10 ORTHOPEDICS PRIMARY CARE

CORE CONCEPTS

- Discuss anatomy and physiology of musculoskeletal components.
- Recognize common musculoskeletal injuries.
- Assess a musculoskeletal injury or disorder.
- Perform specialized tests on a musculoskeletal patient when required.
- Treat common musculoskeletal disorders.

INTRODUCTION

Combat medics are required to assist or personally examine individuals who have orthopedic (musculoskeletal) injuries or disorders. Because physical exertion and strenuous activity are a part of the everyday job required of most soldiers, it is no surprise that musculoskeletal problems are extremely common. Often there are no obvious findings on a physical exam. Whether in a field environment or in a medical treatment facility, you must know what questions to ask and which examinations to conduct. You then must select an appropriate treatment plan to provide the best quality medical care, ensure a speedy recovery, prevent further injury, and even prevent permanent disability.

BONES

Bones have a variety of functions, and together, form the skeletal structure (Figure 10-1). They give the body its shape, provide structural support (in conjunction with muscles and adipose tissue), and protect vital organs. For example, the skull protects the brain and the rib cage protects the heart, lungs, liver, and kidneys. Bones assist in movement, serving as points of attachment for the muscles of the limbs. These attachments of muscle to bone allow us to do many things, such as stand erect, sit, jump, lift, and run. In addition to their structural and movement roles, bones produce blood cells, store minerals, and store chemical energy. There are five types of bones in the human body and they are the hardest and least flexible of the musculoskeletal tissues (Figure 10-2).

Flat Bones

Flat bones primarily function to protect internal organs. They also provide structural support and surfaces for muscle attachment. They are usually flat and thin. Examples include the skull, ribs, sternum, scapula, and coccyx.

Long Bones

The bones of the limbs, such as the humerus and femur, are long bones. They are longer than they are broad. Long bones support the weight of the body and facilitate movement. Long bone fractures may become a life-threatening injury due to the possibility of the jagged ends of the bone severing the arteries (eg, brachial or femoral) within the corresponding limb.

Short Bones

These roughly cube-shaped bones help provide stability and movement. They are located in the wrists and ankles.

Irregular Bones

Irregular bones protect internal organs. They have complex, varied shapes. For example, vertebrae are irregular bones that protect the spinal column. Other irregular bones include pelvic bones and facial bones. Irregular bones like the pelvic bones may also pose life-threatening risks when fractured. These bones, like long bones, can sever the major vessels and cause massive blood loss.

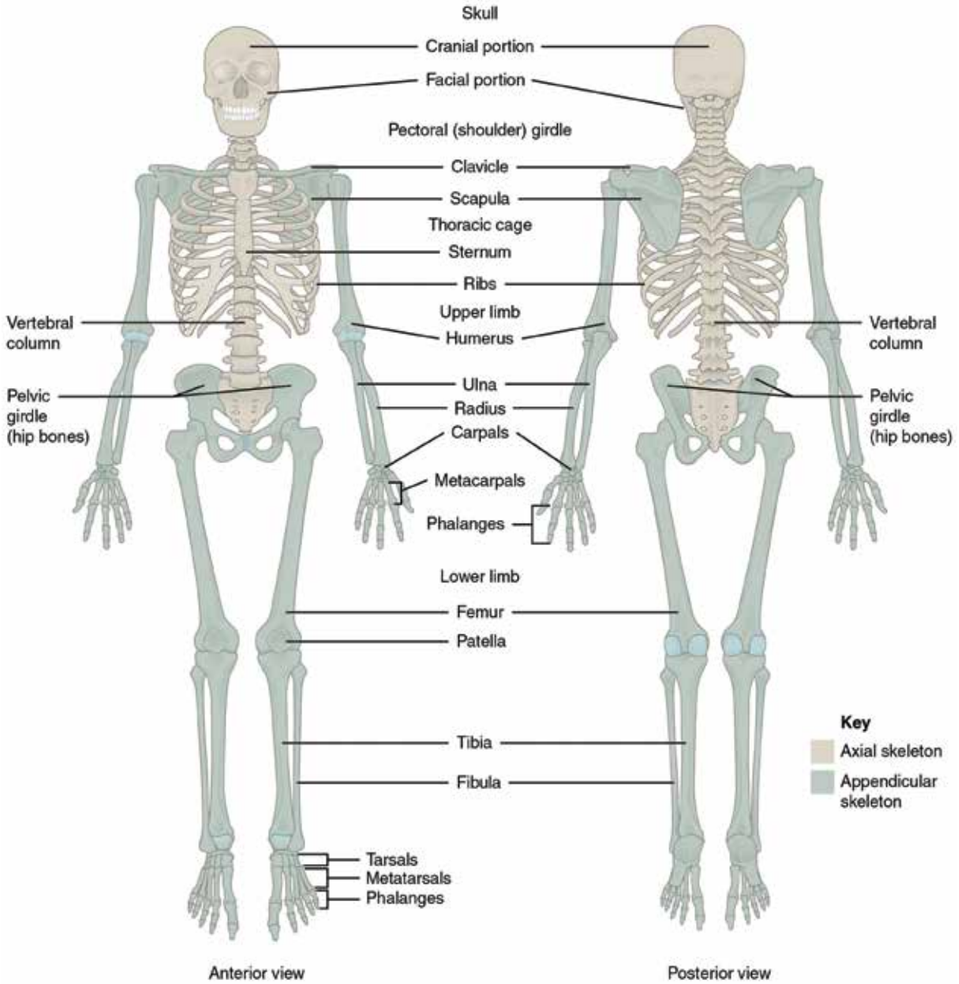

Figure 10-1. The human axial and appendicular skeleton. Reproduced from OpenStax College. Provided by Rice University. Access for free at https://openstax.org/books/anatomy-and-physiology/pages/1-introduction. License at https://creativecommons.org/licenses/by/4.0/legalcode https://openstax.org/books/anatomy-and-physiology/pages/7-1-divisions-of-the-skeletal-system

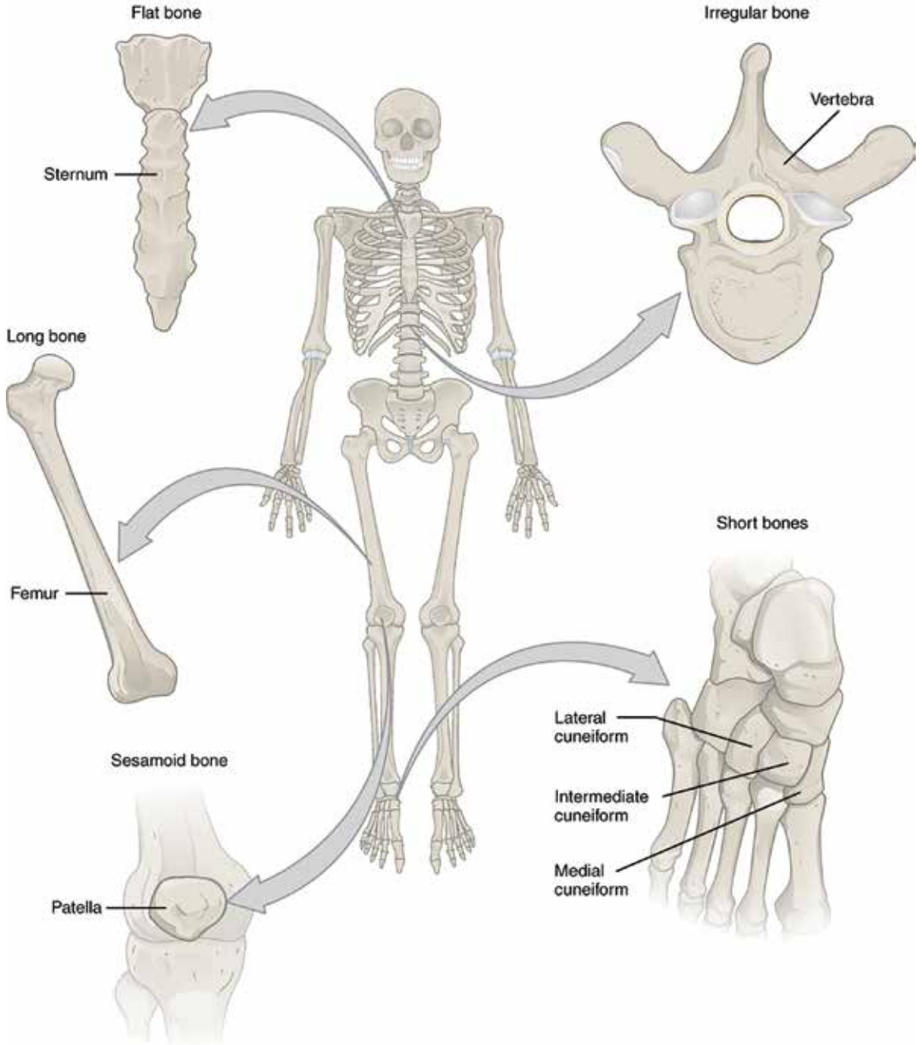

Figure 10-2. The five types of bones. Reproduced from OpenStax College. Provided by Rice University. Access for free at https://openstax.org/books/anatomy-and-physiology/pages/1-introduction. License at https://creativecommons.org/licenses/by/4.0/legalcode https://openstax.org/books/anatomy-and-physiology/pages/6-2-bone-classification#0y

Sesamoid Bones

The small, roundish sesamoid bones are embedded in **tendons** and help reinforce and protect them. The largest sesamoid bone in the human body is the knee (patella), but most are in the hands and feet.

Check on Learning

1. List five functions of bones.
2. How many types of bones are there?
3. What is the largest sesamoid bone in the body?
4. What are long bones and why could a fracture of these bones become life threatening?

JOINTS

A joint is a structure of bones connected to other bones by ligaments. The six different types of joints enable movement and provide stability. The joints with the most movement provide the least stability and the joints with the least movement have the most stability. Most joints of the extremities are synovial joints, which allow the greatest amount of motion (Figure 10-3). A bursa is a fluid filled sac typically found near a joint that helps reduce friction between bones and tendons or between tendons and ligaments.

Ball-and-Socket Joints

The shoulder and hip have ball-and-socket joints, the type of joint with the greatest range of motion. Their movements include anterior and posterior, lateral and medial, and they can rotate around the long axis. Structurally, a ball at the end of one bone rotates in a round, concave socket in another bone. The typical injuries that affect ball-and-socket joints like the shoulder are **dislocation** and **subluxation**. Dislocation occurs when the articular surfaces of the bones that make up the joint completely separate and no longer contact one another. Subluxation occurs when there is an incomplete dislocation of a joint.

Hinge Joints

Hinge joints can only bend and straighten. The convex end of one bone articulates with the concave end of another bone. Hinge joints include the elbow, knee, ankle, and joints between finger and toe bones.

Pivot Joints

The pivot joints rotate on a single axis. Structurally, a rounded portion of one bone is held in place at the **articulation** point of another bone and ligament ring. The joint between the atlas and axis allows the head to turn from side to side. The joint between the radius and ulna allows the forearm to rotate.

Condyloid Joints

These joints allow movement in two planes at right angles, bending, straightening, and moving side to side. They have an elliptical structure at the end of one bone that rests in a shallow depression at the end of another. Examples include the joint between the radius and carpus, and the knuckle joints.

Saddle Joints

These joints allow movement in two planes at right angles, without any axial rotation. The ends of both adjoining bones are saddle shaped and fit together like a rider in a saddle. The joint at the base of the thumb gives us the function of opposable thumbs. Saddle joints also occur in the shoulder (sternoclavicular joint) and inner ear (between the malleus and incus).

Gliding Joints

Gliding joints (plane joints) may allow limited movement in several directions, but the movement is constrained by surrounding ligaments. The surfaces at the end of articulating bones are flat (or mildly curved), so they can slide against one another. These joints are located between vertebrae, carpal bones of the wrist, tarsal bones of the foot, and between the clavicle and scapula of the shoulder.

TENDONS, LIGAMENTS, AND CARTILAGE

Tendons

Tendons connect muscle to bone to facilitate movement. The fibrous structures connect voluntary muscles to bones, cartilage, or ligaments. Tendons enable muscles to produce motion in the joint or body area to which they attach. They modulate forces from muscle contraction and provide stability.

