

Musculoskeletal / Orthopedic Injuries

EMT-Basic





Overview

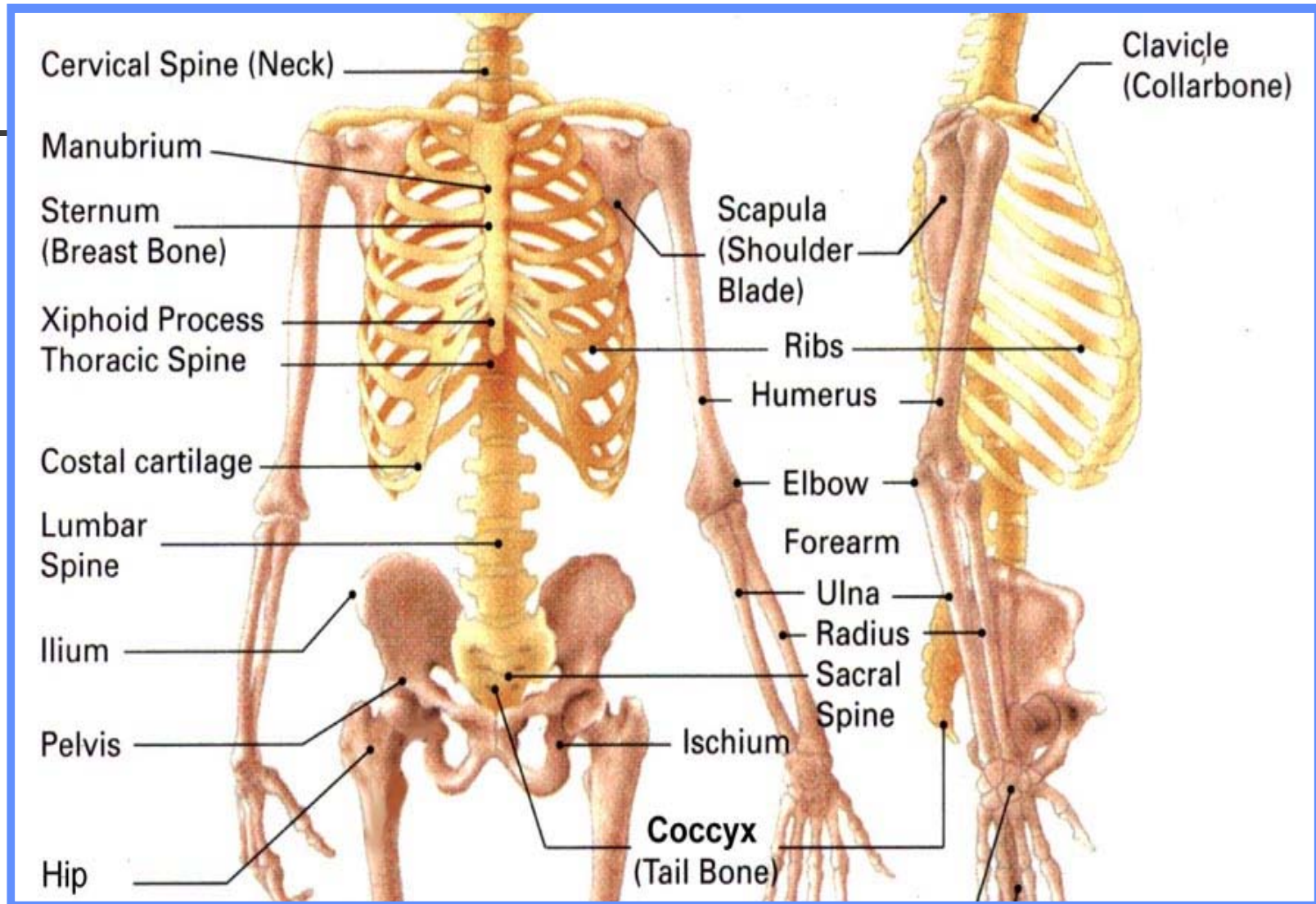
- Skeletal system A & P review.
- Fracture / orthopedic injury recognition.
- Fracture / orthopedic injury management.
- Long-term complications of orthopedic injury.
 - Unavoidable.
 - Avoidable with proper field care.
- Life threatening orthopedic injuries.
- Other injuries associated with orthopedic injury.
- Dislocations, Strains & Sprains.



Skeletal System

- Purpose:
 - To maintain body structure.
 - Protects internal organs.
 - Fractured bones may suggest internal injury.
 - Rib fractures may suggest lung or heart injury.
 - Pelvic fracture may suggest bladder or other abdomino-pelvic organ injury.
 - Allows for structured movement. Otherwise we would look like a jelly-fish as far as structure is concerned.
 - Skeletal muscles are under conscious control of the brain and are therefore considered **voluntary muscles**.
 - Links bones to bones allowing movement.

Some Skeletal Anatomical Structures

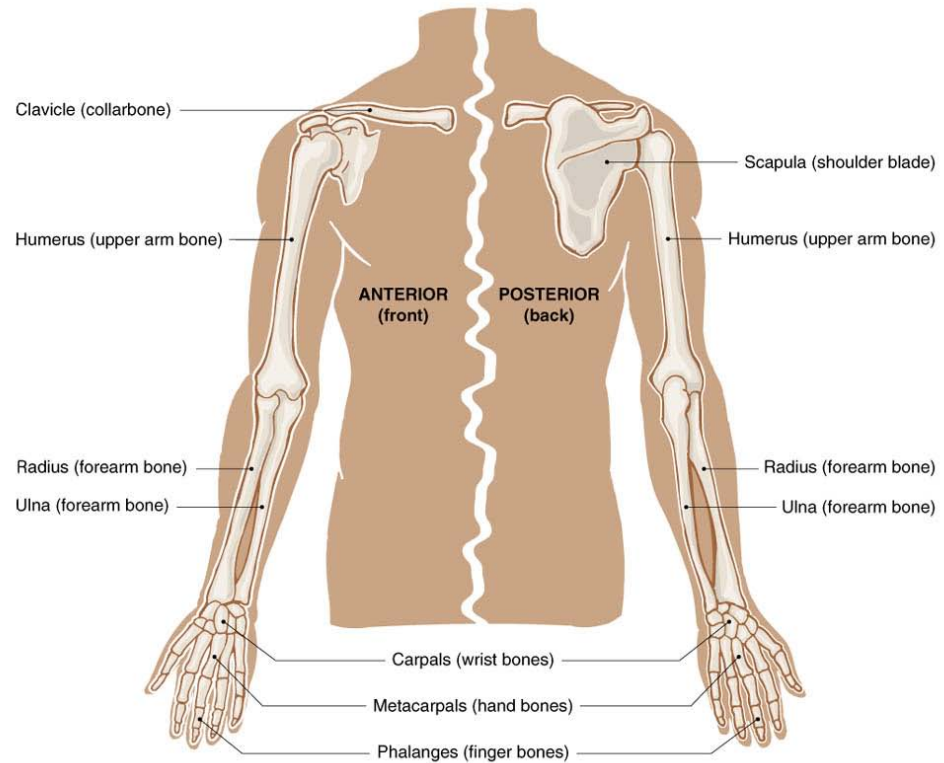




Bones to know without a doubt

- Upper extremities:
 - Scapula – shoulder blade
 - Clavicle – collar bone
 - Humerus – upper arm
 - Radius – thumb side bone of lower arm (radial pulse)
 - Ulna – small finger side of lower arm
 - Carpal bones – wrist bones
 - Metacarpal bones – hand bones
 - Phalanges - fingers

Upper Extremities



THE UPPER EXTREMITIES

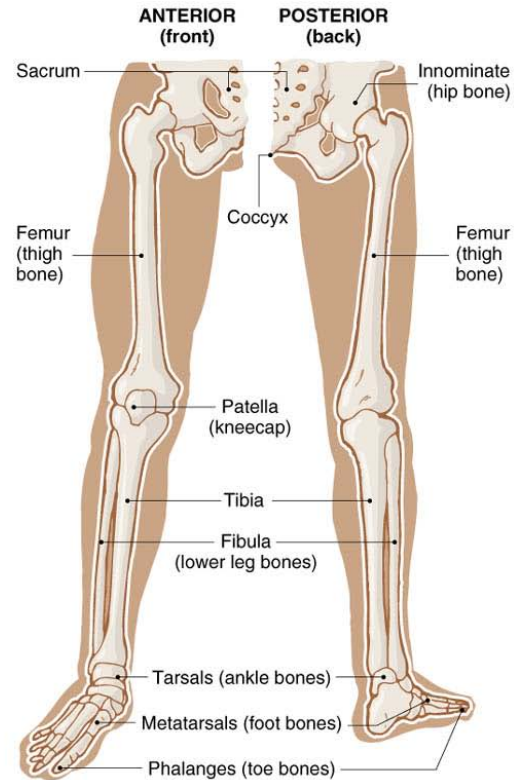
COMMON NAME	ANATOMICAL NAME
Shoulder girdle	Pectoral girdle (PEK-tor-al): clavicle, scapula, and head of humerus
Collarbone (1/side)	Clavicle (KLAV-i-kul)
Shoulder blade (1/side)	Scapula (SKAP-u-lah)
Arm bone (1/limb, from shoulder to elbow)	Humerus (HU-mer-us)
Forearm bones (2/limb, from elbow to wrist: 1/medial, 1/lateral)	Ulna (UL-nah)—medial Radius (RAY-de-us)—lateral
Wrist bones (8/wrist)	Carpals (KAR-pals)
Hand bones (5/palm, palm bones)	Metacarpals (meta-KAR-pals)
Finger bones (14/hand)	Phalanges (fah-LAN-jez)



