

Chapter 12

Musculoskeletal Injuries

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Introduction

- Musculoskeletal system involves all bones, muscles, and connective tissue of the human body
 - Gives the body shape, protects vital organs, and provides movement
 - Injuries can alter the normal structure and function of the body

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2

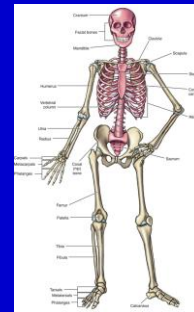
Musculoskeletal System

- Adult body has >600 individual muscles (muscular system) and 206 skeletal bones (skeletal system)
- As you assess a patient suspected of having a musculoskeletal injury rely on your knowledge of normal structure and function
- Involves body's intricate network of nerves and blood vessels
- When two or more bones come together, their union creates a joint

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Musculoskeletal System



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Musculoskeletal System

- Skeletal system
 - Skeleton is divided into two main sections
 - Axial skeleton
 - Central part of body
 - Appendicular skeleton
 - Extremities of the body
 - Axial system
 - Central part of the skeleton carries most of the weight of the body and is composed of bones that make up the skull, spinal column, and thorax
 - Skull comprises the cranium

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5

Musculoskeletal System

- Skeletal system
 - Axial skeleton
 - Spinal column is made up of 33 individual bones
 - Each bone is called a vertebra
 - Runs from the base of the skull to the bottom of the pelvis
 - Houses and protects the spinal cord
 - Nerves of the spinal cord exit the spinal column between each vertebra and continue to each muscle and organ

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6

Musculoskeletal System

• Skeletal system

➤ Axial skeleton

- Injury to the spinal column can cause:
 - Feeling of "pins and needles"
 - Sharp pain with movement
 - Total lack of sensation or ability to move the extremities
 - Paralysis of the muscles

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Musculoskeletal System



Skeletal system

➤ Axial Skeleton

- Spinal column is divided into five specific areas
 - Cervical area is composed of the first 7 vertebrae and is associated with the patient's neck
 - Thoracic vertebrae are the next 12 vertebra that make up the back (posterior) of the chest
 - Lumbar portion is the patient's lower back and contains the next 5 vertebrae
 - Sacrum makes up the posterior portion of the pelvis and is composed of 5 fused vertebrae
 - Coccyx (tailbone) is composed of 4 fused vertebrae

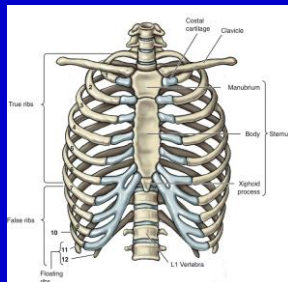
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Musculoskeletal System

➤ Axial Skeleton

- Thorax (chest) is composed of:
 - Clavicles (collarbones)
 - Scapula (shoulder blades)
 - 12 pairs of ribs
 - Sternum (breastbone)



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Musculoskeletal System

• Skeletal system

➤ Appendicular skeleton

- Composed of the pelvis and upper and lower extremities
- Pelvis is made up of two larger bones, which combine with the sacrum and coccyx to form the pelvic girdle
 - Protects lower internal organs of the digestive system, urinary systems, and internal female reproductive organs
 - Highly vascular area
 - Injury can cause significant blood loss

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Musculoskeletal System

• Skeletal system

➤ Appendicular skeleton

- Bones of the upper extremities (arms):
 - Humerus
 - Radius
 - Ulna
 - Carpals
 - Metacarpals and phalanges
 - Lower arm/forearm

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Musculoskeletal System

• Skeletal system

➤ Appendicular skeleton

- Bones of the lower extremities (legs):
 - Femurs
 - Patellae
 - Tibias
 - Fibulas
 - Tarsals
 - Metatarsals and phalanges of the feet

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Musculoskeletal System

- Muscular system
 - Responsible for movement of the body and is composed of three different types of muscles:
 - Skeletal
 - Smooth
 - Cardiac

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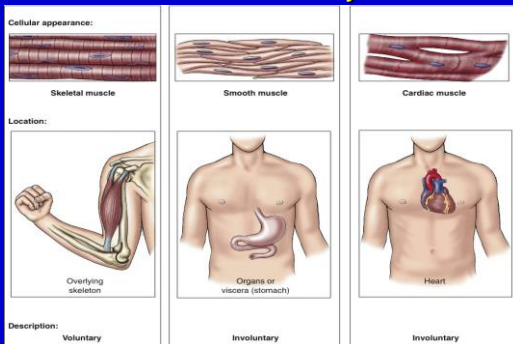
Musculoskeletal System