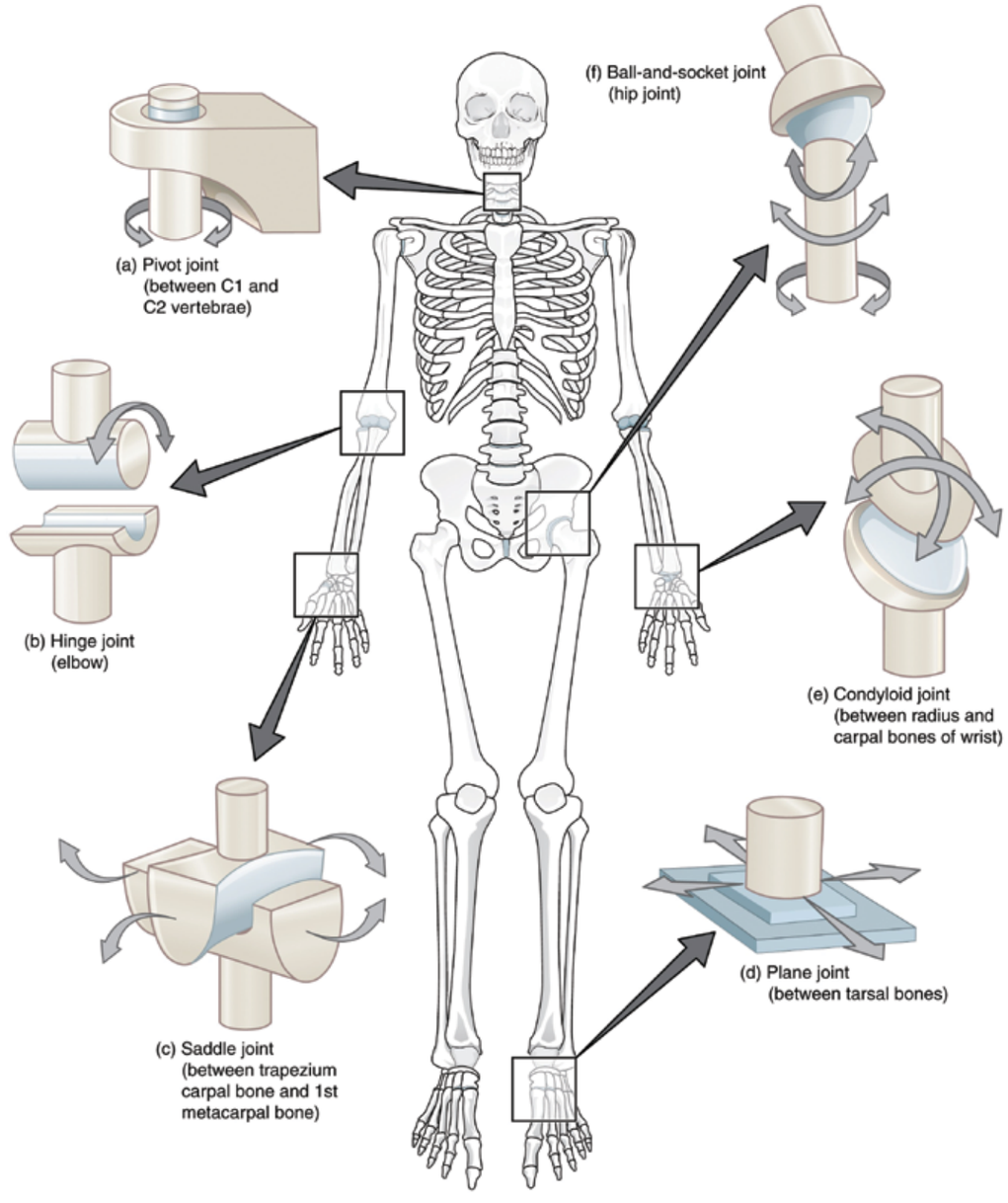

Figure 10-3. The types of synovial joints. Reproduced from OpenStax College. Provided by Rice University. Access for free at https://openstax.org/books/anatomy-and-physiology/pages/1-introduction. License at https://creativecommons.org/licenses/by/4.0/legalcode https://openstax.org/books/anatomy-and-physiology/pages/9-4-synovial-joints

Ligaments

Ligaments connect bone to bone at joints to provide stability. Ligaments are bundles of flexible connective tissue that form part of the fibrous capsule surrounding and attaching to a joint. Two or more ligaments reinforce all extremity joints. Ligaments stabilize and support the joint through its normal range of motion by confining its movement to specific planes and preventing **hyperextension** or **hyperflexion**. Ligaments within the ankle region are frequent sites of **sprains** in service members.

Cartilage

Cartilage is tissue that acts as padding and protects the ends of bones at the joint. Cartilage is also present in the rib cage, nose, spine, and various other locations. Cartilage is a semi-rigid, fibrous connective tissue with a smooth surface. It is **avascular** and derives its nourishment from the synovial fluid and the underlying vascular bone. Cartilage has many functions in adults, including the following:

- support soft-tissue structure (eg, keep trachea open, maintain shape of ear and nose);
- provide strength and elasticity;
- reduce friction between bones within joints;
- cushion vertebrae and resist compression;
- prevent abrasion, wear of bones, and ultimately, bone-to-bone contact in joints; and
- allow the rib cage to move during breathing.

MUSCLES

Muscles produce movement (voluntary and involuntary) and heat. Skeletal muscles contribute to voluntary and involuntary muscle movement through the somatic nervous system (SNS) and autonomic nervous system (ANS). Your ability to exert enough force to complete a 3-repetition maximum deadlift during the Army Combat Fitness Test is the result of the SNS acting on your skeletal muscles. In contrast, the ANS is responsible for involuntary muscle contractions, such as those that occur when your body is cold, cardiac contractions, and peristalsis.

Muscles are composed of contractile tissues. Their functions include the following:

- produce voluntary and involuntary movement,
- stabilize body position,
- move substances through the body,
- regulate temperature, and
- protect organs.

The different types of muscles have different functions.

Skeletal Muscles

Skeletal muscles allow for voluntary movement throughout the body (Figure 10-4). They also help with posture and stability, protect organs, and regulate body temperature. Familiar examples include muscles such as biceps, quadriceps, and gluteals. A muscle **strain** is a common injury among soldiers. It can occur in many locations (eg, calf, lower back, and groin).

Smooth Muscles

Smooth muscles are located in the walls of blood vessels, the digestive tract, and the reproductive tract. The muscle contractions within smooth muscle are involuntary. They help move food and urine and regulate diameter of blood vessels.

Cardiac Muscles

Cardiac muscles continuously contract to pump blood throughout the body and maintain blood pressure. Special pacemaker cells regulate the involuntary contractions of cardiac muscles.

Check on Learning

5. What are the functions of a joint?
6. Where are ball-and-socket joints located in the body?
7. Where are hinge joints located in the body?
8. Tendons connect bone to _____.
9. What are the functions of ligaments?
10. What is the main difference between skeletal and smooth muscle?

SKELETAL STRUCTURE

In an adult, the skeleton comprises 206 bones, divided into two distinct portions: the axial skeleton and the appendicular skeleton (see Figure 10-1).

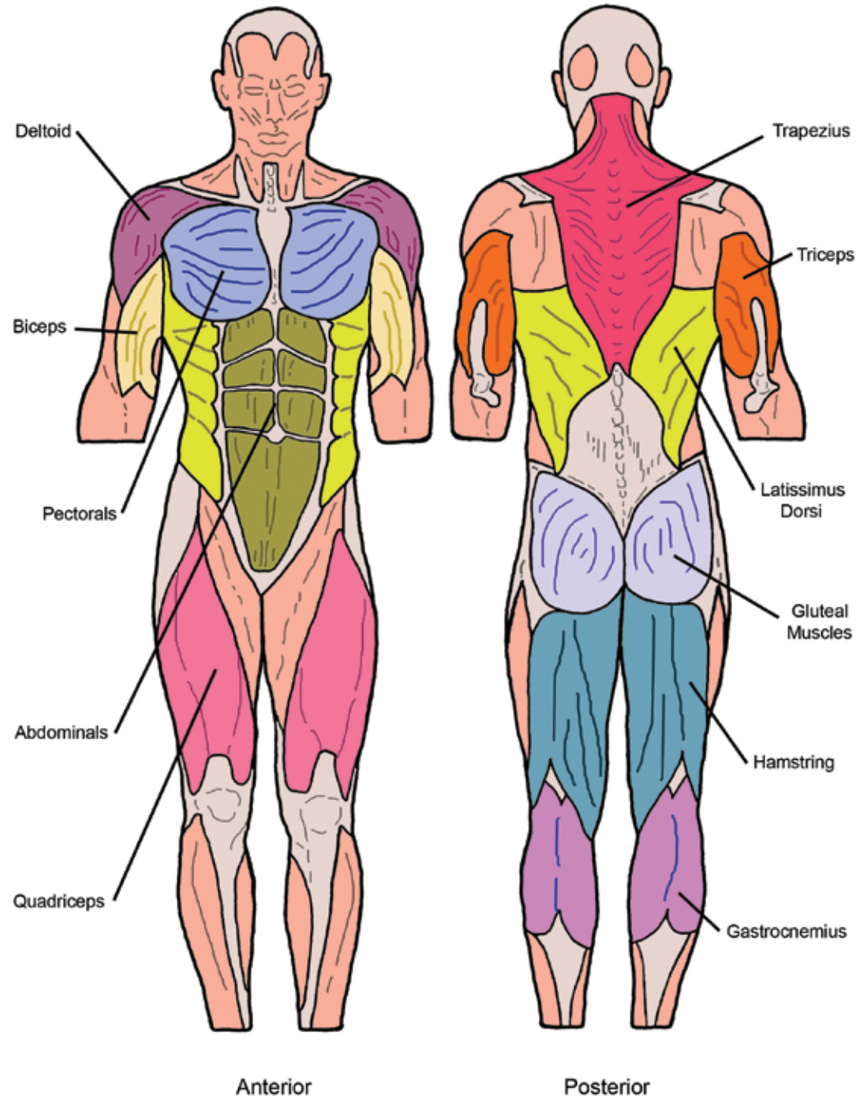

Figure 10-4. The major skeletal muscles of the body. Skeletal muscles are under voluntary control and are required for movement.

Axial Skeleton

The word "axial" refers to bones that are close to the medial axis of the body. The axial skeleton provides midline support above the pelvis, and protects the vital organs. The axial skeleton, with approximately 80 bones, consists of the skull, vertebral column, ribs, and sternum.

Head

The head consists of the skull and the facial bones. The skull includes the cranium and mandible. Several fused flat bones make up the cranium, which is the dome that protects and encloses the brain. Cranial sutures are the visible lines of fusion in the skull. The mandible is the lower portion of the mouth and jaw, which forms the chin. The facial bones (14 in total) include the nasal bones, cheekbones, and the upper mouth.

Spine

The spinal (vertebral) column is a curved structure that consists of 33 spinal vertebrae, divided into sections from top to bottom as follows (Figure 10-5):

- cervical (7 vertebrae),
- thoracic (12 vertebrae),
- lumbar (5 vertebrae), and
- sacrococcygeal (5 fused vertebrae in the sacrum and 4 fused vertebrae in the coccyx).

The cervical spine includes the atlas and axis (specialty vertebrae). The atlas allows you to move your head vertically, as in a "yes" nod, and the axis allows you to move your head laterally, as in a "no" movement. The cervical spine (neck region) supports the head and is vulnerable to whiplash-type injuries. The thoracic region provides attachment points for the ribs. The lumbar region is where the spine naturally curves back inward to the body and is a common site of injury and pain. The sacrum (5 fused vertebrae) helps stabilize the hips and supports the base of the spinal column. The coccyx (3–5 fused vertebrae) forms the "tailbone."

Each vertebra has an opening through the middle called the spinal canal. The spinal cord runs down the spinal canal, starting at the foramen magnum. The spinal cord only extends as far as the second lumbar vertebra. Below that point, only nerve roots pass through the spinal canal. The spinal column protects

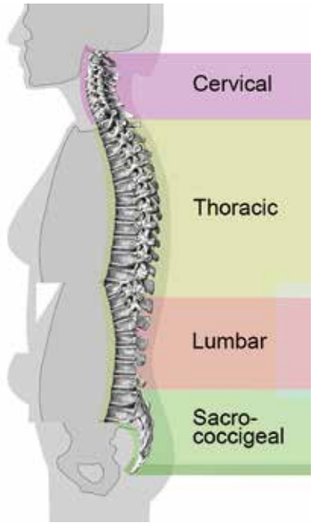

Figure 10-5. The segments of the spinal column. Image by Jmarchn, CC BY-SA 3.0, via Wikimedia Commons. Adapted from Wikimedia Commons. https://commons.wikimedia.org/wiki/File:Spinal_column_curvature_ca.svg

the spinal cord, which has nerve roots exiting between each of the vertebrae.

There is an intervertebral disc on the anterior side of each vertebra. This rubber-like disc acts as a cushion between the stacked vertebrae. The posterior portion of each vertebra has a bony projection called the spinous process, which connects with adjacent vertebra to create facet joints. These facets limit the movement of the spine. The concave and convex curves of the spine help distribute upper body weight and cushion the impact of walking and running.