Bones to know without a doubt

- From the Waist down and Lower extremities:
 - Ilium – upper, anterior portion of the pelvis
 - Ischium – lower, posterior portion of the pelvis
 - Femur – thigh bone
 - Patella - knee
 - Tibia – anterior of the 2 lower leg bones (medial)
 - Fibula – posterior of the 2 lower leg bones (lateral)
 - Tarsal bones – ankle bones
 - Metatarsal bones – foot bones
 - Phalanges - toes

Pelvis and Lower Extremities

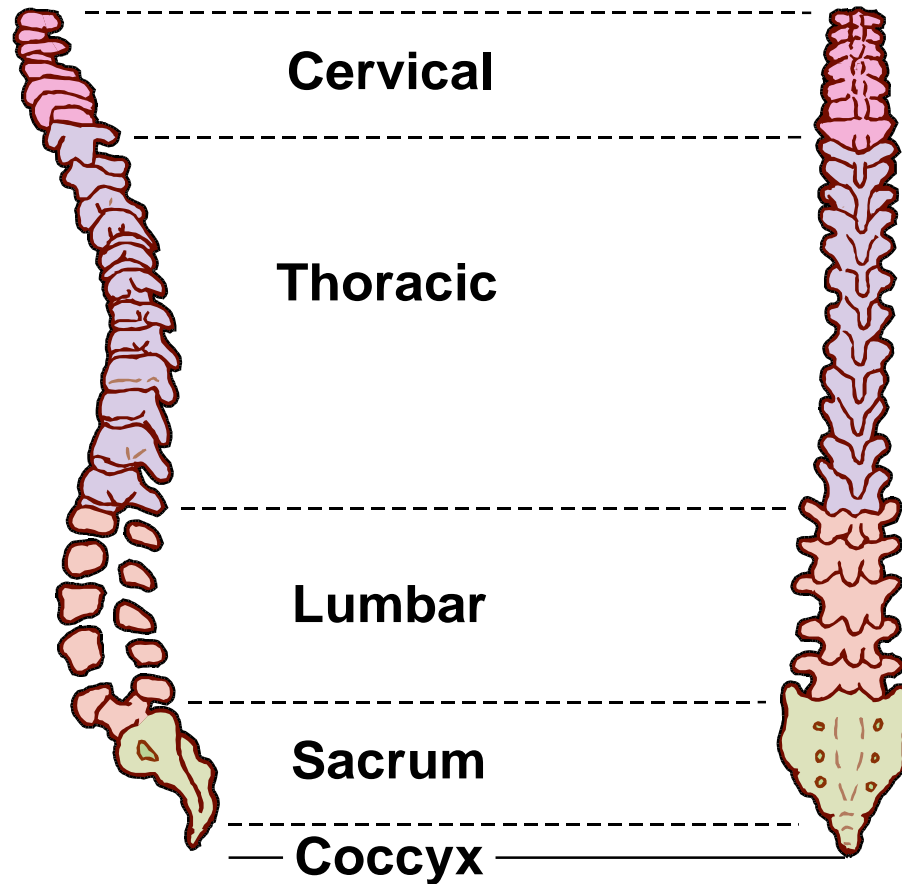


THE LOWER EXTREMITIES

COMMON NAME	ANATOMICAL NAME
Pelvic girdle (pelvis or hips)	Innominate on each side made up of the fused ilium, ischium, and pubis bones, as well as sacrum and coccyx posteriorly
Thigh bone (1/limb)	Femur (FE-mer)
Kneecap (1/limb)	Patella (pah-TEL-lah)
Leg bones (shin bones, 2/leg, 1 medial, 1 lateral)	Tibia (TIB-e-ah) – medial Fibula (FIB-yo-lah) – lateral
Ankle bones (7/foot)	Tarsals (TAR-sals)
Foot bones (5/foot)	Metatarsals (meta-TAR-sals)
Toe bones (14/foot. Some people have two bones in their little toe, others may have three.)	Phalanges (fah-LAN-jez)



Spinal Column / Vertebral Column





Bones to know without a doubt

- Vertebrae – Spinal column (you should already know)
 - _____ Cervical vertebrae
 - _____ Thoracic vertebrae
 - _____ Lumbar vertebrae
 - _____ Sacral vertebrae
 - _____ Coccyx vertebrae



Bones to know without a doubt

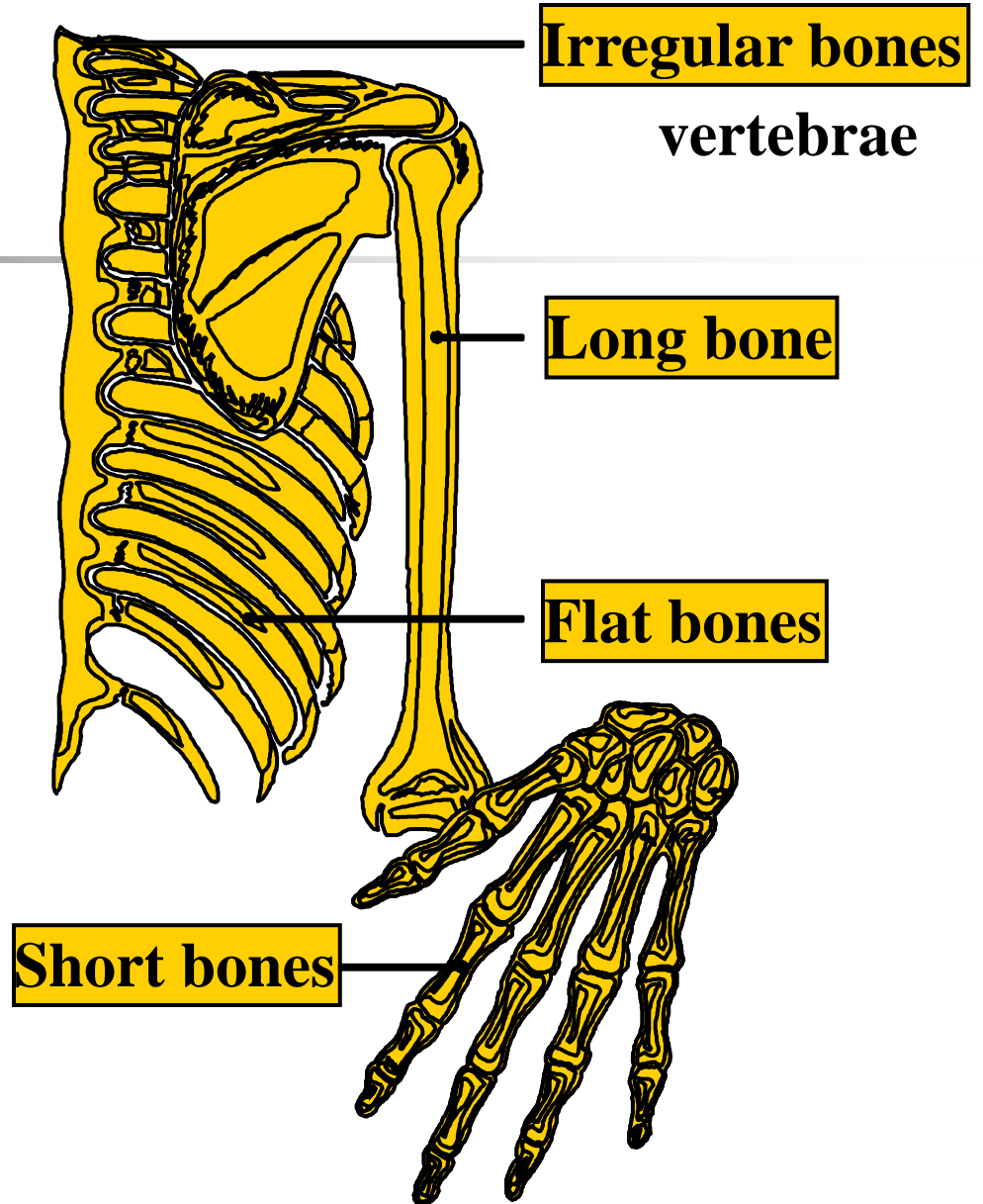
- Vertebrae – Spinal column (you should already know)
 - 7 Cervical vertebrae
 - 12 Thoracic vertebrae
 - 5 Lumbar vertebrae
 - 5 Sacral vertebrae
 - 4 Coccyx vertebrae
-
- 33



Types of Bones

- Irregular
 - Vertebrae
- Short
 - Fingers & toes
- Flat
 - Ribs
- Long
 - Femur, humerus, radius, ulna, tib / fib...