- Muscular system
 - All muscles work by contracting and relaxing
 - Coordinated effort allows for muscle activity such as:
 - Skeletal movement
 - Movement of food through the digestive system
 - Beating heart
 - Many other tasks

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Musculoskeletal System



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Musculoskeletal System

- Muscular system
 - Skeletal muscles
 - Muscle that is connected to bone
 - Also called a voluntary muscle
 - Any action of your body that you can start/stop uses skeletal muscle
 - Gives body form and stabilizes joints
 - Generates heat and helps maintain body temperature

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Musculoskeletal System

- Muscular system
 - Smooth muscle
 - Greatest difference between skeletal and smooth muscle is the ability to start/stop an action
 - Also called involuntary muscle
 - Found in areas such as the circulatory, digestive, urinary, and respiratory systems

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Musculoskeletal System

- Muscular system
 - Cardiac muscle
 - Hearts are composed of cardiac muscle
 - Has unique ability to generate its own electrical impulse independent of the nervous system
 - Not under voluntary control and is, therefore, a second type of involuntary muscle
 - Sensitive to any decrease in O_2 /blood supply
 - Can tolerate an interruption of an inadequate O_2 or blood supply for only short time before suffering damage

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Mechanisms of Injury

- MOI
 - Most musculoskeletal injuries are the result of some type of trauma
 - Trauma is the result of an outside force that has a negative effect on the body
 - Direct injury is a result of force applied directly to injured part of the body
 - Indirect injury is caused by a force applied to a different area of the body that is then transmitted to the injured part
 - Twisting injury results from an extremity being twisted/pulled

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Mechanisms of Injury



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Mechanisms of Injury

- When approaching a scene in which a musculoskeletal injury may have occurred, pay attention to the surrounding environment and consider forces involved
- Certain injuries can be predicted based on the MOI

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Mechanisms of Injury

- Certain medical conditions/process of aging may also have a role in musculoskeletal injuries
 - Bones become more fragile and brittle with age
 - Certain conditions such as osteoporosis weaken bone structure
 - Understanding how an injury has occurred will allow you to better assess and manage the patient

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Types of Musculoskeletal Injuries

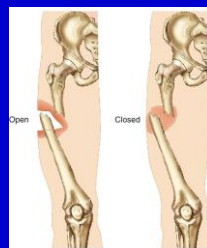
- Can be classified into many different types
 - Pre-hospital emergency care is the same regardless of type
 - As an EMR, you are not responsible for distinguishing between types of injury
- Classified by defining musculoskeletal injury as open or closed
 - Injury in which the skin is open is called an open injury
 - If skin is not open, referred to as a closed injury

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Types of Musculoskeletal Injuries

- Other classifications include:
 - Fracture
 - Another name for a broken bone
 - Often involves injury to nearby soft tissue, nerves, blood vessels; results in bleeding and potential nerve damage



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Types of Musculoskeletal Injuries

- Other classifications include:
 - Sprain
 - Injury in which ligaments (connect bone to bone) are stretched or torn



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Types of Musculoskeletal Injuries

- Other classifications include:
 - Strain
 - Muscle pull around a joint
 - Does not involve ligament and is characterized by pain with movement
 - Little to no swelling of the joint



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Types of Musculoskeletal Injuries

- Other classifications include:
 - Dislocation
 - Separation of a bone from its normal position in a joint
 - Damage blood vessels, nerves, soft tissue, and ligaments, very painful
 - Can also be associated with fractures

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General Assessment of Musculoskeletal Injuries

- General assessment of musculoskeletal injuries
 - Before attempting assessment for injury, ensure that scene is safe and all life threatening conditions have been identified and treated
 - Musculoskeletal injuries are often painful and visually dramatic but rarely life threatening

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General Assessment of Musculoskeletal Injuries

- Complete your initial assessment (ABC's) before moving on to a detailed physical examination
 - Use adequate personal protection equipment (PPE)
 - Gloves at a minimum but may include eye protection and mask if there is a risk for blood spatter

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General Assessment of Musculoskeletal Injuries

- After initial assessment and management of life-threatening conditions, a more detailed assessment of the injury can occur
 - Always compare injured side of body to uninjured side to assess extent of the injury
 - Assess for the following:
 - Deformities
 - Open wounds
 - Tenderness
 - Swelling

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General Assessment of Musculoskeletal Injuries