From the spine, 12 pairs of ribs and the sternum form the thorax anteriorly (Figure 10-6). The thorax helps protect many vital organs and great vessels. There are 12 ribs, 1 attached to each of the 12 thoracic vertebrae of the spinal column and curving anteriorly toward the sternum. The 2 ribs not attached to the sternum are "floating ribs." Intercostal muscles between the ribs have 3 layers of muscle. They help expand the chest outward as you breathe.

The back comprises bones, discs, facet joints, ligaments, and muscles. The deep, paraspinal muscles are also called intrinsic muscles. They extend from the base of the skull to the sacrum and are responsible for back movements such as extending, arching, bending, twisting, or leaning to the side. The erector spinae act to flex

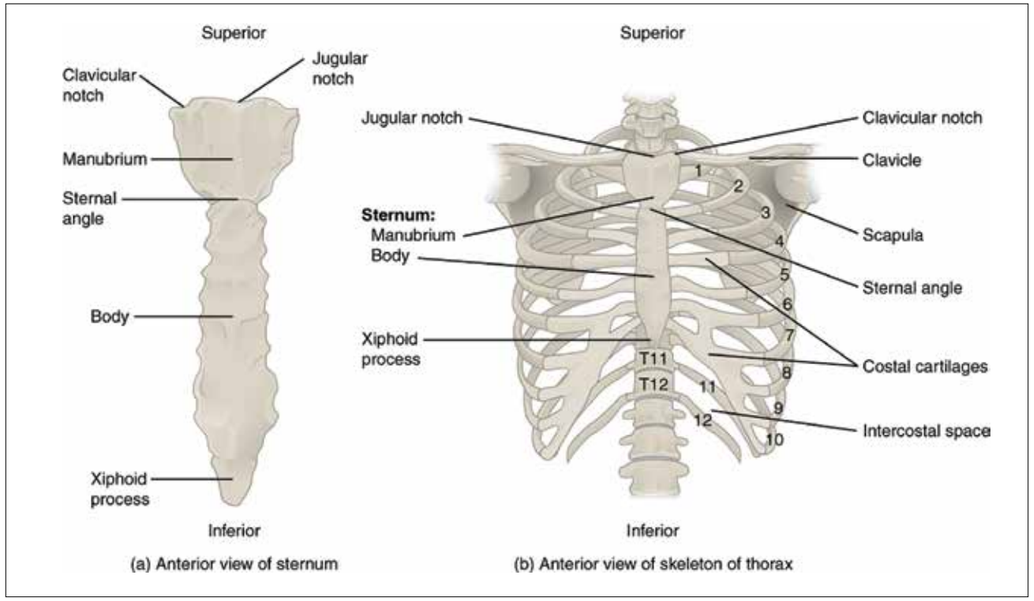

Figure 10-6. The ribs and sternum. Reproduced from OpenStax College. Provided by Rice University. Access for free at https://openstax.org/books/anatomy-and-physiology/pages/1-introduction. License at https://creativecommons.org/licenses/by/4.0/legalcode
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and extend the back. The transversospinales extend, rotate, and stabilize the vertebral column.

Appendicular Skeleton

The term "appendicular" derives from the word "appendage." The appendicular skeleton supports body movement. It comprises 126 bones divided into four sections: (1) shoulder girdle (or pectoral girdle), (2) upper extremities, (3) pelvic girdle, and (4) lower extremities (see Figure 10-1).

Shoulder Girdle

The shoulder (Figure 10-7) permits a wide range of movement in all directions through the action of four joints, three bones, and muscle groups. Together, these make up the shoulder girdle. Unlike other joints, there are no major ligaments to hold the bones together. The shoulder includes the clavicle (collarbone), scapula (shoulder blade), and head (ball) of the humerus. The

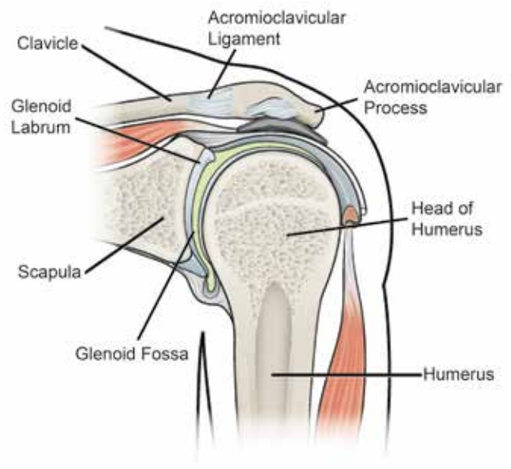

Figure 10-7. The shoulder. Image by CNX OpenStax, CC BY 4.0. Adapted from Wikimedia Commons (added labels). https://commons.wikimedia.org/wiki/File:Figure_38_03_10.jpg

clavicle is anterior and serves as support between the sternum and the scapula. The scapula is posterior and forms a part of the shoulder girdle, connecting the humerus laterally. The humerus hangs from the scapula, suspended from the shallow glenoid fossa (a socket or depression) by the joint capsule, ligaments, the glenoid labrum (a ring of tissue that increases the depth of the fossa), and a mesh of muscles and tendons. The acromion process of the scapula is the highest portion of the shoulder. It forms the acromioclavicular joint with the clavicle and is a frequent area of shoulder injury (acromioclavicular separation).

Upper Extremities

The upper arm and forearm (see Figure 10-1) include three main bones and many muscles. The humerus is the bone between the shoulder and elbow. The radius is the lateral bone of the forearm that joins with carpals (thumb side). When aligned with the thumb, the radius articulates with the humerus. The ulna is the medial forearm bone (little finger side). The elbow joint helps position the hand in space and stabilizes the lever action of the forearm. The humerus and the two bones of the forearm form the elbow.

The wrist consists of eight carpal bones. The hands include 5 metacarpals and the 14 finger bones, known as phalanges. The wrist and hand form a complex unit of small, highly active joints. These have little protection from overlying soft tissue and are vulnerable to trauma and disability.

Pelvic Girdle

The pelvic girdle consists of three fused bones (Figure 10-8). Together they form the hipbone. The ilium is the largest and most superior bone that makes up the hip joint. The superior aspect of the ilium is the iliac crest. Place your hands on your hips near your waist to feel this wide, bony wing. The ilium provides numerous attachment points for muscles and ligaments of the torso and hip.

The ischium is the lower and posterior portion of the pelvis. We sit on this bone. The joining of the bones of the anterior pubis forms the ischium.

The pubis (or pubic bone) makes up the anterior position of the pelvis. The pubis symphysis is a cartilaginous joint at the midline, where the left and right pubic bones join. It is in front of the bladder and is palpable above the genitalia.

The pelvis joins posteriorly to the sacral spine at the sacroiliac joint. The ball-and-socket hip joint is deeply

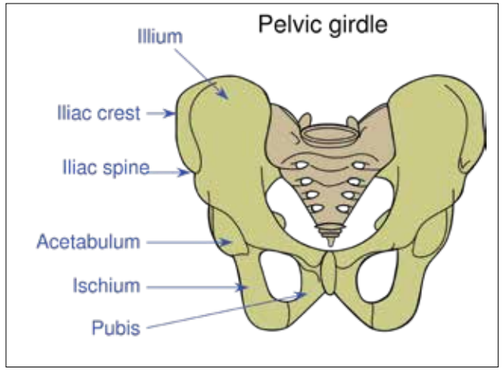

Figure 10-8. The pelvic girdle. Image by Fred the Oyster. Original by U.S. National Cancer Institute. Vectorization by Fred the Oyster, German translation kopiersperre/Rothwild, CC BY-SA 4.0. Reproduced from Wikimedia Commons. https://commons.wikimedia.org/wiki/File:Pelvic_girdle_illustration.svg

embedded in the pelvis and is the only moveable joint in the pelvis. It consists of the acetabulum (socket of the hip joint) and the ball at the proximal end of the femur (femoral head). The hip joint is stable and strong and has a wide range of motion **(ROM)**.

Lower Extremities

See Figure 10-1. The femur (thighbone), tibia, and fibula are the long bones in the leg. The femur is the longest and largest single bone of the body. The proximal end (head) of the femur is seated into the acetabulum (socket of the pelvis) to create a ball-and-socket joint. The distal end articulates with the tibia to create a hinge joint (the knee).

The tibia (shinbone) is the anterior bone of the lower leg and it forms the inferior portion of the knee joint. The smaller bone of the lower leg, the fibula, is lateral. The patella (kneecap) is the largest sesamoid bone in the body. The patella is incorporated into the quadriceps tendon and is anterior to the knee joint.

The knee joint is a hinge joint that involves the femur, tibia, and patella (Figure 10-9). It has three articulating surfaces: two between the femur and the tibia, and one between the femur and patella. Internal ligaments and cartilage of the knee include the anterior and posterior cruciate ligaments, **meniscus**, and the medial and lateral collateral ligaments. The stability of the knee is dependent on ligaments to hold the joint in place. The dependency of ligaments and the lack of

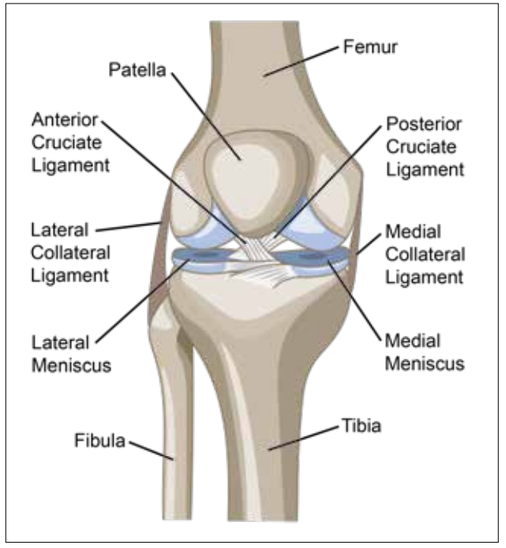

Figure 10-9. An anterior view of the knee. Image by DataBase Center for Life Science (DBCLS). Adapted from Wikimedia Commons (added labels). https://commons.wikimedia.org/wiki/File:202108_Anterior_view_of_knee_joint.svg

padding from fat or muscle make the knee joint highly vulnerable to injury.

The ankle is a hinge joint, located where the tibia and fibula connect with the talus (the most superior bone of the foot). There are two distinct protrusions (principal landmarks) on the lateral and medial aspects of ankles, the lateral malleolus (lower end of the fibula) and the medial malleolus (lower end of tibia). The tibia and fibula sit on the talus like an inverted cup.

The midfoot consists of seven bones called tarsals. The more distal foot bones (5) are metatarsals, and the calcaneus is the heel bone. The 14 toe bones are the phalanges. The total weight of the body transmits through the ankle to the foot. The ankle and foot balance the body and absorb the impact of the heel strike and **gait**. The ankle and foot are vulnerable to tendon, ligament, and bone injuries.

Check on Learning

11. What are the two major skeletal regions?
12. Name the five subsections of the spinal column.
13. Approximately how far does the spinal cord extend down the spinal column?

ASSESSMENT OF ORTHOPEDIC COMPLAINTS

Collect and document the subjective and objective data (see Chapter 1, Sick Call and Medical Documentation). All physical exams begin with obtaining a thorough history of the patient. Gather information from direct observation, witnesses, and others who can provide patient history related to the injury. When assessing any patient with orthopedic complaints, it is imperative to ask applicable questions based on the mechanism of injury (MOI) and available evidence. Note: Skull injury identification and treatment are not included here.

Direct observation can begin before a patient gets to an examination room. For example, an assessment of the spine can begin with watching a patient walk to the room. For a quick general impression, observe the patient's need for assistance (eg, litter, wheelchair, carry), the appearance of obvious pain, and their gait (the way they walk). Some patients may try to understate their symptoms so they do not appear weak, whereas others may exaggerate their injuries to receive a desired treatment. The legitimate extent of the injury may become more evident when the patient believes no medical professional is observing. Maintain an index of suspicion for orthopedic injury.

Physical Examination

The physical examination consists of inspection, palpation, ROM, and special tests. Document these in the order they are performed.

Inspection, Palpation, and Range of Motion

Inspection will include identifying any abnormalities such as trauma, deformities, redness, bruising, and swelling. Palpate the affected area for tenderness, abnormal masses, crepitus, and temperature changes. Observe the patient walking or moving and analyze ROM. ROM may be full or impaired. Measure ROM in degrees of angle from the affected area's normal, extended position. Ask the patient to complete specific ROM movements that pertain to the affected area, but neither you nor the patient should physically force a motion. For active ROM, instruct the patient to complete the test. If the patient has trouble completing the active test, conduct passive testing (if appropriate) by assisting movement, until you meet resistance or the patient complains of pain. Document ROM deficiencies and pain reported by the patient. Compare ROM in both the affected and unaffected extremities. Assess the patient's muscle strength and document as full or

limited. Muscle strength tests determine the ability of the muscle to perform against examiner resistance.

Special Tests

Your medical officer (MO) will train you on any special tests you may need to perform.