Types of Bones:





Types of Joints

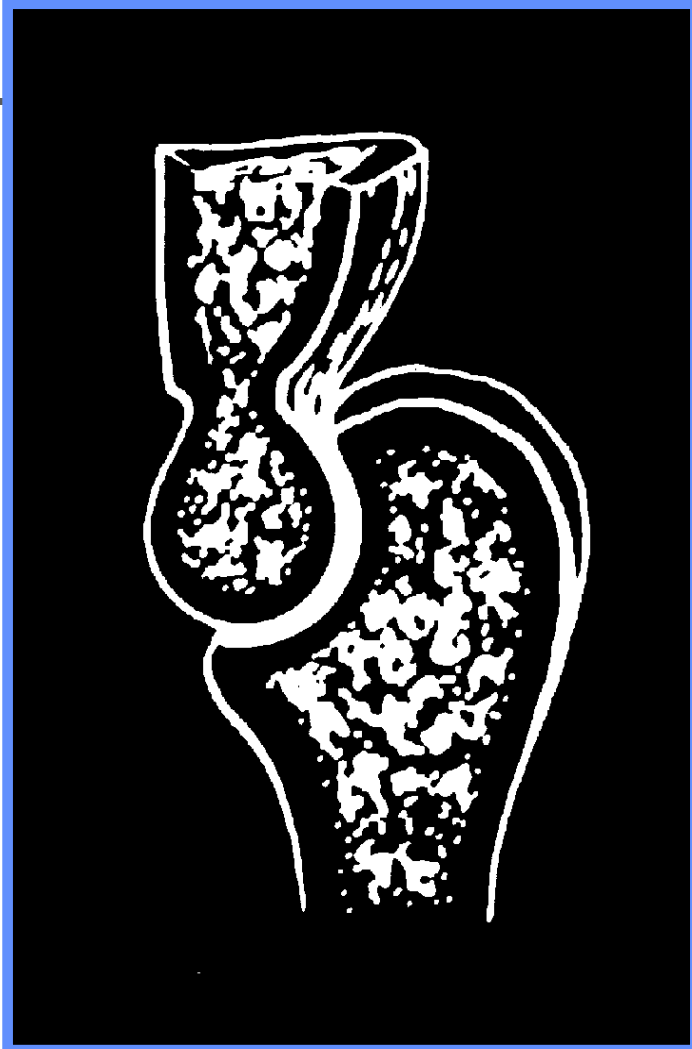
- Ball and socket
 - Hip
- Hinge
 - Knee, elbow...

Ball-and-Socket Joint



Hip

Hinge Joint



**Elbow
or
Knee**



Tendons and Ligaments

- Tendons:
 - Hold muscles to bones.
- Ligaments:
 - Hold bones to bones / stabilize and hold bones in place.
 - Typically what are injured in knee injuries that require surgery and lengthy rehabilitation. Sometimes involves tendons as well.



Strains and Sprains

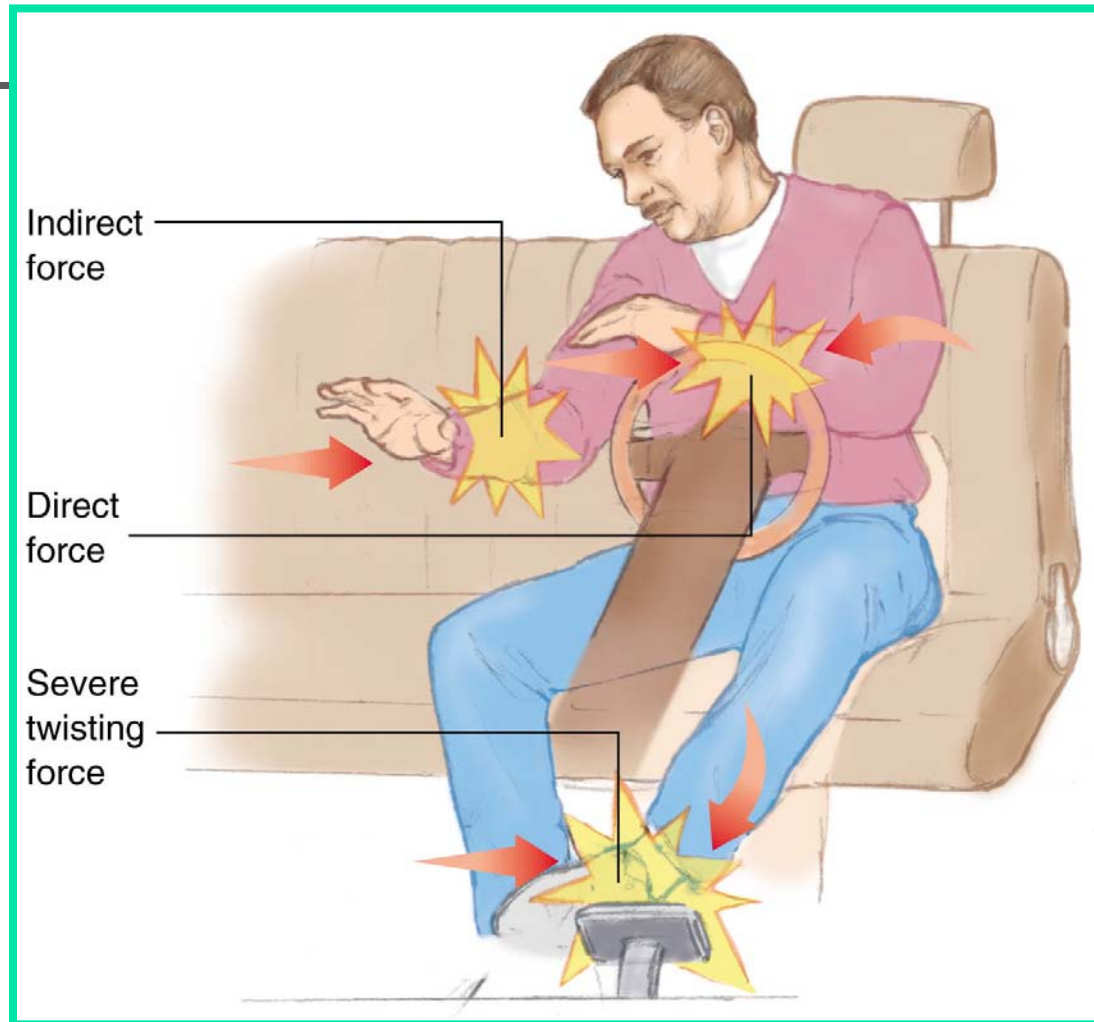
- **Strains** are typically over working or over stretching muscles.
 - You **strain** your back.
 - Immobilize (limit movement) and place patient in position of comfort.
 - “I was moving the couch and now I can hardly get up and down”.
- **Sprains** often involve ligaments and / or tendons.
 - You **sprain** your ankle.
 - Treat as a fracture – splint and ice / cold packs.
 - “I was playing field hockey and tried to turn quickly and felt my ankle twist and now it’s swollen and very painful”.
 - Sometimes requires surgery if ligaments are involved.