- Assessment includes checking circulation, sensation, and movement on injured extremities to identify damage to blood vessels/nerves:
 - Circulation
 - Assess the circulation of an extremity by feeling a pulse distal to the site of injury
 - Sensation
 - Assess sensation by lightly touching fingers/toes
 - Movement
 - If upper/lower extremity is injured (excluding hand/foot) assess movement of hand/foot

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Skill 12-1 Assessing Circulation, Sensation, and Movement

- Assess radial pulse for and upper extremity injury
- Assess sensation of upper extremity injury by lightly pressing on a finger and asking patient if he can feel it



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Skill 12-1 Assessing Circulation, Sensation, and Movement

- Assess movement of upper extremity injury by asking patient to move his hand/grasp your hand
- Assess pedal pulse for lower extremity injury



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Skill 12-1 Assessing Circulation, Sensation, and Movement

- Assess lower extremity injury by pressing on toe and asking patient if he can feel it
- Assess movement of lower extremity injury by asking patient to point/flex foot/move foot against your hand



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Management of Musculoskeletal Injuries

- Goal of management of musculoskeletal injuries despite type or cause is:
 - Manage patient's pain
 - Prevent further injury
 - Minimize risk of permanent injury

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Management of Musculoskeletal Injuries

- General management steps in managing musculoskeletal injury include the following:
 - Manually stabilize the injury
 - Allow patient to remain in position of comfort
- Control any bleeding unless it is coming from patient's ears
- Never attempt to straighten any musculoskeletal injury that is angled or misshapen
- Check and compare circulation, sensation, and movement both above and below the injury site and continue to monitor

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Management of Musculoskeletal Injuries

- Dress any open wounds
- Do not move patient until injury is appropriately splinted unless it is absolutely necessary
- Consider application of cold to injury site to help control swelling and pain
- If bone ends are visible, do not try to reposition or replace
- Calm, comfort, and reassure the patient
- Splint the injury as required

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Management of Musculoskeletal Injuries

- Splinting of musculoskeletal injuries
 - General principles for splinting a musculoskeletal injury are as follows:
 - Manually stabilize the injury
 - Remove/cut away clothing from injured site and dress any open wounds
 - Assess circulation, sensation, movement distal to injury
 - Immobilize the joint above and the joint below injured site with a splint
 - Splint injury in position found
 - After splinting, reassess circulation, sensation, and movement distal to the injury
 - Pad the splint to prevent pressure points on patient

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Skill 12-2 Splinting an Upper Extremity

- Provide manual stabilization of joint above and joint below the injury
- Assess circulation distal to the injury



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Skill 12-2 Splinting an Upper Extremity

- Assess sensation distal to injury
- Assess for movement distal to injury



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Skill 12-2 Splinting an Upper Extremity

- Apply splint to immobilize joint above and below injury
 - Assess circulation distal to injury after splinting
- Assess sensation and movement distal to injury after splinting



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Management of Musculoskeletal Injuries

- Splinting of a musculoskeletal injury
 - Splinting equipment and techniques
 - There are many types of equipment and techniques to perform splinting
 - Commercially made splints are available

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Management of Musculoskeletal Injuries

- Splinting of a musculoskeletal injury
 - Splints can be improvised from things such as towels, pillows, rolled magazines, wood, or cardboard:
 - Rigid splint
 - Made of firm, nonformable material
 - Soft splint
 - Flexible, formable, provides gentle support from an injury
 - Air splint is a special type of commercially available soft splint

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Skill 12-3 Techniques of Splinting



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Skill 12-3 Techniques of Splinting



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Management of Musculoskeletal Injuries

- Splinting of a musculoskeletal injury
 - Splints can be improvised from things such as towels, pillows, rolled magazines, wood, or cardboard
 - Sling and swathe
 - Injuries to the shoulder, clavicle, or humerus are best splinted using a sling and swathe technique

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Management of Musculoskeletal Injuries



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Skill 12-4 Applying the Sling & Swathe

- Check circulation, sensation, movement distal to injured site
 - Apply padding underneath extremity on side of the injury
 - Material for sling should be made into a triangle



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Skill 12-4 Applying the Sling & Swathe

- Apply sling to support weight of extremity
 - Point of triangle should be toward patient's elbow
 - Bring two long ends around patient's neck and secure in a knot behind shoulder



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Skill 12-4 Applying the Sling & Swathe

- Secure point of triangle into a knot, or point to the rest of the material to maintain support of the extremity