Documentation

Base the suspected diagnosis on the patient's history and your physical examination findings. List all findings, including those within normal limits. Document all physical examination findings in your SOAP (subjective, objective, assessment, plan) notes.

RED FLAGS

RED FLAGS are certain situations and complaints that call for special consideration. Refer these conditions to an MO immediately.

Check on Learning

14. When does assessment of the patient begin?
15. What are the three components of the physical exam for an orthopedic complaint?

ASSESSMENT OF THE NECK AND BACK

Subjective

Gather subjective information by asking the patient questions pertaining to their current spinal or back issue. Follow the directions given in Chapter 1, Sick Call and Medical Documentation. Specific details for subjective assessment of neck and back complaints follow.

Thoroughly investigate the quality of pain reported in neck and back injuries. Ask questions to determine if the patient is experiencing numbness or tingling anywhere in the body. Ask if they have localized, regional, or radiating pain. Ask for descriptions of their pain (eg, sharp, dull, throbbing).

Note: Patients may have difficulty describing their type of pain.

Investigate the severity and timing of the pain. Ask the patient to score their pain severity on a scale from 1 to 10, with 10 being the most severe pain imaginable. Ask if the pain limits or prevents activity. Determine if the pain is constant or intermittent. If it is intermittent, ask them if certain movements or activities trigger the pain.

The history of the complaint also provides important diagnostic information. Be sure to ask if they have painful or frequent urination. Determine if the issue is chronic or if a specific event caused the pain. Be sure to ask about previous injuries to their neck or back as well as how they were treated (eg, surgery, medication, rest).

Objective

Inspection

When conducting the physical examination of the neck and back, evaluate both anterior and posterior positions. The head should be midline with the shoulders; note any abnormalities from this position. If possible, have the patient point to where it hurts the most.

Palpation

Sweep the spine descending from the base of the skull, along the spinal column, all the way to the top of the pelvis to rule out misalignment and to locate any other abnormalities. If the patient has radiating pain, note how far it radiates from the point of origin. Tuning forks are an additional tool to assess for fractures when radiographs may not be immediately available. The high-frequency vibrations of the tuning fork pass through bone and elicit pain in a fractured bone. Certain locations may require auscultation while using a tuning fork in order to determine the pitch of a fracture in a patient. A fractured bone has a diminished pitch compared with a bone that is uninjured.

Range of Motion of the Neck

ROM assessments for the neck include flexion, extension, lateral bending, and rotation. Perform the following assessments:

- Flexion—have the patient bend their head forward and touch their chin to their chest (Figure 10-10).
- Extension—have the patient tilt their head back (Figure 10-11).

Figure 10-10. Neck flexion.

Figure 10-11. Neck extension.

Figure 10-12. Neck lateral bend.

Figure 10-13. Neck rotation.

- Lateral bending—have the patient tilt their head to the side as if attempting to touch the ear to the shoulder (Figure 10-12). Repeat in the opposite direction.
- Rotation—have the patient turn their head to the right and then to the left as far as they can without straining, while keeping their torso facing forward (Figure 10-13).

Examine the cervical muscles, using resistance to determine stability.

Caution: Do not force patients beyond pain threshold; this may cause permanent damage.

Range of Motion of the Back

ROM assessments for the back include flexion, extension, lateral bending, and rotation. Expose the patient's back during the examination to note smoothness and symmetry during flexion. Perform the following assessments:

- Flexion—have the patient bend forward at the waist as if attempting to touch their toes while keeping their knees locked (Figure 10-14). Once the patient is in the flexed position (about 75°–90°), check for curvature and other abnormalities (eg, deformity of the thorax) indicating scoliosis or muscle spasm.

Figure 10-14. Back flexion.

Figure 10-15. Back extension.

Note: Not all patients will be able to touch their toes, and the inability to do so does not necessarily indicate a limited ROM.

- Extension—have the patient arch their back posteriorly (Figure 10-15). This movement is very limited in comparison to back flexion in the average person. When conducting the extension movement (about 30°), support the patient by placing your hand in the position of the posterior pelvis or have them lean against the examination table, then tell the patient to lean back as far as possible. This movement helps evaluate the deep intrinsic muscles of the back.
- Lateral bending (about 35° on each side) uses the intrinsic muscles of the back and abdominal muscles. Assess lateral bending by having the patient bend at the waist laterally to the right and then left (Figure 10-16). Allow the arms to hang freely. Stabilize the patient by placing your hand laterally on the patient's pelvis as the patient bends side to side.
- Rotation (about 30° on each side) also evaluates the abdominal muscles and the intrinsic muscles of the back. Assess rotation by having the patient twist at the waist to the right and the left while keeping the hips facing forward (Figure 10-17). If you help the patient with stability, do not interfere with movement.
- Document any limited ROM as LIMITED or IMPAIRED; otherwise document ROM as FULL. Be sure to document any pain associated with the movements. Many patients can have full ROM yet have some pain in doing so.
- Assess quality of pain during flexion. Note signs and symptoms of an existing condition related to the chief complaint or any other underlying issue causing pain or stiffness. ROM may be limited, but this is a common complaint and a neurological exam may be normal.

Figure 10-16. Back lateral bend.

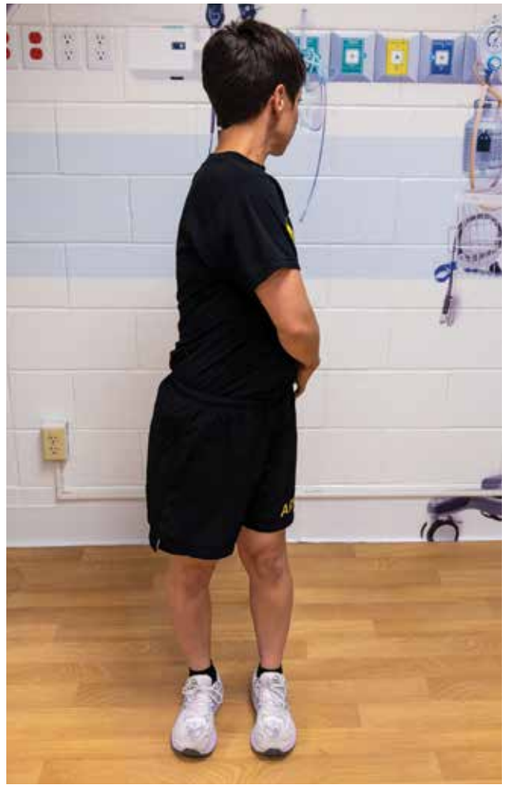

Figure 10-17. Back rotation.

Muscle Strength. There are many ways to assess muscle strength, including the following:

- The hamstring muscle test. Instruct the patient to sit on the edge of the exam table with their legs hanging freely at the knee. Ask the patient to flex the hamstring by bending one leg at the knee. Hold the ankle of the patient's flexed leg. Ask the patient to attempt to touch their foot to their buttocks while you apply gentle resistance against their motion (Figure 10-18).
- The quadriceps muscle test. Ask the patient to sit on the edge of the exam table with their legs hanging freely at the knee. Gently hold the ankle and instruct the patient to extend their leg against your resistance (Figure 10-19). Repeat with the other leg, and document any differences in strength.
- The calf muscle and anterior leg strength test can also be an indicator of lower back injury. Instruct the patient to sit on the edge of the exam table and let their legs hang freely. Since knees are bent, the gastrocnemius (calf muscle) is relaxed (its origin and insertion are closer together) and eliminated as a possible restriction of dorsiflexion. Now as you grip the forefoot, push as one unit into the plantar flexion (Figure 10-20) and dorsiflexion (Figure 10-21). The patient should be able to resist these motions. Document any differences in strength.

Special Tests. Additional specialized exams for cervical or spinal conditions may be required. MOs will train you on any additional special tests you may be required to perform.

Figure 10-18. The hamstring muscle-strength test.

Figure 10-19. The quadriceps muscle-strength test.

Figure 10-20. An assessment of calf muscle strength.

Figure 10-21. An assessment of anterior leg strength.

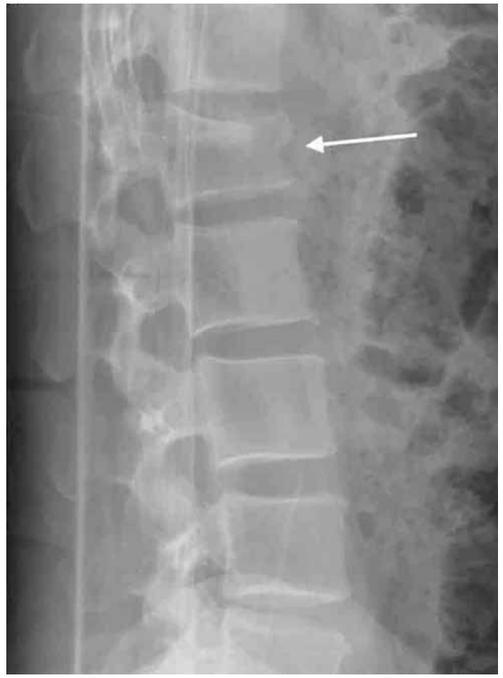

Figure 10-22. A cervical compression fracture. The reduced height of the vertebra in relation to the other vertebrae is a sign of compression fracture (arrow). Radiograph by Dr. Henry Knipe, CC BY NC SA 3.0. Reproduced from Store Medisinske Leksikon. https://sml.snl.no/ryggs%C3%B8ylebrudd

RED FLAGS of Spinal Complaints

RED FLAGS indicate immediate referral to the MO. RED FLAGS of spinal complaints include any of the following:

- unbearable pain that does not respond to treatment;
- repeated visits for the same complaint;
- numbness, tingling, or weakness in the extremities;
- bony deformities, step-offs, or crepitus;
- trauma with neurological changes or a deteriorating examination (alert, verbal, pain, unresponsive [**AVPU**] or Glasgow Coma Scale [**GCS**]);
- fever, weight loss, night sweats, night pain (and/or narcotic use);
- loss of bowel or bladder control;
- statements such as "I can't pee";
- inability to bear weight due to pain in the lower back; and
- significant decrease in ROM of the back.

Note: Recurrent or chronic pain can be a sign of cancer or fracture. An MO MUST evaluate the condition. Imaging is likely.

Check on Learning

16. Why should you avoid forcing patients to move beyond their point of pain?
17. List five RED FLAGS of spinal complaints.

COMMON COMPLAINTS OF THE NECK AND BACK

Neck and lower back pain are common complaints in a clinical and field setting. You must be able to evaluate the patient properly and refer to the MO as needed for further evaluation and treatment.

Cervical Fracture

Cervical fractures (Figure 10-22) are associated with significant MOIs supporting the diagnosis, such as trauma to the head and neck from a fall, motor vehicle collision, diving accident, or deceleration injuries. The location, persistence, distribution, and quality of pain are all important considerations in assessing cervical spine patients.

Signs and symptoms of cervical fracture include severe neck pain, radiating pain, and loss of movement to one or multiple extremities. Physical examination shows reduced or absent ROM, muscle strength, and sensory function. The patient may also display edema, erythema, ecchymosis, deformity, Battle's sign, neurological changes, crepitus, and step-off. Examine the patient. If they are clear of trauma, carefully evaluate their cervical spine ROM. Pain or stiffness can cause limited ROM of the neck.

Treatment of suspected cervical fractures includes immobilization and evaluation by the MO as soon as possible. Monitor the patient en route if transport or evacuation is necessary.

Warning: If the MOI is significant, immediately immobilize the cervical spine.

Cervical Strain

Cervical strain correlates with a history of whiplash injury and results when the soft tissues of the neck have sustained a hyperflexion injury.

Signs and symptoms include cervical pain and muscle stiffness, pain that increases with motion, and muscle spasms. Physical exam may reveal tenderness to palpation (**TTP**) or a limited ROM. A neurological examination is usually normal.

Treatment of suspected cervical strain is to refer patients with significant trauma to the MO to order radiographs and prescribe medications. Soft cervical collars, nonsteroidal anti-inflammatory drugs (NSAIDs), and muscle relaxants (for spasms) can all be useful, as well as profiles. Have the patient follow up in 24 hrs with the MO to determine if the signs and symptoms are worsening.

Lumbar Fractures

Lumbar fractures (Figure 10-23) are associated with high-energy trauma or minimal trauma in patients with osteoporosis, tumors, infections, or long-term steroid use.

Figure 10-23. A burst fracture of L4 as seen on computed tomography. Image by James Heilman, MD, CC BY-SA 4.0. Reproduced from Wikimedia Commons. https://commons.wikimedia.org/wiki/File:BurstCoL4LCT.png

Signs and symptoms include moderate to severe back pain that increases with motion. Numbness, tingling, weakness, or bowel and bladder dysfunction can suggest nerve root or spinal cord injury. Physical examination will reveal TTP at the point of injury, with edema, ecchymosis, hematoma, step-off, or a gap between the spinous processes (the portion of the spine that projects posteriorly and serves as the attachment of ligaments and muscles).