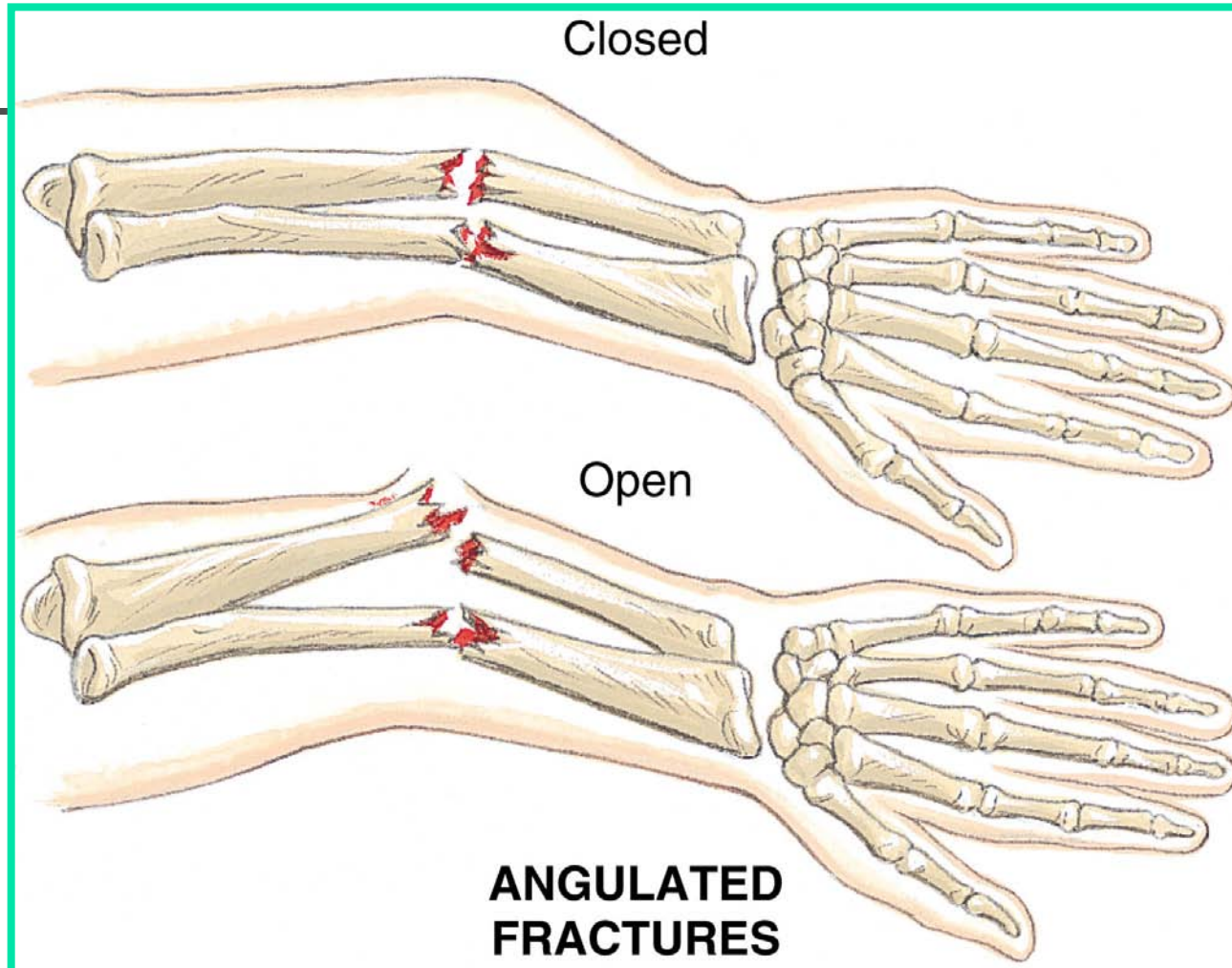
Dislocations

- A dislocation occurs when a bone is displaced from its joint where it interfaces with another bone:
 - Hip (most common dislocation for EMS Providers)
 - Shoulder (common injury)
 - Knee (common injury)
 - Ankle (pretty uncommon)
- Dislocations are treated just like a fracture.
 - More likely to cause nerve or blood vessel impingement.

Assess Mechanisms of Injury



Types of Fractures





Other Types of Fractures

- Spiral (caused by a twisting motion)
- Green-stick (seen in children due to the elasticity of their bones)
- Compression (typically a loading fracture – jump or fall from a high area...)
- Angulated or Straight (in-line)
- Comminuted fracture (fragmented into many pieces)



Signs & Symptoms of a Fracture

- Pain / tenderness.
- Swelling.
- Deformities or angulations.
- Visible bone ends or bulging / nearly through the surface of the skin.
- Grating or crepitus of bone ends rubbing against each other.
- Bruising.
- Loss of, or diminished circulation to an extremity when compared to the other.
- “Immobile / locked in place” joint (knee, elbow...).



The Golden Rule of EMS

- **DO NO FURTHER HARM.**
 - All efforts should be made to stabilize bone ends and reduce the probability of further tissue or bone damage.



Reasons for Splinting

- Help to reduce or minimize pain.
- Reduce disability – vascular or nerve damage.
- Keep closed fractures from becoming open fractures.
- Minimize blood loss.



Splinting Guidelines

- BSI / Scene safety....
- Expose the area around the fracture – remove clothing.
- When in doubt – splint.
- Isolated fractures alone are rarely going to pose a life threat.
 - They may look terrible due to angulation or exposed bone ends but should only be considered a **distraction** in the severely traumatized patient.
 - **Bilateral femur fractures, pelvic fractures and multiple rib fractures are those of most concern as life threats.**
 - Don't forget the rapid trauma assessment and load and go situations you've been taught! Don't get lured away by gross fractures.
- **Immobilize the joint above and below the fracture.**



Splinting Guidelines

- Control bleeding, remember to administer oxygen and treat for shock.
 - Cover wounds with sterile dressings.
- Use the correct materials for the situation.
 - Correctly sized splint, correct splinting device, dressings and bandages.
- Slightly elevate (a couple of inches only) splinted limbs.
- Ice / cold packs to help minimize swelling.
- **Joint injury takes priority over straight bone injury.**
 - More likely to have vascular / nerve injury or impairment and increased likelihood of long-term complications.



Splinting Guidelines

- Place limbs in the “splinting position” – or position of function.
 - Arms **bent at the elbow when feasible**. Sling and swathe.
 - Legs **straight and properly aligned** with toes pointing up.
- Pad all void areas where the body isn't in contact with the splint – wrists, behind the knee, lower back....
- **Always check distal pulse, CRT and Sensory / Motor responses before and after immobilizing fractures.**
 - **PMS (Pulse, Motor, Sensory).**
 - **CRT (Capillary Refill Time).**
 - **Movement, Sensory, Circulation (MSC) – used by some instead of PMS.**



Splinting Guidelines

- A **pulseless** or **cyanotic** extremity is a **Priority 1** patient in what may otherwise have been a Priority 3.
- **DO NOT** attempt to push exposed bone ends under the skin. Align the fracture / limb but **do not attempt to make an opened fracture a closed one**.
 - **Realignment should always be done with gentle traction so broken bone ends do not rub against one another.**
- Splint before moving if the patient is stable. Otherwise, align the bones anatomically, place on full board and move to transport.
- Splinting takes time. **When the patient is unstable or borderline move to your unit and splint enroute to the hospital.** Use the full board as a full body splint.



Splinting Guidelines

- Place fractured extremities in proper anatomical alignment ASAP if they are cyanotic, pulseless or with neurological impairment.
 - Remember to use gentle traction during the realignment process.
 - **Contact Medical Control when in doubt.**
- Splinting should be done so the extremity is in the “**position of function**” as previously stated.



