY

- Presence of one of the above risk factors (for example, diabetic foot ulcers, bone palpable, or bone exposed)
- Mild to moderate fever may be present if either abrupt or slow onset
- Infection of overlying skin and subcutaneous tissues may be present
- Localized pain, sometimes increased by weight-bearing or movement
- Heat, redness and swelling of affected area
- Fatigue
- Malaise

Acute Osteomyelitis

- Gradual onset of symptoms over several days
- Patients with osteomyelitis of the hip, vertebrae or pelvis usually only have pain
- Can result in septic arthritis as the presenting condition if pus gets into joint (*see the section “Septic Arthritis”*)

Chronic Osteomyelitis

In addition to the above symptoms under “History”:

- Sinus may be draining
- Ulcer that is not healing

Hematogenous (Blood-Borne) Osteomyelitis

In addition to the above symptoms under “History”:

- Original site of infection frequently not apparent; often history of acute bacteremia if vertebrae are involved
- Most commonly occurs in vertebrae
- Presents as persistent back pain with minimal or absent fever
- Onset and symptom progression is slow or abrupt
- May present as acute back pain with high fever, paravertebral muscle spasm and guarding of movements (mimicking pyelonephritis)

PHYSICAL FINDINGS

- Temperature may be elevated
- Heart rate moderately elevated
- Client in moderate distress
- Distress with weight-bearing and/or non-use of the extremity
- Involved area swollen and may be fluctuant, overlying skin red
- Range of motion reduced if adjacent joint is involved
- Purulent drainage from sinus may be present (late finding and/or if chronic)
- Area warm and tender to touch
- Nonhealing fracture (chronic osteomyelitis)

DIFFERENTIAL DIAGNOSIS

- Septic arthritis
- Cellulitis
- Active rheumatoid arthritis
- Animal bite
- Spinal cord infection or neoplasm
- Gout
- Deep vein thrombosis
- Lumbar disk disorder

COMPLICATIONS

- Chronic osteomyelitis with draining sinus tracts
- Chronic bone pain
- Loss of limb
- Subcutaneous, bone, paravertebral or epidural abscess
- Bacteremia
- Fracture
- Cellulitis (over the site)

DIAGNOSTIC TESTS

Draw blood for CBC, ESR, and blood cultures × 3.

MANAGEMENT**Goals of Treatment**

- Relieve infection
- Prevent complications

Appropriate Consultation

Consult a physician immediately.

Nonpharmacologic Interventions

- Bed rest
- Elevate and splint affected area
- Apply a sterile dressing if ulcer is present and/or if there is a draining sinus

Adjuvant Therapy

Start IV therapy with normal saline to keep vein open.

Pharmacologic Interventions

Antipyretic or analgesic for pain and fever:

acetaminophen (Tylenol), 325 mg, 1–2 tabs PO q4-6h prn (maximum 4 g [12 regular-strength tabs] daily)

Consider starting empiric antibiotics in consultation with physician if there will be any delay in transfer to hospital.

The choice of antibiotic and the route of administration (oral or parenteral) for initial treatment of osteomyelitis will vary with the presentation and the patient's medical history. Consult a physician.

Referral

Medevac as soon as possible. A prolonged course of antibiotics and possibly a referral to an orthopedic or general surgeon is necessary for this condition.

SEPTIC ARTHRITIS^{145,146}

Infection of a joint. It is usually bacterial, but includes fungal and mycobacterial infections as well. Also known as infectious arthritis. Approximately half of the cases involve the knee.

CAUSES

Common pathogens include *Neisseria gonorrhoeae*, *Staphylococcus aureus*, *Streptococcus pneumoniae*, *Mycobacterium tuberculosis*, *Pseudomonas aeruginosa*, gram-negative bacilli and occasionally *Haemophilus*. Infection with viruses and fungus is rare but may occur in immunocompromised clients.

Risk Factors

Predisposing Factors

- Elderly (age > 80)
- Diabetes mellitus
- Pre-existing joint disease (for example, rheumatoid arthritis)
- Recent joint surgery
- Previous corticosteroid joint injection
- Prosthetic joint
- Injection drug use
- Alcoholism
- Integumentary infection (for example, cellulitis), skin ulcers

Origin of Infection

- Contiguous spread from osteomyelitis
- Trauma (penetrating [for example, bite] or blunt)
- Hematogenous spread of bacteria (in 80% to 90% of cases) (for example, from injection drug use, indwelling catheter, immunosuppression [for example, HIV, medications])
- Inoculation during joint surgery

HISTORY

- Presence of one or more of the above risk factors
- Fever and occasionally chills
- Sudden onset of acute monoarticular or polyarticular joint pain, which is often severe (pain may gradually increase in prosthetic joint infections)
- Heat
- Redness
- Swelling
- Large joint usually involved
- Client unable to bear weight on affected limb, unable to move joint fully
- Recent history of urethritis, salpingitis or hemorrhagic skin lesions (indicating gonococcal infection) may be present
- Recent vascular catheterization or joint injection or aspiration
- Exposure to ticks (Lyme disease)
- Recent diarrheal illness
- Injection drug use

PHYSICAL FINDINGS

The classic signs of acute inflammation may be absent in elderly clients, those who are immunocompromised and those who use injection drugs.

- Temperature elevated (in 40–60% of cases)
- Heart rate elevated
- Client appears ill and in acute distress
- Joint(s) red (in only 50% of cases)
- Joint swelling (because of effusion)
- Range of motion severely limited (both active and passive)
- Client actively resists any movement of joint(s)
- Hemorrhagic skin lesions may be present
- Joint(s) warm (in only 50% of cases)
- Joint(s) tender
- Regional lymphatic nodes enlarged and tender
- Draining sinus (if prosthetic joint)
- Papular, pustular and/or vesicular skin lesions (if gonococcal septic arthritis)
- Concomitant skin, urinary tract or respiratory infection

DIFFERENTIAL DIAGNOSIS

- Localized synovitis due to trauma
- Cellulitis
- Rheumatic fever arthritis
- Active rheumatoid arthritis
- Active gout or pseudogout
- Reactive arthritis (Reiter’s syndrome)
- Psoriatic arthritis
- Lyme disease arthritis
- Drug-induced arthritis
- Viral arthritis
- Infective endocarditis (must always rule this out, as septic arthritis may be the presenting sign)

COMPLICATIONS

- Sepsis
- Septic shock
- Osteomyelitis
- Joint destruction
- Dysfunctional joint(s)
- Loss of limb

DIAGNOSTIC TESTS

Draw blood samples for complete blood count (CBC), differential erythrocyte sedimentation rate (ESR) and blood cultures × 3.

MANAGEMENT**Goals of Treatment**

- Relieve pain, infection and inflammation
- Prevent complications

Appropriate Consultation

Consult a physician immediately.

Nonpharmacologic Interventions

- Bed rest
- Splint limb, using pillows or a back slab, to protect involved area from injury and to control pain

Adjuvant Therapy

Start intravenous (IV) therapy with normal saline to keep vein open.

Pharmacologic Interventions

Analgesic or antipyretics for pain and fever:

acetaminophen (Tylenol), 325 mg, 1–2 tabs PO q4–6h prn (maximum 4 g [12 regular-strength tabs] daily)

Consider starting empiric antibiotics in consultation with physician; delay in treatment may result in joint destruction and/or sepsis.

The choice of antibiotic and the route of administration (oral or parenteral) for initial treatment of septic arthritis will vary with the presentation and the patient’s medical history. Consult a physician.

Monitoring and Follow-Up

Monitor vital signs frequently.

Referral

Medevac as soon as possible.

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