Treatment involves full spinal immobilization and evaluation in an emergency room.

Lower Back Pain

Lower back pain is a common complaint among soldiers. The cause of back pain varies, but usually occurs after poor lifting and twisting techniques, bad posture, and other repetitive movements over several years. The most likely cause of back pain is from injury to one of the three muscle groups (collectively called the paravertebral muscles) that help support the spinal column.

The extensor muscles attach to the back of the spine and help support the spinal column in standing and lifting heavy objects. Strenuous, repetitive, or sudden activity without sufficient preparation causes damage. If this activity damages the disc, compression could cause nerve damage.

The flexor muscles attach to the front of the spine and support forward bending and lifting of the lower back. Because the hip flexors attach the thigh to the spine and run through the pelvis, they are at risk of hyperextension and overexertion from improper lifting and supporting heavy and awkward-shaped weights. They can also become tight from sitting at a computer desk for long periods, resulting in lower back pain.

The oblique muscles attach to the lateral aspect of the spine and assist with twisting and good posture. Weak oblique and abdominal muscles can lead to bad posture over time, which will in turn cause tightening and shortening of paravertebral muscles that may eventually manifest as lower back pain. Axial loading can cause twisting injuries to the lateral spinous muscles. Sacral and coccyx injuries occur among soldiers who fall while carrying full gear.

Lower back strain is an injury to the paravertebral spinal muscles, whereas a sprain is an injury involving the ligaments. The patient may have strained the paravertebral spinal muscles due to a history of repeated or improper lifting or twisting motion. A trauma patient with back pain may also complain of numbness, tingling, weakness, or bowel or bladder dysfunction, which could indicate a spinal cord injury.

A limited ROM due to stiff and painful bending is a key indicator for common complaints such as arthritis, spinal stenosis (narrowing of the spinal column, which causes pressure on the spinal cord), and herniated or bulging discs. Pain may radiate and ROM may be limited, especially during flexion. Lower extremity motor and sensory functions are usually normal, although severe muscle spasms could cause pain or numbness in the lower extremities.

> **Note:** Do not confuse lack of limberness with a limited ROM.

Make sure there are no underlying causes for pain. Other causes may not be related to orthopedic complaints, such as kidney or gallbladder infections. Severity of pain should also take into account the patient's pain threshold, which varies among patients.

Symptomatic treatment includes activity modification, use of acetaminophen or NSAIDs for pain, heat application, and education on proper lifting and bending techniques. Lower back pain resolves quickly and the patient should return to duty in a few days. Refer the patient to an MO after repeated visits or if the patient has decreased or absent motor or sensory function.

Check on Learning

18. Which common spinal complaint is usually associated with a history of whiplash injury?
19. What is the common treatment for lower back strain?

ASSESSMENT OF THE SHOULDER AND UPPER EXTREMITIES

Subjective

Gather subjective information, as directed in Chapter 1, Sick Call and Medical Documentation. Ask the patient questions pertaining to their upper extremity complaint.

Objective

Inspection

For all patients, obtain a thorough history and maintain an index of suspicion. Consider the MOI and gather information obtained from the patient, witnesses, or associates (statements may reveal RED FLAGS, such as "my hand is numb," or "I cut my knuckle in a fight"). If a patient complains of joint symptoms, evaluate the joint above and below the area of complaint. Inspect the extremity for abnormalities. Have the patient place one finger on the most painful spot to localize the pain. Compare the affected extremity to the unaffected one. Observe the patient walking to evaluate the evenness and symmetry of the motion and make sure arms swing together with the opposite lower extremity.

Palpation

Palpate the affected area for tenderness, abnormal masses, crepitus, and temperature changes. Evaluate pulse and motor and sensory function at the affected area.

ROM of the Shoulder

Evaluate ROM of the patient's shoulder with flexion, extension, abduction, adduction, and rotation movements. Perform the following assessments on each shoulder:

- Forward flexion—instruct the patient to sit or stand with their arms at their sides. Have the patient slowly raise one or both arms anteriorly, continuing until they are pointing above the head (typically 180°) (Figure 10-24).
- Hyperextension—ask the patient to stand with the arm at their side, palms facing forward. Have the patient slowly raise the arm rearward (typically 50°) (Figure 10-25).
- External rotation and abduction (scratch test)—direct the patient to reach behind their head and attempt to touch the opposite shoulder blade (Figure 10-26).
- Internal rotation and adduction (scratch test)—direct the patient to reach behind their back and attempt to touch the opposite shoulder blade (Figure 10-27).

Figure 10-24. Shoulder forward flexion.

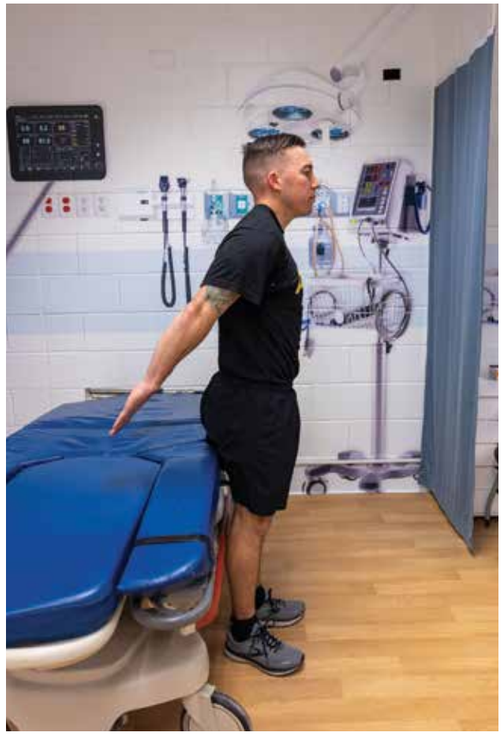

Figure 10-25. Shoulder hyperextension.

Figure 10-26. Right shoulder external rotation.

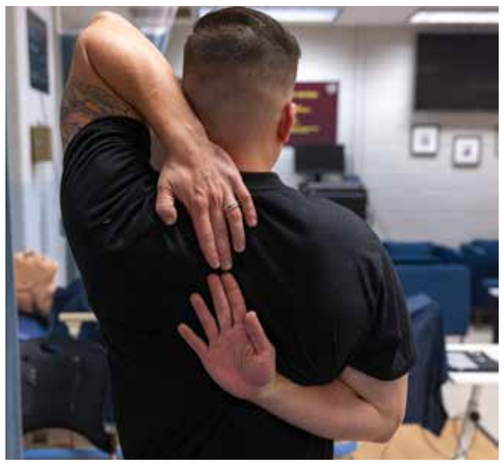

Figure 10-27. Right shoulder internal rotation.

ROM of the Elbow

Evaluate ROM of the elbow with extension, flexion, supination, and pronation. MOs will provide additional training as needed. Perform the following assessments on each elbow:

- Flexion—have the patient hold the arm extended, palm up, at shoulder height in front of the body. Ask the patient to bend the arm at the elbow, bringing their palm toward the shoulder (typically 140°) (Figure 10-28).
- Extension—evaluate when arm is returned to the fully extended position, palm up (Figure 10-29).

Figure 10-28. Elbow flexion.

Figure 10-29. Elbow extension.

Figure 10-30. Elbow supination.

Figure 10-31. Elbow pronation.

- Supination—with the arm at the patient's side and elbows bent to a 90° angle in front of the body, instruct the patient to rotate the palms face up (in an outward direction) as far as they can (Figure 10-30).
- Pronation—ask the patient to rotate the palms to face down (in an inward direction) as far as they can (Figure 10-31).
- Additional specialized exams may be required for associated shoulder conditions.

ROM of the Wrist

Evaluate ROM of the wrist with extension, flexion, radial flexion, and ulnar flexion. Perform the following assessments on each wrist:

- Flexion—ask the patient to move the hand downward at the wrist (typically 60°) (Figure 10-32).

- Extension—ask the patient to move the hand upward at the wrist (typically 60°) (Figure 10-33).
- Radial flexion—ask the patient to move the hand laterally (toward the thumb) at the wrist (typically 20°) (Figure 10-34).
- Ulnar flexion—ask the patient to move the hand medially (towards the 5th metacarpal) at the wrist (typically 30°) (Figure 10-35).

Muscle Strength

Have that patient complete the following, while the provider applies a minimal amount of resistance.

- flexion,
- extension,
- abduction,
- adduction,
- external rotation, and
- internal rotation.

Ask the patient to shrug their shoulders.

Figure 10-32. Wrist flexion.

Figure 10-33. Wrist extension.

Figure 10-34. Radial flexion.

Figure 10-35. Ulnar flexion.

Special Tests

Additional specialized exams for upper extremities may be required. MOs will train you on any additional special tests you may be required to perform

RED FLAGS of Upper Extremity Complaints

RED FLAGS indicate immediate referral to an MO. RED FLAGS of upper extremity complaints consist of any of the following:

- unbearable pain that does not respond to treatment;
- repeated visits for the same complaint;
- open fractures or deformities;
- neurovascular compromised extremities;
- hot, swollen joint;
- inability to fully extend or flex (decreased ROM);
- trauma with neurological changes, muscle weakness, or a deteriorating exam in the affected extremities; and
- any suspected fracture.

Note: Recurrent or chronic pain can be a sign of cancer, fracture, or other serious injury and MUST be evaluated by a medical provider. Imaging is likely.

COMMON COMPLAINTS OF THE SHOULDER AND UPPER EXTREMITIES

Shoulder Disorders

A careful history, physical examination, and radiographs are used to diagnose most shoulder disorders.

Dislocated Shoulder

The shoulder joint has great mobility and is susceptible to subluxation and dislocation (most commonly from trauma). A dislocated shoulder (Figure 10-36) occurs when the humeral head partially slips out of socket. Dislocations may be anterior (>90%), posterior (<10%), or inferior (1%–2%). Anterior dislocation is the most common because there is no bone in front to stop the movement. Posterior dislocations are the second most common. Inferior dislocations are very rare but come with severe associated injury to the arteries, brachial plexus, and other structures in the axilla. The patient may describe a feeling of the shoulder slipping out of joint when the arm is abducted and externally rotated. Initial dislocations are associated with significant trauma, while subsequent dislocations require less force.

Figure 10-36. An anteroposterior projection showing a shoulder dislocation. Radiograph by Mikael Häggström. Reproduced from Wikimedia Commons. https://commons.wikimedia.org/wiki/File:Shoulder_dislocation,_anteroposterior_before_reduction.jpg

Movement causes considerable pain; the patient will usually self-splint (support arm on side of injury) to a neutral position. There is a loss of the rounded contour of the shoulder and the acromion is prominent, resulting in a squared-off appearance. Check neurovascular function before and after any treatment and document your observations.

Refer the patient to the MO for reduction (actively reseating the humeral head) of the dislocation. Treatment after successful reduction is shoulder immobilization with a sling and swath or shoulder immobilizer. The typical immobilization time is 1 to 3 weeks, but an MO should follow up each week. In some cases, the patient may require referral to an orthopedic surgeon.

Advise the patient to use NSAIDs for shoulder pain and inflammation. Tell the patient to modify physical activities based on pain level. The patient should allow the pain to dictate the activity. The patient WILL be referred to physical therapy for continued care and management. Physical therapy or specified exercises may be required to rehabilitate the shoulder.

Clavicle Fracture

The most common bony injury of the shoulder is a clavicle fracture (Figure 10-37). Eighty percent of fractures occur in the middle third of the clavicle. The MOI is often a fall on the shoulder or a strike over the clavicle with a heavy object.

The patient is usually unable to lift the arm due to pain and may complain of pain at the site. Physical examination will reveal TTP, edema, ecchymosis, erythema, tenting of the skin, and deformity at the fracture site. ROM will be decreased and crepitus may be present. Assess neurovascular function in the affected extremity. Refer the patient to the MO for evaluation.

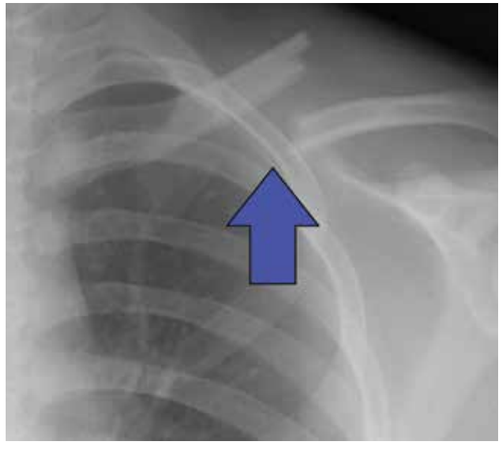

Figure 10-37. A clavicle fracture. Radiograph by Majorkev at English Wikipedia, CC BY 3.0. Reproduced from Wikimedia Commons. https://commons.wikimedia.org/wiki/File:Clavicle_Fracture_Left.jpg

Most clavicle fractures are treated without surgery with an arm sling for 4 to 6 weeks, use of NSAIDs, activity modification, and shoulder rehabilitation. Surgery may be indicated for more severe fractures and those associated with neurovascular impairment.