Fracture Management Techniques



Types of Splints

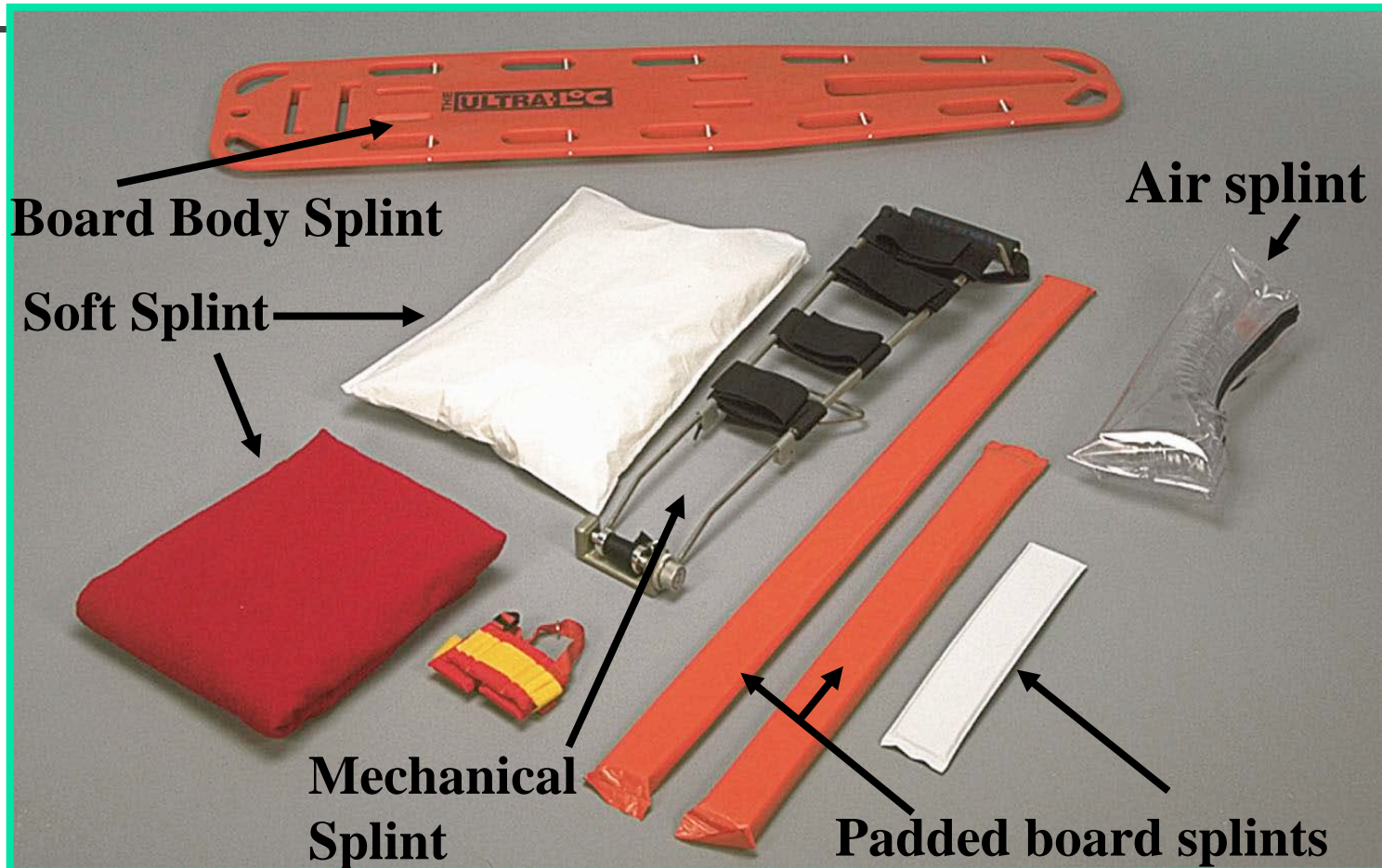
Full Board Body Splint

Soft Splint

Air splint

Mechanical Splint

Padded board splints



Long-Bone Splinting

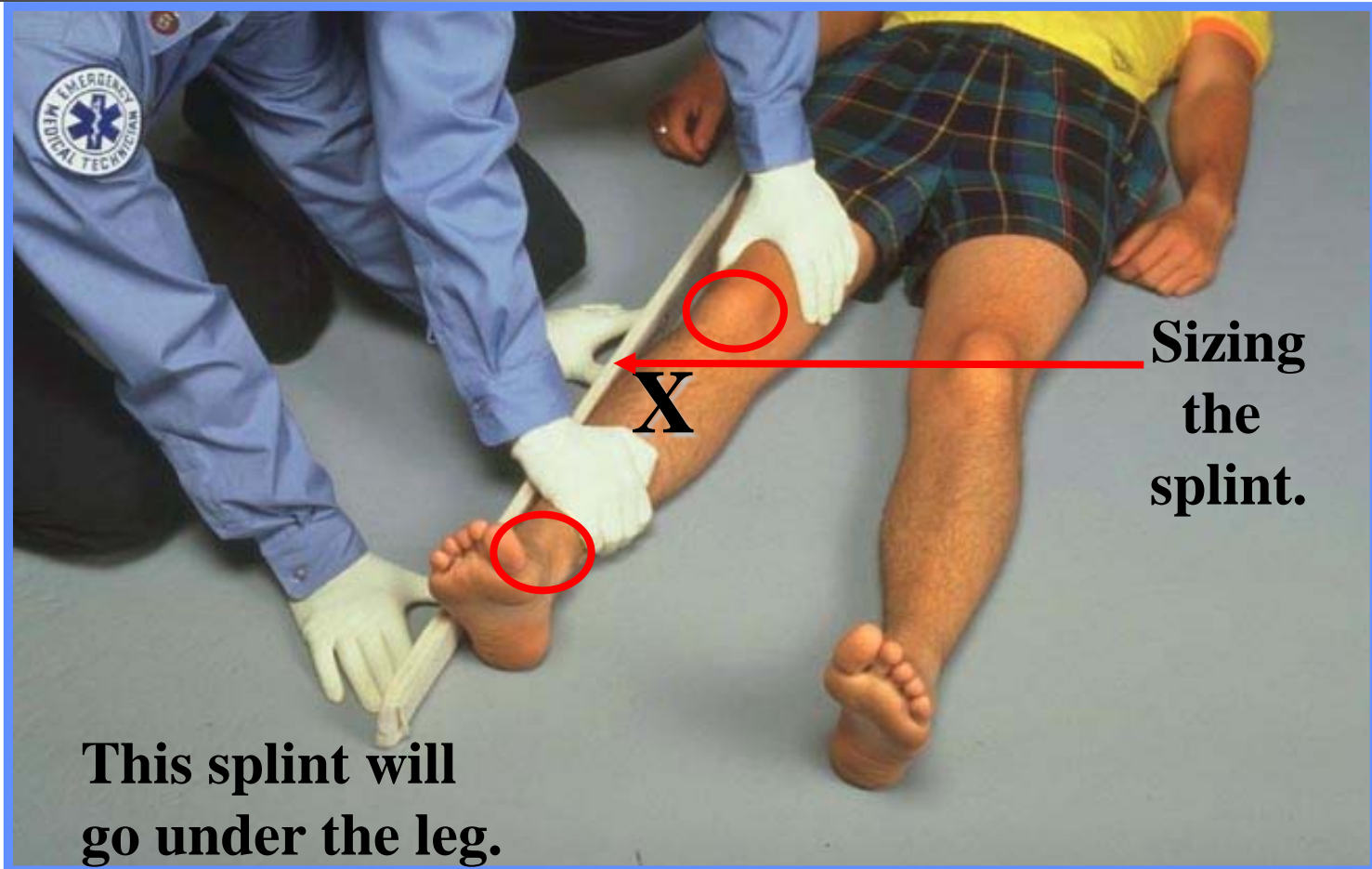
Stabilize Extremity Manually.



Assess Distal Pulse / Motor / Sensory (PMS).

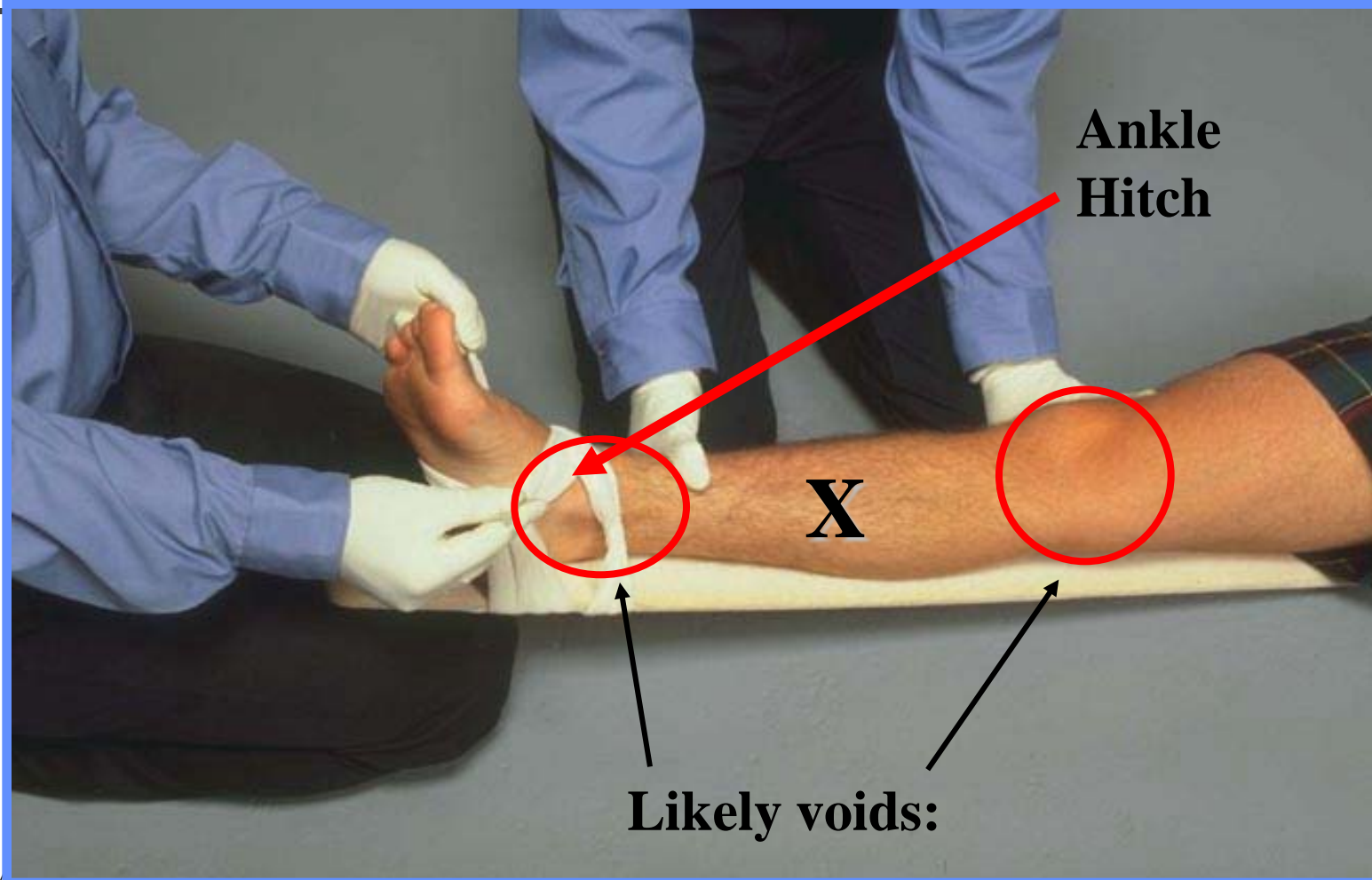


Always Try to Immobilize the Joints Above and Below the Fracture.