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Skill 12-4 Applying the Sling & Swathe

- Apply swathe to secure extremity to chest without restricting breathing
 - Recheck circulation, sensation, and movement
- Pad behind both knots



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Special Considerations

- Any patient with suspected spinal or head/chest injury will require special considerations
- Initial assessment will always remain the same:
 - Identify and manage any life-threatening conditions

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Special Considerations

- Suspected spinal injury
 - Manage aggressively
 - Injuries to the spine can result in permanent paralysis if not recognized and treated
 - As an EMR, you should be able to identify a suspected spinal injury and provide appropriate and rapid management

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Special Considerations

- Suspected spinal injury
 - MOI
 - Can present with/without initial signs and symptoms
 - Identifying MOI is an important part of the assessment
 - MOI's that lead to high suspicion of injury include:
 - Any mechanism that produces a violent impact on head, neck, torso/pelvis
 - Incidents that produce sudden forces to neck/torso
 - Any fall, especially in the elderly
 - Ejection/fall from a motorized device
 - Shallow-water diving incidents

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Special Considerations

- Suspected spinal injury
 - Assessment and management
 - Initial assessment of suspected spinal-injured patient is the same as with any other patient
 - Wear appropriate PPE
 - Ensure scene is safe
 - Identify and manage any life-threatening conditions
 - Special attention should be given to control the airway

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Special Considerations

- Suspected spinal injury
 - Assessment and management
 - Patient should not be moved until full spinal immobilization has been applied
 - If unresponsive patient is having difficulty breathing, assist his respirations
 - After initial assessment, assess circulation and movement in all four extremities
 - Complete detailed assessment when needed

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Special Considerations

- Suspected spinal injury
 - Manual stabilization of head and neck
 - Once you recognize the potential for spinal injury, the first step will be to manually stabilize patient's head and neck in a neutral position
 - Position that maintains normal curvature of cervical spine with eyes facing forward and parallel to the ground if patient is standing
 - Can be provided for a patient lying on the ground, sitting upright, or found standing
 - Patients found lying face down should be log rolled onto their backs to maintain spinal stabilization whenever possible

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Special Considerations



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Special Considerations

- Suspected head injury
 - Need special attention and management
 - Injuries to head can be either open/closed
 - Early recognition, management, and transportation of a patient with suspected head injury to appropriate facility are imperative

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Special Considerations

- Suspected head injury
 - Assessment and management
 - Any patient who has altered mental status or is unresponsive should be assumed to have a head injury and should be managed accordingly
 - During initial assessment, in addition to identifying and managing any life-threatening conditions, calculate a GCS score and repeat in ongoing assessment
 - When performing a physical examination of a suspected head injury patient, avoid movement of head and spine when palpating the skull

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Special Considerations

- Suspected head injury
 - Assessment and management
 - Management includes the following:
 - Do not move patient unless it is absolutely necessary
 - Manually stabilize head and neck
 - Use trauma jaw-thrust to open and maintain airway
 - Assist patient's ventilations if necessary
 - Apply supplemental O₂ if possible
 - Control minor external bleeding
 - Cover all open wounds
 - Do not stop any bleeding/fluid loss from ears
 - Continue to monitor patient's vital signs

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Special Considerations

- Suspected chest injuries
 - Patients with suspected chest trauma may have serious internal injuries
 - Most common are rib fractures
 - Patients will almost always have chest pain and may experience significant difficulty with breathing
 - In these cases, you may need to assist ventilations

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Management

- Management of a patient with suspected chest injury includes:
 - Assisting ventilations as needed
 - Providing supplemental O₂, if available
 - Traumatic injuries to the chest may also have caused spinal injuries

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Management

- As an EMR, you may be asked to assist in further management of a patient with suspected musculoskeletal injury
 - May include:
 - Applying a traction splint
 - Applying a cervical collar
 - Performing spinal immobilization

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Management



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Management

- Cervical collars
 - Rigid devices that help support the head and neck and keep it from moving
 - On its own does not completely immobilize a patient's head and neck
 - As an EFR, you may have to assist with placement for a patient with a suspected spinal injury

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Management

- Spinal immobilization
 - Any patient suspected of having a spinal injury should be fully immobilized
 - Full immobilization of the spine requires stabilization of the joint above and below injured head
 - Full immobilization is done by moving patient onto a long backboard
 - As an EFR, you will probably be asked to assist with immobilization of a patient with a suspected spinal injury because it requires at least three or four providers

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Management



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Questions?

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