Acromioclavicular (AC) Separation

An acromioclavicular (AC) separation (shoulder separation) (Figure 10-38) commonly results from trauma to the AC joint ligaments such as a fall onto the tip of the shoulder. When the acromion is driven into a hard surface, variable degrees of ligamentous disruption occur, from grade I (minor) to grade VI (severe).

Patients will report pain over the AC joint and pain on lifting the arm. With grade III or higher injuries, there is an obvious deformity. Physical examination reveals TTP, edema, ecchymosis, and erythema at the AC joint. The patient will support the arm in an adducted position with little movement or ROM. Assess neurovascular function. Refer the patient to the MO for evaluation.

Figure 10-38. An acromioclavicular separation. Photograph by Lee Down, CC BY-SA 2.0. Reproduced from flikr.com. https://www.flickr.com/photos/leedman/1399799871/

Treatment includes use of a sling, NSAIDs, and ice, as well as shoulder rehabilitation. Surgery becomes an option for separations in grades III and above.

Arm and Hand Disorders

Humerus, Radius, and Ulna Fractures

Fractures of the humerus (Figure 10-39) are uncommon, while distal radius fractures are the most common in adults. The MOI for ulna and radius fractures (Figure 10-40) is falling on an outstretched hand (FOOSH). The two most common types of distal radial fractures are the Colles (most common) and Smith

Figure 10-39. This radiograph of a right humerus bone (including elbow joint and a portion of the shoulder joint) shows a badly displaced fracture of the humerus. It was broken on 6 Aug 2007, during an arm wrestling match. Photo by Chris Norlin. https://commons.wikimedia.org/wiki/File:Arm-Wrestle-Xray.jpg

Figure 10-40. A midshaft fracture of the radius and ulna. Radiograph by James Heilman, MD, CC BY-SA 4.0. Reproduced from Wikimedia Commons. https://commons.wikimedia.org/wiki/ File:FracRadUlnaMark.png

(less common) fractures. A Colles fracture typically occurs when falling onto wrists in extension, causing fragmentation dorsally. A Smith fracture occurs when falling onto wrists in flexion, causing fragmentation ventrally.

Signs and symptoms include acute pain following injury and pain with movement. Physical examination will reveal TTP at the site, edema, ecchymosis, deformity, and decreased ROM. It is imperative to assess for signs of shock and the pulse, motor, and sensory status of the extremity distal to the fracture. Refer patients to the MO for evaluation.

Treatment includes use of a splint and sling; NSAIDs; and rest, ice, compression, and elevation (**RICE**) for acute treatment of suspected fractures.

Medial and Lateral Epicondylitis

An injury such as a fracture, dislocation, or tendon or ligament rupture causes acute pain and swelling. Chronic pain can be indicative of arthritis or overuse injuries from work or sport.

Medial and lateral epicondylitis are common complaints of the elbow. The epicondyle is the protrusion on top of the condyle where muscles can attach. The

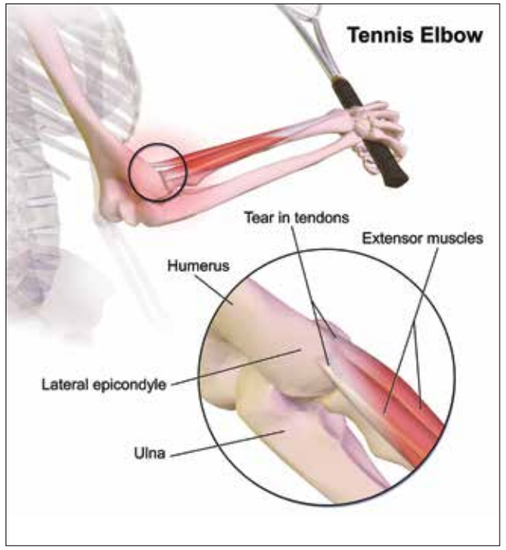

Figure 10-41. Epicondylitis (tennis elbow). Image by BruceBlaus, CC BY-SA 4.0. Reproduced from Wikimedia Commons. https://commons.wikimedia.org/wiki/File:Tennis_Elbow.png

condyle is the rounded end of a long bone that articulates with another bone at a joint. These two epicondyles are the anchoring points for the large muscles groups of our forearm.

Lateral epicondylitis (tennis elbow) (Figure 10-41) is more common than medial epicondylitis (golfer's elbow). The MOIs are possible overuse, sudden maximal muscle contraction, or a direct blow to the site. Signs and symptoms include gradual onset of pain in the lateral or medial elbow. Note that the patient may have no history of participating in either tennis or golf and still present with the complaint.

For lateral epicondylitis, the patient will report pain in the lateral elbow and forearm during activities involving wrist extension, such as lifting or hitting a backhand in tennis. Over time, pain becomes more severe and may occur at rest or with minimal activities. Patients will report pain at the site when lifting objects with their palms down. In the case of medial epicondylitis, pain occurs with active wrist flexion, such as with a golf swing or weight lifting. Patients will report pain at the site when lifting objects with their palms up. Physical examination for lateral epicondylitis will reveal localized TTP 1 cm distal to the lateral epicondyle and pain at that site with resisted extension of the wrist. Physical examination for medial epicondylitis will reveal localized TTP 1 cm distal to the medial epicondyle and pain at same site with resisted flexion of the wrist. Refer the patient to the MO for treatment.

The most important step in treatment is to modify or eliminate activities causing symptoms. Other treatment measures include RICE, use of NSAIDs, an elbow strap, and physical therapy. Corticosteroid injections may alleviate pain from persistent problems, but injections can be avoided with proper rehabilitation of the injury.

Wrist and Hand Fractures

Careful assessment and proper treatment are essential for fractures of the wrist (carpal), hand (metacarpal), and fingers (phalanges) to avoid serious complications and poor outcomes following injury. Signs and symptoms of wrist and hand injury include pain, ecchymosis, edema, erythema, or deformity at the injury site and an associated MOI.

Carpal Fractures. The most commonly fractured carpal bone is the scaphoid, usually resulting from a fall on an outstretched hand (forced extension of the wrist). The scaphoid is a wrist bone on the radial side that is important for stability and motion of the wrist. Pain occurs at the anatomical snuffbox. This is the deepened or hollowed area on the radial, dorsal aspect of the hand at the carpal level when the thumb is extended. The scaphoid is at the base of the anatomical snuffbox and is where the patient most commonly complains of pain or tenderness.

Metacarpal Fractures. Commonly, fractures in the hand are at the fourth or fifth metacarpal (Figure 10-42). The MOI for a fourth or fifth metacarpal fracture is a closed fist striking an object. Physical assessment may reveal a depressed knuckle, TTP, ecchymosis, and edema. Tenting of the skin may be present with metacarpal fractures.

Phalangeal Fractures. The distal phalange is the most common site for a finger fracture. Physical examination will reveal localized TTP, edema, ecchymosis, erythema, deformity, and a break in the skin. ROM is decreased. Evaluate the affected digit for rotation or shortening. Distal phalangeal fractures may present with a fingernail that is avulsed, missing, or with a subungual hematoma. Treat amputated phalanges as any other amputation.

Treatment. Treatment includes referring all hand and wrist complaints to the MO for evaluation. Splint and place the affected arm in a sling to prevent further injury; splint finger injuries with a finger splint or by taping the injured finger to an uninjured finger (buddy taping). Advise the patient to use RICE and NSAIDs, and put the patient on profile.

Figure 10-42. A neck fracture of the fourth metacarpal bone, commonly known as a boxer's fracture. Radiograph by Louis Philippe Lessard, CC BY-SA 3.0. Reproduced from Wikimedia Commons. https://commons.wikimedia.org/wiki/File:Neck_Fracture_of_the_Fourth_Metacarpal_Bone.png

Check on Learning

20. List five RED FLAGS of upper extremity complaints.
21. What are the common MOIs for medial and lateral epicondylitis? What is the most common onset?
22. Your patient states he was upset so he hit a wall with his fist. What is the most common injury associated with this MOI?

ASSESSMENT OF THE PELVIS AND LOWER EXTREMITIES

Examination of the Lower Extremities

Subjective

Gather subjective information, as directed in Chapter 1, Sick Call and Medical Documentation. Ask the patient questions pertaining to their lower extremity complaint. During questioning, patients may reveal RED FLAGS from statements such as "I can't extend my knee," "I can't walk or bear weight on my leg," "My knee gives out," or "My knee locks up."

Objective

Inspection. If a patient complains of joint symptoms, evaluate the joint above and below the area of complaint. Inspect the extremity for abnormalities. Have the patient place one finger on the most painful spot to localize the pain. Compare the affected extremity to the unaffected one. Observe the patient walking to analyze gait and arm swing. Does the patient bear weight on the affected extremity?

Palpation. Palpate the affected area for tenderness, abnormal masses, crepitus, and temperature changes. Evaluate pulse and motor and sensory function at the affected area.

ROM of the Hip. Include flexion and extension motions to evaluate ROM of the patient's hip. Perform the following assessments on each hip:

- Hip flexion—position the patient in a supine position on the exam table and instruct them to bring one knee up toward their body (typically 110°) (Figure 10-43).
- Hip extension—with the patient standing and facing the edge of the exam table, direct them to bend over onto the exam table to support their upper body. Then have them raise one leg posteriorly as high as they can without arching their back (typically 30°) (Figure 10-44).

ROM of the Knee. Include flexion and extension motions to evaluate ROM of the patient's knee. Perform the following assessments on each knee:

- Flexion—with the patient positioned supine on the exam table, have have them bend a knee, place the foot flat on the exam table, and slide the heel as far back as far back toward the buttocks as possible (Figure 10-45).

Figure 10-43. Hip flexion.

Figure 10-44. Hip extension.

Figure 10-45. Knee flexion.

Figure 10-46. Knee extension.

Figure 10-47. Ankle dorsiflexion.

Figure 10-48. Ankle extension.

- Extension—with the patient positioned supine on the exam table, have them straighten their lower leg as far as possible (Figure 10-46).

ROM of the Ankle. Include dorsiflexion and plantar flexion motions to evaluate ROM of the patient's ankle. Perform the following assessments on each ankle:

- Dorsiflexion—with the patient seated on the edge of the exam table, instruct them to raise the balls of their feet upward by movement of the ankle. Alternately, have the patient stand on their heels and raise the balls of their feet off the ground (Figure 10-47).
- Plantar flexion (extension)—with the patient seated on the edge of the exam table, ask them to point their toes towards the ground (Figure 10-48). Alternately, extension can be assessed by having the patient stand on their toes (Figure 10-49).

Special Tests. Additional specialized exams for lower extremities may be required. MOs will train you on any additional special tests you may be required to perform.

Figure 10-49. Standing ankle extension.

RED FLAGS of Lower Extremity Complaints

RED FLAGS of lower extremity complaints that require immediate referral to an MO include:

- intolerable pain;
- pain that is not responsive to treatment;
- repeated visits for the same complaint;
- open fractures, deformities, or neurovascular compromised extremities;
- trauma with neurological changes, muscle weakness, or a deteriorating exam in the affected extremity;
- inability to bear weight, repeated giving way (instability), or locking;
- any hot, swollen joint;
- inability to fully extend or flex the extremity (decreased ROM); and
- any suspected fracture.

Note: Recurrent or chronic pain can be a sign of cancer, fracture, or other serious injury. An MO MUST evaluate the condition. Imaging is likely.

COMMON COMPLAINTS OF THE LOWER EXTREMITIES

Hip and Thigh Disorders

Pelvic Fracture

Pelvic fractures among soldiers usually result from high impact MOIs (eg, motor vehicle accidents, falls from heights, and IEDs). Unstable fractures cause loss of pelvic structural integrity and may be life threatening. In unstable fractures, bones are displaced or the ends of bones are moved apart (Figure 10-50). These fractures can cause significant bleeding and may damage internal organs. Stable fractures (Figure 10-51) are those in which the pelvis retains its structure. They are usually less serious than unstable fractures.