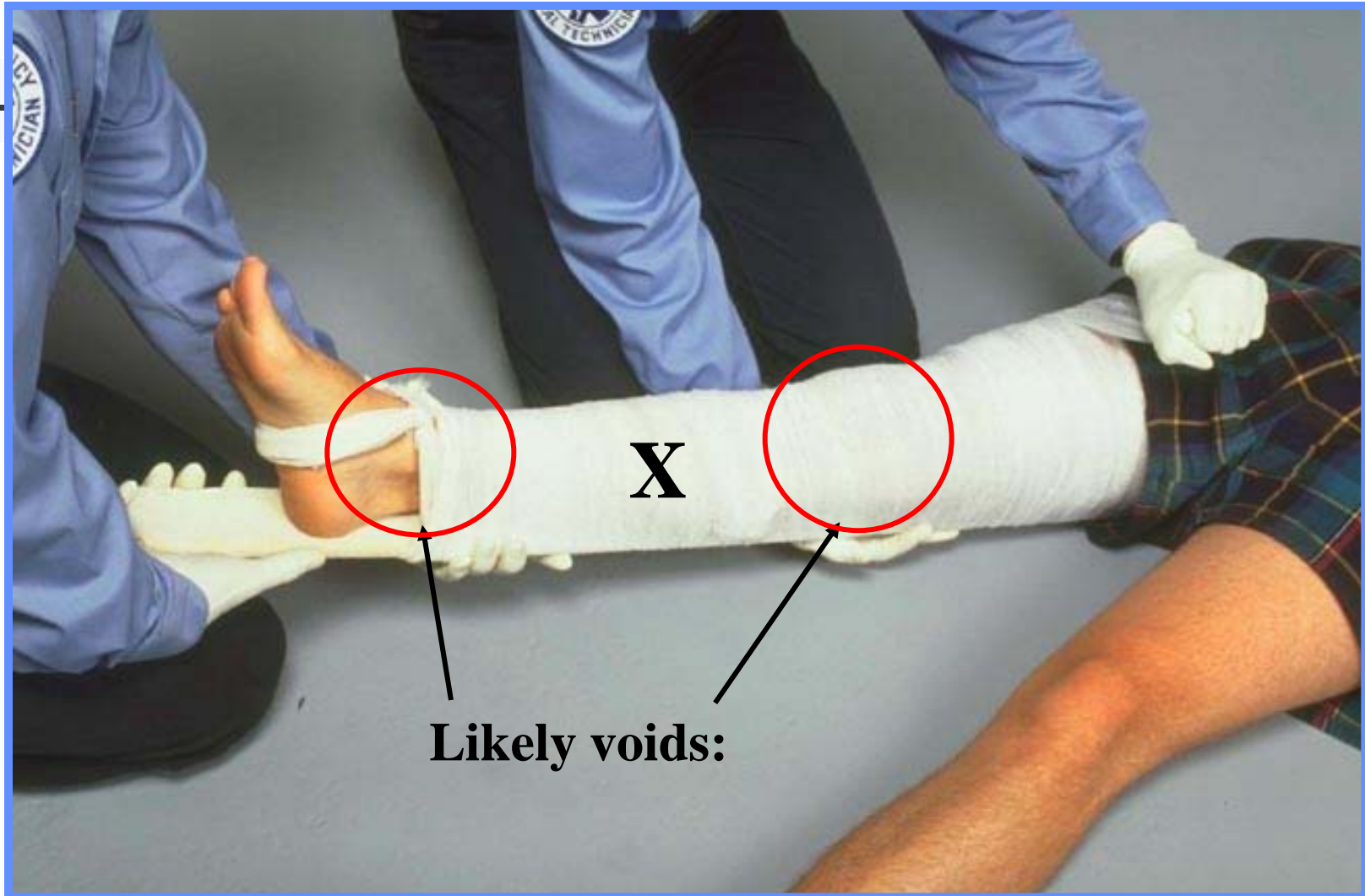


Apply Splint to Immobilize Joints Above & Below the Fracture.

This technique is used for knee to ankle fractures.



Secure Entire Extremity to Splint – Pad Voids.



Secure foot or hand in position of function.

Place a roller bandage in the palm of the hand to maintain position.

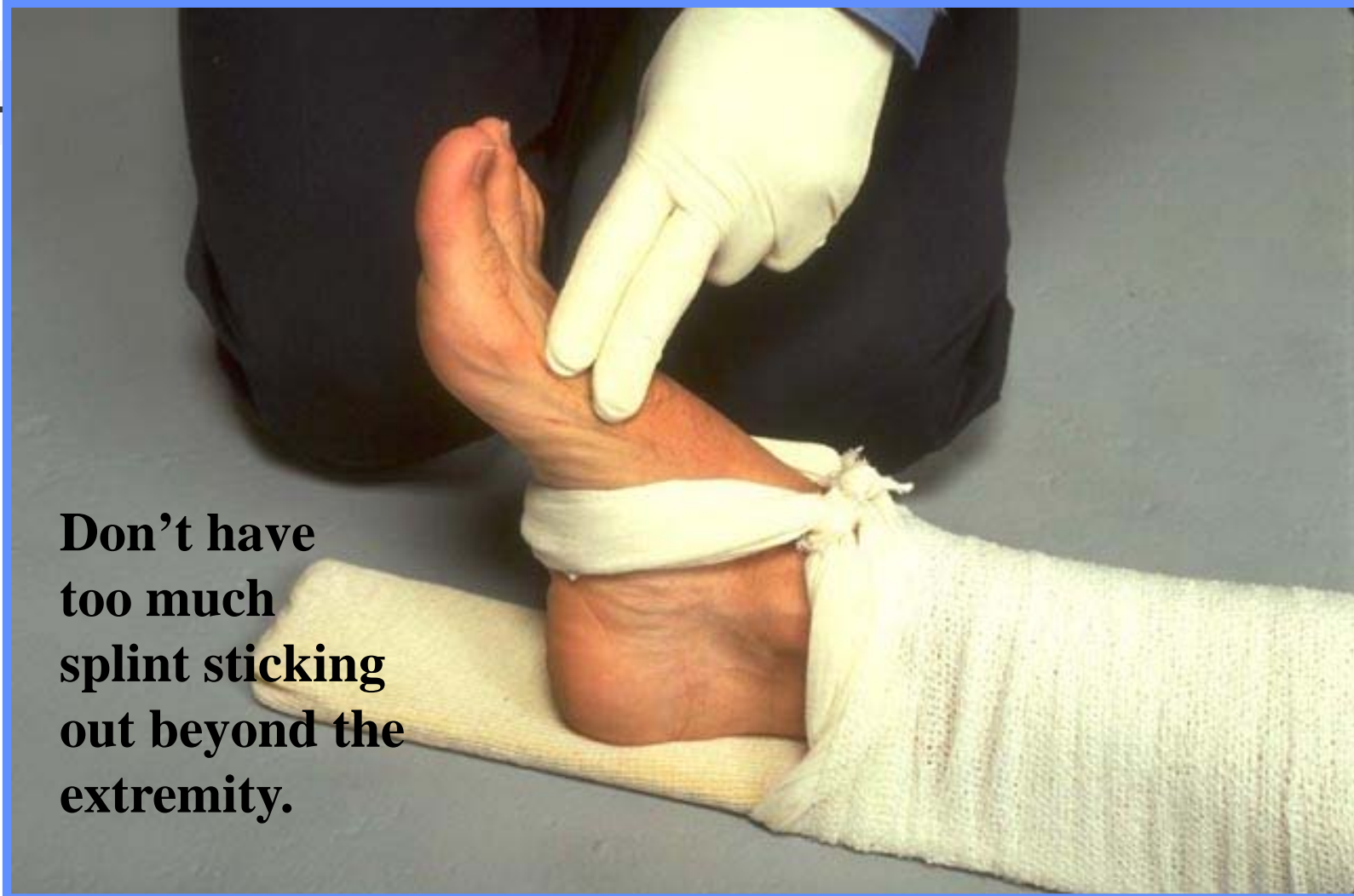


The toes should point straight up.



Pad voids:

Reassess distal PMS.



**Don't have
too much
splint sticking
out beyond the
extremity.**

Joint Immobilization: Stabilize Injured Area Manually.



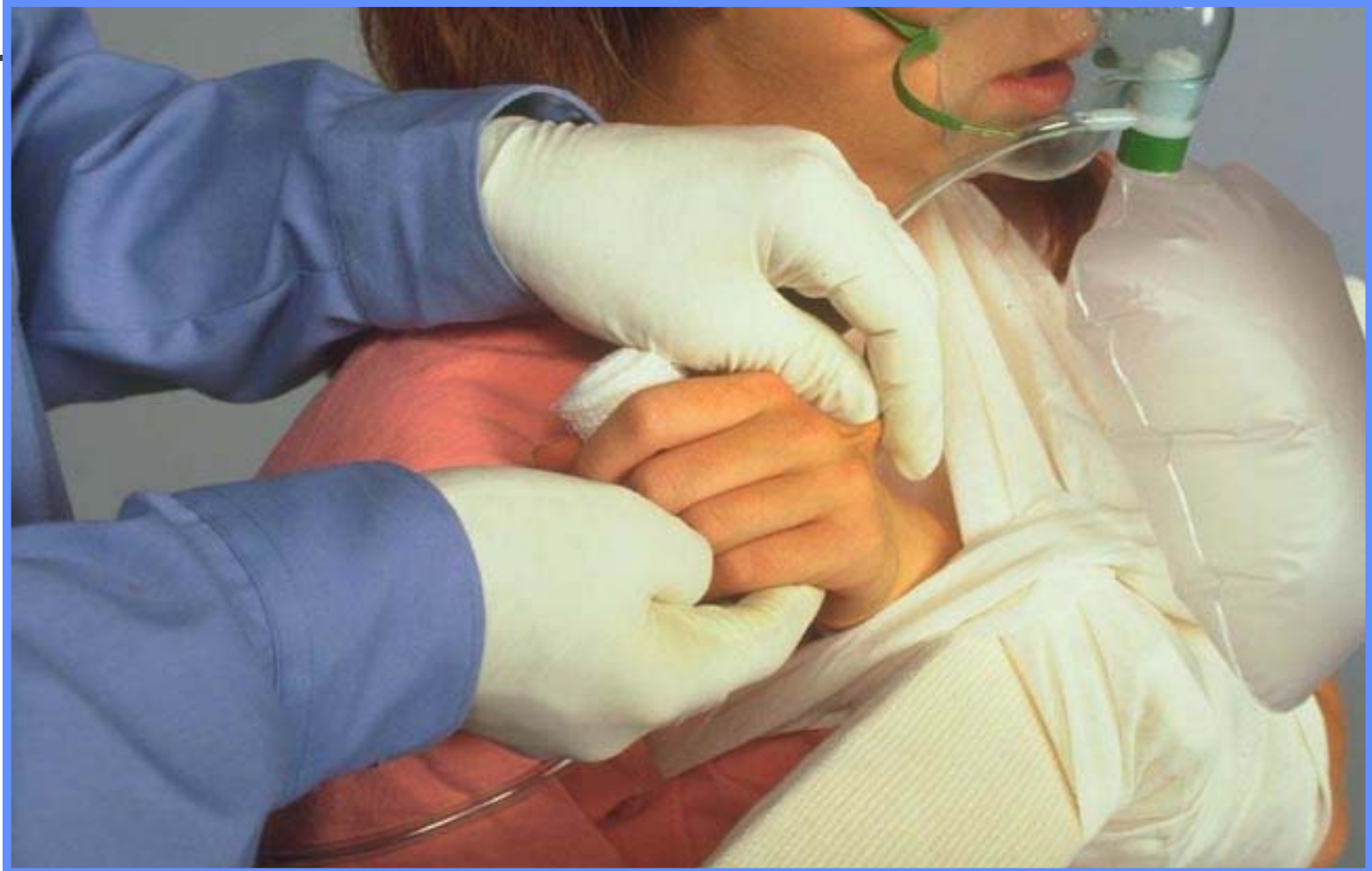
Assess Distal PMS (Motor / Sensory).



Immobilize Above & Below Fractures.



Reassess Distal PMS & Place Hand in Position of Function.



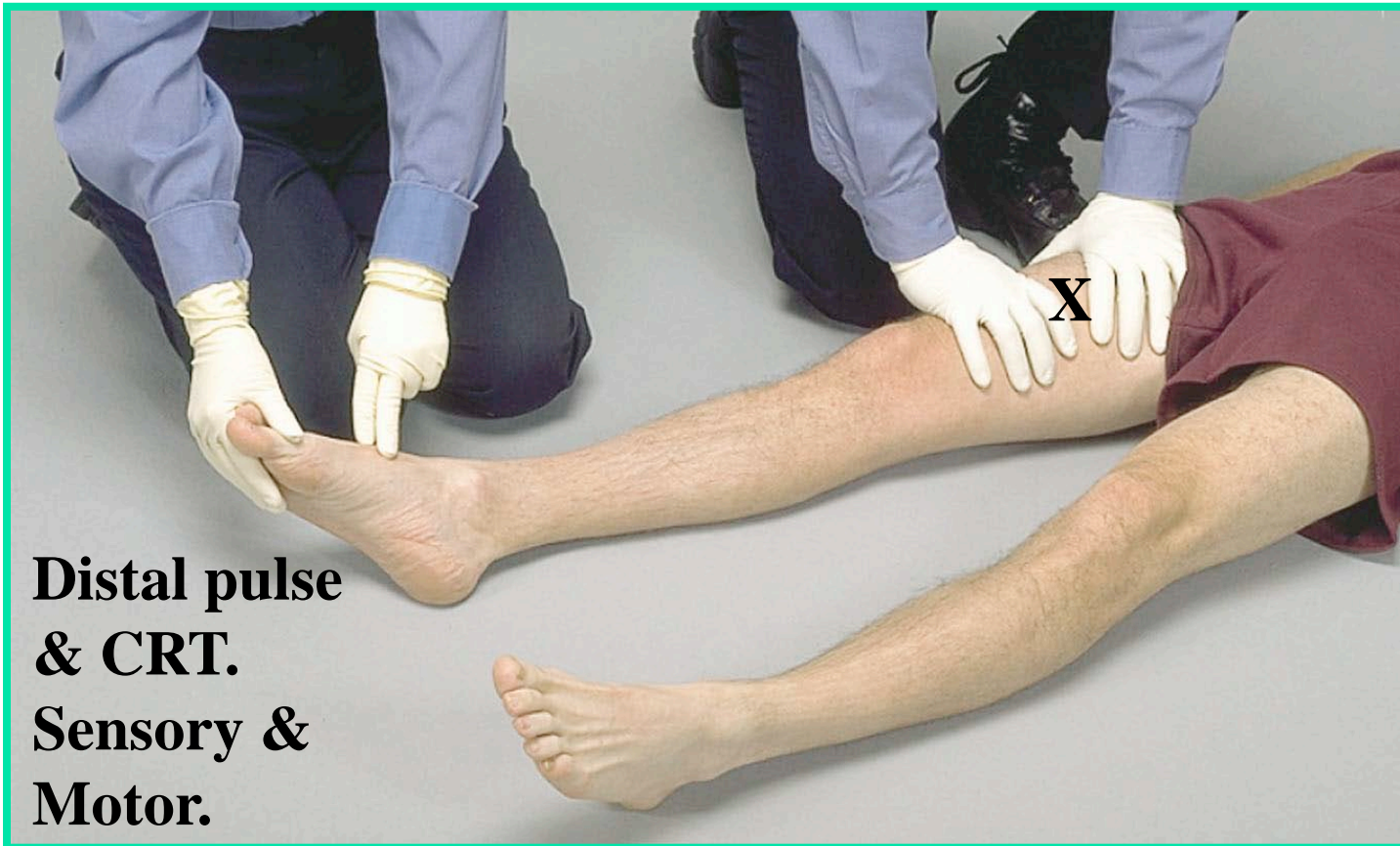


Femur Fracture: Mechanical Traction Splint

■ Hare Traction Splint:

- Used exclusively for femur fractures.
 - Cannot be used if there are suspected fractures at or below the knee.
 - Cannot be used if partial amputation of the intended extremity exists.
 - May complete the amputation.
 - Should not be used if hip fracture or dislocation is suspected.
- Other Mechanical Splints are available but much less seldom used.
- Available in adult and pediatric sizes.

Traction Splinting: Stabilize Leg Manually. Assess Distal PMS.



POOR TECHNIQUE:

Direct application of manual traction.



**This is NOT how you will be taught to maintain traction.
Your pictures will be substituted.**

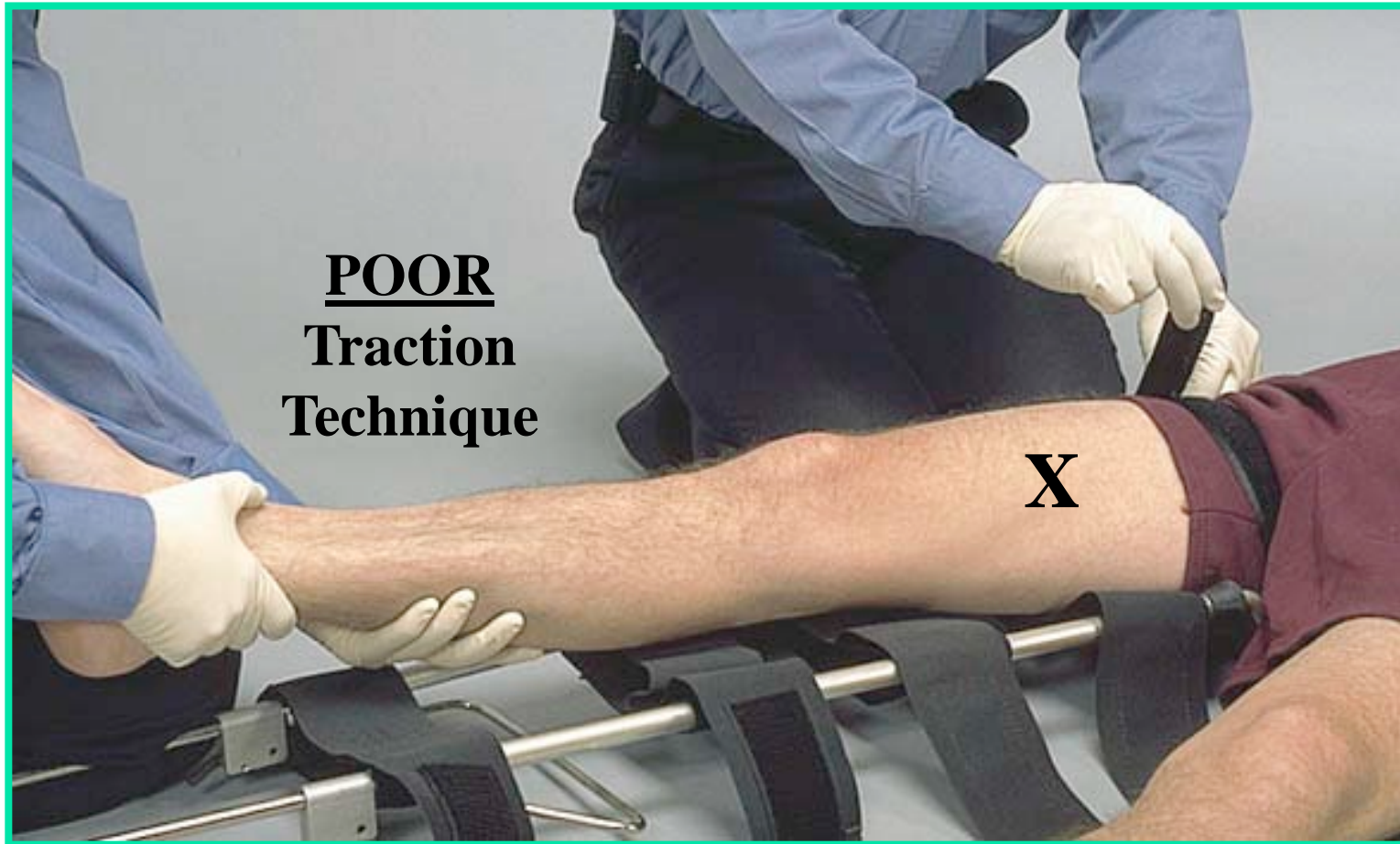
Adjust Splint Length and Position. Measure the Unbroken Leg.