In the primary care setting, you are most likely to see stress fractures or avulsion fractures related to sports activities or physical training. Stress fractures are small cracks in bone caused by overuse or repetitive use. In an avulsion fracture, an injured tendon pulls away from the bone, taking with it a small piece of bone. Patients may complain of pain in the hip or

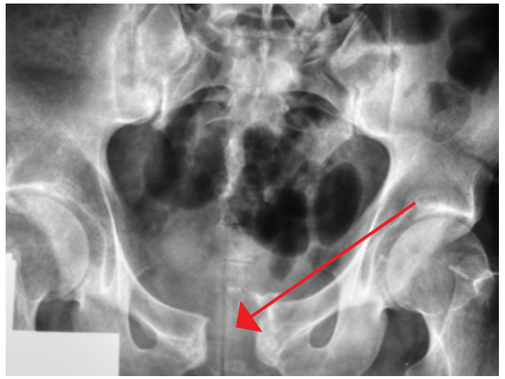

Figure 10-50. A traumatic open book pelvis fracture and significant diastasis in the symphysis pubis. Radiograph by Nevit Dilmen, CC BY-SA 3.0. Adapted from Wikimedia Commons (added a pointer). https://commons.wikimedia.org/wiki/File:Diastasis_symphysis_pubis_1300500.JPG

Figure 10-51. A pelvic acetabulum fracture as seen on plain radiograph. Radiograph by James Heilman, MD, CC BY-SA 3.0. Reproduced from Wikimedia Commons. https://commons.wikimedia.org/wiki/File:AcetabularfracX.png

groin that gets worse with activity. There may be visible bruising or swelling in the affected area. Check for numbness or tingling. Refer patients with suspected pelvic fracture to an MO.

Hip Strain and Sprain

Hip pain is a common complaint in new soldiers who are not used to running frequently or walking great distances while bearing heavy loads. Their bodies may not have endured the harsh treatment and conditioning some athletes are used to and can find the training to be punishing. The most common sites of hip pain are in the groin and lateral hip.

Extra-articular (outside of the joint) injuries are the largest source of hip and groin pain in active adults. Tendinitis, tendon tears, **bursitis**, and muscle injuries cause lateral hip pain. Among runners and athletes involved in running-based sports, acute muscle strains and tendinopathies are the most common injuries. Intra-articular (in the joint) disorders are in part caused by overuse or trauma, which may result in stress fractures or sprained ligaments. Intra-articular hip pain is most notably felt in the groin, hip, and buttocks. Hip strain is a broad term related to overuse caused by strenuous muscular contraction.

Weight bearing, flexion, and excessive standing induce most of the problems that correlate with hip complaints. The hip is the center of the body and it endures loads and stress from running and jumping. Conduct hip assessment tests with the patient positioned standing, sitting, lateral decubitus (lying on one side), prone, and supine. For the following special tests consider alignment, focus on differences in leg length, and note pain induced by bearing weight and with any movement:

- Trendelenburg's test for hip stability. The patient stands on one leg and alternates legs when instructed (Figure 10-52). In a negative test, the pelvis will be level or greater on the side of the raised leg. In a positive test, the pelvis will be lower on the side of the raised leg.
- Thomas test for ROM of the hip flexors. It helps identify early signs and symptoms of arthritis, and patellofemoral pain syndrome. Ask the patient to lie supine on exam table. Stabilize the patient's pelvis by placing your hand under the patient's lumbar spine and flexing their hip (Figure 10-53). As the patient flexes the hip, the lumbar spine flattens and the pelvis is stabilized. Normally, a person should be able to bring their knee to their chest without flexing their thoracic spine or arching their lumbar spine. If the patient compensates in either of these ways, there may be hip flexion pathology.

Figure 10-52. Trendelenburg's test for hip stability.

Figure 10-53. The Thomas test for hip flexor range of motion.

Figure 10-54. The FABER test for sacroiliac joint injury.

Figure 10-55. The Ely test for lumbosacral or hip injury.

- **FABER** test (Patrick's test) for the sacroiliac joint injury. The patient's hip is flexed to a 90° angle, abducted, and externally rotated (Figure 10-54). If a patient has hip, groin, or back pain, the test will be positive. This can suggest iliopsoas pain or pathology within the sacroiliac joint.
- Ely test for muscle tightness caused by a lumbosacral or hip injury. Ask the patient to lie in a prone position. Instruct the patient to flex their leg until the heel touches the buttocks (Figure 10-55). A positive test occurs when the patient cannot touch the heel to the buttocks without pain or the hip of the tested side rising off the table. A positive test may also be indicative of a bulging disc.

Figure 10-56. The Scour test, medial rotation, for hip pain of unknown origin.

Figure 10-57. The Scour test, lateral rotation, for hip pain of unknown origin.

Figure 10-58. The McMurray test for knee meniscus injury.

Figure 10-59. The valgus test for medial collateral ligament injury.

- Scour test to assess for hip pain of unknown origin. Ask the patient to lie in a supine position. Flex and rotate the knee to check ROM (Figures 10-56 and 10-57). Any irregularities including patient apprehension, pain, clicking, or grinding indicate a positive test.

Physical examination will affirm TTP (although it may be difficult to pinpoint the exact location of the injured muscle due to hip muscle depth). A patient may complain of pain over the injured muscle area that continues during strenuous activity. Refer patients to an MO.

Ice, NSAIDs, activity modification, and physical therapy are the pillars of treatment.

Femur Fracture

High-energy trauma (eg, from a motor vehicle collision) causes most fractures of the femoral shaft in adults. Pathologic fractures from low-energy trauma (falls) are less common and often occur in bone weakened by disease.

A patient may present with severe pain in the thigh along with an obvious deformity. They will be unable to move or bear weight on that extremity. Examination may reveal TTP, edema, ecchymosis, deformity, and/or an open wound at the site. The injured extremity may present shorter than the unaffected extremity or rotated. ROM may be reduced and the patient will not tolerate placing weight on the injured leg. It is imperative to assess for signs of shock and the PMS status of the extremity distal to the fracture.

Treatment should begin with immediate referral to an MO. Splint using a traction splint if available to prevent further injury and decrease pain associated with the fracture. Evaluate for and treat associated life-threatening injuries. Consider optional pain management.

Femoral Stress Fracture

A femoral stress fracture usually results from overuse and repetitive processes rather than from a single acute traumatic event. Femur stress fractures occur most commonly in military recruits and athletes.

Signs and symptoms include vague pain in the groin or anterior thigh associated with activity or weight bearing that subsides after cessation of activity. The patient will also likely have a history of increased or repetitive physical activity preceding the symptoms. Physical examination will reveal vague TTP at the proximal thigh due to soft-tissue irritation. The patient will have pain at extreme ROM that increases with internal rotation. An early radiograph will usually be normal. Refer these patients to an MO.

Treat nondisplaced stress fractures by directing the patient to cease activities that stress the leg and to use crutches to prevent weight bearing until the injury is healed (usually 6–8 w). NSAIDs and activity modification may also be helpful. Displaced fractures will require surgery.

Thigh Strain

A thigh strain can be temporarily painful and can seriously impair an athlete. The posterior thigh muscle (hamstring) is injured more often than the anterior thigh (quadriceps). Patients will report sudden onset of posterior thigh pain that occurred during rapid movement (eg, running). The onset of pain may have been accompanied by a "pop" feeling.

Physical examination will reveal local tenderness at the site of the injured muscle. There may be ecchymosis at the posterior thigh. Refer the patient to an MO. Treatment consists of RICE and physical therapy.

Check on Learning

23. What should you do if you suspect a pelvis fracture?
24. Repetitive overloading and increased workloads can result in which injury?

Knee Pain and Disorders

Internal Derangement of the Knee

Internal derangement of the knee includes damage to the ligaments or cartilage of the knee. Injuries to the knee occur most commonly from twisting, hyperextension, or medial or lateral force (as seen in sports-related activities, explosions, or motor vehicle accidents). Most patients will report an activity associated with sudden knee pain. Some will report an audible "pop" (eg, with a tear of the anterior cruciate ligament), and the patient will not be able to continue the activity due to pain. Following the acute injury, the patient may report pain, stiffness, swelling, giving out, locking, and popping. When assessing the knee, do not force the patient to bear weight or manipulate the knee in any way that causes pain, as this may cause further injury to the underlying ligaments. Use the following specialty tests to examine the knee in more detail:

- McMurray test for meniscus injury. Ask the patient to lie in a supine position. Hold their heel with one hand and flex their knee. Cup your other hand over their knee, with your fingers and thumb placed along the medial joint line. Using pressure on the patient's heel, rotate the patient's lower leg externally, then push on the lateral side of the knee to put a valgus stress on the medial side of the joint at the same time (Figure 10-58). Maintain pressure and slowly extend the patient's lower leg, while keeping it in external rotation. Use the same manipulation, but with internal rotation of the foot, to stress the lateral meniscus. Consider the test positive if a click is felt or heard at the joint line during flexion and extension of the knee, or if tenderness is noted along the joint line.
- Valgus and varus tests for medial and lateral collateral ligament injuries. To test the medial collateral ligament, hold the patient's ankle with one hand and place your other hand on the lateral aspect of the patient's knee. Then push medially against the knee and attempt to open the knee joint on the inside (valgus stress) (Figure 10-59). To test the lateral collateral ligament, reverse the position of your hands and push laterally against the knee and medially against the ankle to open the knee joint on the lateral side (varus stress) (Figure 10-60). Consider the test positive if you feel a gap, instability, or pain.
- Anterior and posterior drawer tests for anterior and posterior cruciate ligament injuries. Have the patient lie supine with flexed knees and feet flat on the table. With your thumbs on the medial and lateral joint and your fingers clasping the hamstring muscle, pull forward

Figure 10-60. The varus test for lateral collateral ligament injury.

Figure 10-61. The anterior drawer test for anterior cruciate ligament injury.

Figure 10-62. The posterior drawer test for posterior cruciate ligament injury.

Figure 10-63. The Lachman test to assess integrity of the anterior cruciate ligament.

(Figure 10-61) and push backward (Figure 10-62) to see if the tibia will slide out like a drawer from the femur. There is slight movement in a normal test, as long as you feel it on both sides. If you feel movement and see some shape of the patient's upper tibia, the test is positive.

- Lachman test for anterior cruciate ligament injury. Hold the leg so the patient's joint is between your hands. Place your thumb on the medial or lateral joint line. Twist the patient's femur and tibia in opposite directions. Check for forward deviation (Figure 10-63).

Physical examination will reveal TTP of the knee. The exact location of the tenderness will be helpful to make the diagnosis. Edema and decreased ROM may develop because of bleeding into the joint (hemarthrosis). Refer patients to an MO for evaluation and possible aspiration of the hemarthrosis.

Treatment will include RICE, use of crutches and acetaminophen, followed by NSAIDs during rehabilitation. Knee braces provide additional support. Surgery may be indicated for ligament and meniscus tears, followed by intensive physical therapy.

Patellofemoral Pain Syndrome

Patellofemoral pain syndrome (runner's knee) is related to overuse and overloading of the knee joint. Patients have diffuse, aching anterior knee pain that increases with activities that place additional loads across the knee joint (such as running, climbing up or down stairs, kneeling, and squatting).

Signs and symptoms include a diffuse, aching anterior knee pain that is worse after prolonged sitting, climbing stairs, jumping, or squatting. Physical examination may be completely normal. Observe the patient's gait. Check for crepitus during ROM examination of the knee. Refer the patient to an MO for evaluation.

Treatment involves activity modification (biking and swimming are good alternatives), use of NSAIDs, weight loss for obese patients, and quadriceps strengthening.

Patellar Tendinitis

Patellar tendinitis (jumper's knee) is an overuse or overload syndrome of the quadriceps tendon or the patella tendon.

Anterior knee pain, especially at the inferior pole of the patella, is the hallmark symptom of this condition. Patients can point to a tender spot on the tendon and generally report a history of pain immediately after exercise that sometimes resolves after warming up. The physical examination commonly reveals no swelling. Palpation of the knee reveals focal tenderness to the inferior pole of the patella or patellar tendon. Patients will have full ROM and strength, but with pain. Refer the patient to an MO for evaluation.

Treatment consists of ice and heat, use of NSAIDs, knee sleeves, activity modification, and physical therapy.

Lower Leg and Foot Disorders

Tibia and Fibula Fractures

Fractures. High-energy trauma can cause tibia and fibula fractures. A patient may present with severe pain in the thigh along with an obvious deformity. They will be unable to move or bear weight on that extremity. Examination may reveal TTP, edema, ecchymosis, deformity, and/or an open wound at the site. The injured extremity may present shorter than the unaffected extremity or rotated. ROM may be reduced and the patient will not tolerate placing weight on the injured leg. It is imperative to assess for signs of shock and the pulse, motor, and sensory status of the extremity distal to the fracture.

Stress Fractures. A stress fracture is a nontraumatic microscopic break in a bone. Stress fractures of the tibia and fibula typically follow a rapid increase in exercise intensity. Military recruits and high-performance athletes are susceptible to these injuries from overuse.

Pain from a stress fracture initially occurs only with exercise, but with continued activity, the patient feels pain while walking or at rest. Patients are usually able to locate an extremely painful area on the tibia. Physical examination will reveal TTP localized to the affected area of bone. Impact and stress on the bone will cause pain. Six or more weeks after the onset of symptoms, swelling secondary to the bony callus may be palpable. Refer the patient to an MO for evaluation, leg splints, and radiographs.

Treatment consists of RICE, use of NSAIDs, and a profile for activity modification.

Medial Tibial Stress Syndrome

Medial tibial stress syndrome (also known as shin splints) is a condition characterized by the gradual onset of pain in the anteromedial aspect of the distal third of the leg. This condition develops in response to increased exercise or activity level. The increased exercise or activity level causes stress on the tibia (shinbone) and connective tissue that attaches muscles to the bone. Other common causes are flat feet, poorly fitting shoes, and working out without warm-up or cool-down exercises.

The patient's chief complaint will be a gradual onset of pain with exercise with pain localized to the distal third of the medial tibia or distal third of the leg. During examination, the posterior medial crest of the tibia will be tender to palpation. Refer the patient to an MO for evaluation, leg splints, and radiographs.

Treatment consists of RICE, NSAIDS, and a profile for activity modification.

Ankle Sprains

Ankle sprains are common. They are not always simple injuries and residual symptoms may occur. Ankle sprains lead to recurrent sprains. Most ankle sprains result from ankle inversion (an inward turning of the foot, also known as an inversion roll), which injures lateral ligaments.

Signs and symptoms include pain over the injured ligaments, swelling, and loss of function. Some patients

will report an audible "pop." Physical examination reveals TTP and decreased ROM. Edema and ecchymosis around the entire joint are common. Compare the affected to the unaffected side.

Treatment consists of RICE, use of NSAIDs or acetaminophen, activity modification, use of a splint or brace, and rehabilitation. If you suspect a fracture, treat it as a fracture. Issue crutches and refer the patient to an MO for evaluation.

Ankle, Metatarsal, and Phalangeal Fractures

Ankle, metatarsal, and phalangeal fractures occur frequently among military personnel. Traumatic force usually causes acute fractures, whereas repetitive overloading and increased activity levels usually cause stress fractures.

Following trauma, patients with ankle, metatarsal, and phalangeal fractures (Figure 10-64) usually report acute pain, swelling, and inability to bear weight on the affected appendage. Stress fractures will present with pain that increases with weight bearing and is relieved by rest (without a history of trauma). Edema, erythema, and ecchymosis may accompany an acute fracture, with TTP evident at the fracture site.

Figure 10-64. A left lateral malleolus avulsion fracture. Radiograph by Timdwilliamson, CC BY-SA 4.0. Reproduced from Wikimedia Commons. https://commons.wikimedia.org/wiki/File:Left_lateral_malleolus_avulsion_fracture_detail.jpg

If the chief complaint is ankle pain, with any of the above signs or symptoms, you may consider Ottawa Ankle Criteria. These rules were developed, tested, and validated in adult patients and may inform the need for a radiograph or evacuation. Positive Ottawa Ankle Criteria tests comprise the following indicators during examination:

- bone tenderness at the posterior edge of the distal 6 cm of the patient's medial or lateral malleolus,
- bone tenderness at the tip of the patient's medial or lateral malleolus, or
- bone tenderness not present, but the following criteria must all be present in the patient:
  - unable to bear weight immediately after the injury,
  - unable to bear weight after four steps in the clinic, and
  - tenderness along the lateral edge of the tarsal/metatarsal region.

The MO may still recommend radiographs at their discretion if two out of the three signs are present.

Note: Some sources include tenderness over the fifth metatarsal as another indicator of ankle sprain. This tenderness could be due to an avulsion fracture, which commonly occurs during ankle inversion.

Second metatarsal fractures are the most common metatarsal injuries in soldiers. They are caused by recurrent stress from activities like running or marching. In the Army, a second metatarsal fracture commonly is called a "march fracture."

Lacerations or skin tears may indicate an open fracture. For any suspected fracture, refer the patient to an MO. Radiographs may be requested for definitive diagnosis of a fracture.

Treatment consists of RICE, use of acetaminophen or NSAIDs, use of a splint or crutches, and a profile to protect from further injury. Treat non-angulated toe fractures with RICE and buddy taping the toe. Stress fractures require a stiff-soled shoe and activity modification. Displaced or angulated fractures may require reduction or casting.

Plantar Fasciitis

Plantar fasciitis is the most common cause of heel pain in adults. It occurs as a degenerative tear of part of the fascia on the bottom of the foot and is more common in women and those who are overweight.

Patients will complain of pain at the heel or the sole of the foot that is greatest upon rising from a resting position, especially in the morning, and sitting often relieves symptoms. Symptom onset is not normally related to trauma. Physical examination will reveal TTP at the calcaneus and plantar fascia. No edema, ecchymosis, or erythema will be present. Pain with weight bearing on the heel will be evident. Refer patients to an MO for further evaluation.

Greater than 95% will heal within 6 to 12 months. Over-the-counter heel pads, ice, NSAIDs, and night splints are the mainstays of treatment, along with stretching and alternative exercise programs.

Check on Learning

25. Vague pain in the groin or anterior thigh associated with activity or weight bearing that subsides after cessation of activity could be associated with what complaint?
26. List five RED FLAGS of lower extremity complaints.
27. Patellofemoral pain syndrome also is called _____.
28. Patellar tendinitis also is called _____.
29. What is the hallmark symptom of patellar/quadriceps tendinitis?
30. The lateral ligaments of the ankle are injured mostly as the result of _____.
31. Ankle inversions also are called _____.
32. Which injury results from recurrent stress activities like running or marching? What is the common name for this injury?
33. Degenerative tears of part of the fascia on the bottom of the foot are the most common cause of heel pain in adults. This condition is called _____.
34. 95% of patients with plantar fasciitis will heal in how much time?

SUMMARY

Musculoskeletal injuries are frequently encountered complaints that may have few obvious findings on the physical examination. Your ability to apply these appropriate principles and techniques of assessment and management may mean the difference in reducing recovery time, preventing further painful injury, and preventing permanent disability.

KEY TERMS AND ACRONYMS

Articulation. The place of union or junction between two or more bones of the skeleton.
Avascular. A lack of blood vessels.
AVPU. Alert, verbal, pain, unresponsive.
Bursitis. Inflammation of a bursa (a fluid-filled sac).
Dislocation. A bone that has been displaced from its usual articulation with another bone.
Ecchymosis. Passage of blood from ruptured blood vessels into subcutaneous tissue, marked by a purple discoloration of the skin.
Erythema. Redness of the skin, caused by dilation of the capillaries.
FABER. Flexion, abduction, and external rotation.
Gait. A particular way or manner of walking, described as a normal gait or an antalgic (abnormal) gait.
GCS. Glasgow Coma Scale.
Hemarthrosis. Blood in a joint.
Hyperextension. A joint or muscle straightened beyond its normal ROM.
Hyperflexion. A joint bent or muscle contracted beyond its normal ROM.
Inversion. Elevation of the medial border of the foot (the sole of the foot or ankle turns inward).
Meniscus. A semilunar, fibrocartilaginous wedge that rims and cushions each tibiofemoral articulation (the superior aspect of each tibia).
RICE. Rest, ice, compression, and elevation.
ROM. Range of motion.
Sprain. The stretching, wrenching, or laceration of a ligament, usually characterized by pain, swelling, and disablement of the joint. Sprains result from a joint being forced beyond the limits of its normal plane of motion. This can occur even during common activities such as walking over uneven terrain in a field environment.
Strain. An overstretching or tearing injury to muscle fibers resulting from excessive tension or overuse. Strains can occur due to improper warm-up procedures prior to a strenuous exercise event (eg, sprinting or power lifting).
Subluxation. An incomplete or partial dislocation.
Synovial joints. Joints located between bones that move against each other, such as the joints of the limbs (shoulder, knee, hip, and elbow). These joints have a cavity filled with fluid (synovial fluid) that reduces friction.
Tendinitis. Inflammation of a tendon.
Tendons. Bands of tough, inelastic, fibrous tissue connecting muscles with their bony attachments.
TTP. Tenderness to palpation.

CHECK ON LEARNING ANSWERS

1. List five functions of bones.

   Any five of the following: give the body its shape and structural support, protect vital organs, assist in movement, produce blood cells, store minerals, and store chemical energy.

2. How many types of bones are there?

   Five.

3. What is the largest sesamoid bone in the body?

   Knee (patella).

4. What are long bones and why could a fracture of these bones become life threatening?

   Long bones are longer than they are broad (eg, humerus and femur). Long bone fractures may become life threatening if the jagged ends of the bone sever the arteries within the corresponding limb.

5. What are the functions of a joint?

   To enable movement and provide stability.

6. Where are ball-and-socket joints located in the body?

   In the shoulder and hip.

7. Where are hinge joints located in the body?

   In the elbow, knee, ankle, and joints between finger and toe bones.

8. Tendons connect bone to _____.

   Muscle.

9. What are the functions of ligaments?

   Ligaments stabilize and support the joint through its normal ROM by confining its movement to specific planes and preventing hyperextension or hyperflexion.

10. What is the main difference between skeletal and smooth muscle?

    Skeletal muscles (eg, biceps) allow for voluntary movement, and smooth muscles (eg, intestinal wall muscles) contract involuntarily.

11. What are the two major skeletal regions?

    Axial and appendicular skeleton.

12. Name the five subsections of the spinal column.

    Cervical, thoracic, lumbar, sacral, and coccyx.

13. Approximately how far does the spinal cord extend down the spinal column?

    To the second lumbar vertebra.

14. When does assessment of the patient begin?

    As the patient walks toward the exam room.

15. What are the three components of the physical exam for an orthopedic complaint?

    Inspection, palpation, and ROM assessment.

16. Why should you avoid forcing patients to move beyond their point of pain?

    Forcing movement could exacerbate injury or cause additional injury.

17. List five RED FLAGS of spinal complaints.

    Any five of the following:

    - *unbearable pain that does not respond to treatment;*
    - *repeated visits for the same complaint;*
    - *numbness, tingling, or weakness in the extremities;*
    - *bony deformities, step-offs, or crepitus;*
    - *trauma with neurological changes or a deteriorating examination (AVPU or GCS);*
    - *fever, weight loss, night sweats, night pain;*
    - *loss of bowel or bladder control or statements such as, "I can't pee";*
    - *inability to bear weight, due to pain in the lower back; and*
    - *significant decrease of ROM in the back.*

18. Which common spinal complaint is usually associated with a history of whiplash injury?

    Cervical strain.

19. What is the common treatment for lower back strain?

    Symptomatic treatment includes activity modification, use of acetaminophen or NSAIDs for pain, heat application, and education on proper lifting and bending techniques.

20. List five RED FLAGS of upper extremity complaints.

    Any five of the following:

    - *unbearable pain that does not respond to treatment;*
    - *repeated visits for the same complaint;*
    - *open fractures or deformities;*
    - *neurovascular compromised extremities;*
    - *hot, swollen joint;*
    - *inability to fully extend or flex (decreased ROM);*
    - *trauma with neurological changes, muscle weakness, or a deteriorating exam in the affected extremities; and*
    - *any suspected fracture.*

21. What are the common MOIs for medial and lateral epicondylitis? What is the most common onset?

    Medial epicondylitis MOIs are possible overuse, sudden maximal muscle contraction, or a direct blow to the site. Lateral epicondylitis MOIs are activities involving wrist extension, such as lifting or hitting a backhand in tennis.

22. Your patient states he was upset so he hit a wall with his fist. What is the most common injury associated with this MOI?

    Metacarpal fracture (boxer's fracture).

23. What should you do if you suspect a pelvis fracture?

    Immediately refer the patient to an MO.

24. Repetitive overloading and increased workloads can result in which injury?

    Stress fracture.

25. Vague pain in the groin or anterior thigh associated with activity or weight bearing that subsides after cessation of activity could be associated with what complaint?

    Femoral stress fracture.

26. List five RED FLAGS of lower extremity complaints.

    Any five of the following:

    - *intolerable pain;*
    - *pain that is not responsive to treatment;*
    - *repeated visits for the same complaint;*
    - *open fractures, deformities, or neurovascular compromised extremities;*
    - *trauma with neurological changes, muscle weakness, or a deteriorating exam in the affected extremity;*
    - *inability to bear weight, repeated giving way (instability), or locking;*
    - *any hot, swollen joint;*
    - *inability to fully extend or flex the extremity (decreased ROM); and*
    - *any suspected fracture*

27. Patellofemoral pain syndrome also is called _____.

    Runner's knee.

28. Patellar tendinitis also is called _____.

    Jumper's knee.

29. What is the hallmark symptom of patellar/quadriceps tendinitis?

    Anterior knee pain.

30. The lateral ligaments of the ankle are injured mostly as the result of _____.

    Ankle inversion.

31. Ankle inversions also are called _____.

    Inversion rolls.

32. Which injury results from recurrent stress activities like running or marching? What is the common name for this injury?

    Second metatarsal fracture.

    March fracture.

33. Degenerative tears of part of the fascia on the bottom of the foot are the most common cause of heel pain in adults. This condition is called _____.

    Plantar fasciitis.

34. 95% of patients with plantar fasciitis will heal in how much time?

    6 to 12 months.

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