Improper Technique.

**Will use your pictures
here too.**

Slide the Splint Under the Injured Leg. Apply Proximal Securing Device.



Apply distal securing device.



Technique still incorrect. Your pictures will substitute.

Apply Mechanical Traction.



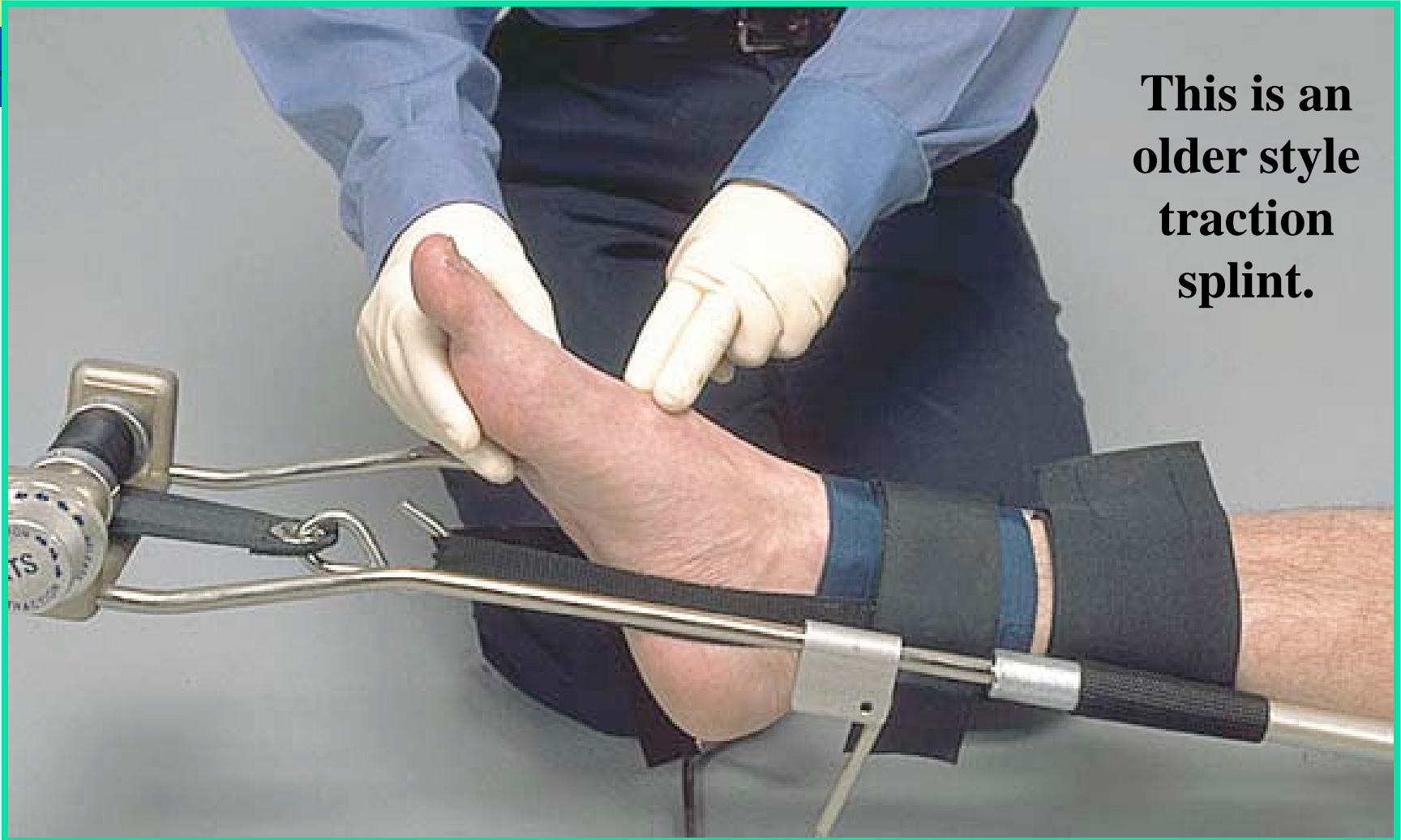
Her technique still incorrect. Nothing is being done to support the fracture

Position / Fasten Support Straps. Re-evaluate Proximal / Distal Securing Devices.



This is an illustration demonstrating how “**not to do**” this skill. We will show you the proper way in class.

Reassess distal PMS & CRT.



**This is an
older style
traction
splint.**

Secure patient and splint to long board.



Make sure the “stand” doesn’t slip off of the board.

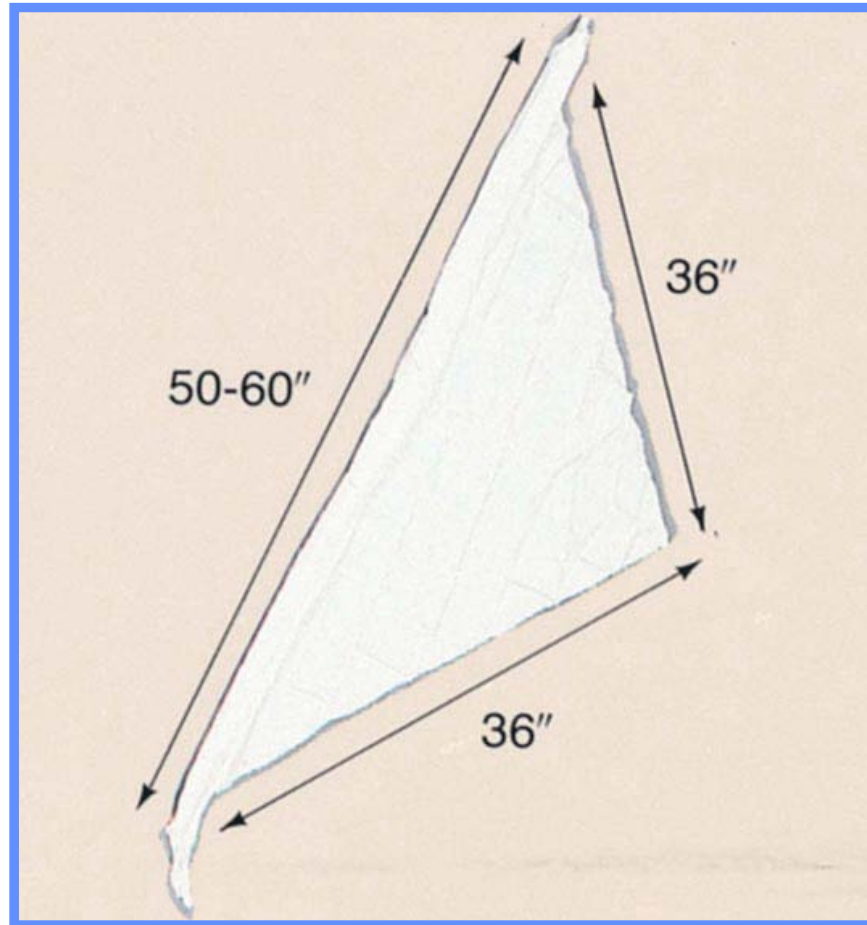


Foot and / or Ankle Orthopedic Injury

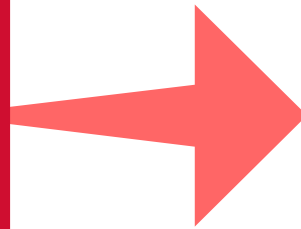
- A soft splint – **pillow** – and several cravats can be used to stabilize a fracture or dislocation of the ankle or fracture of the foot.
- We will include a picture from your class.

Sling and Swathe Materials Should be Triangular (cravat).

Sizes may
vary.



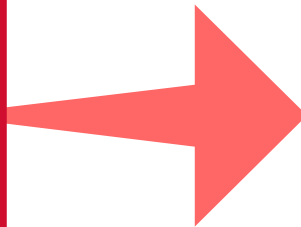
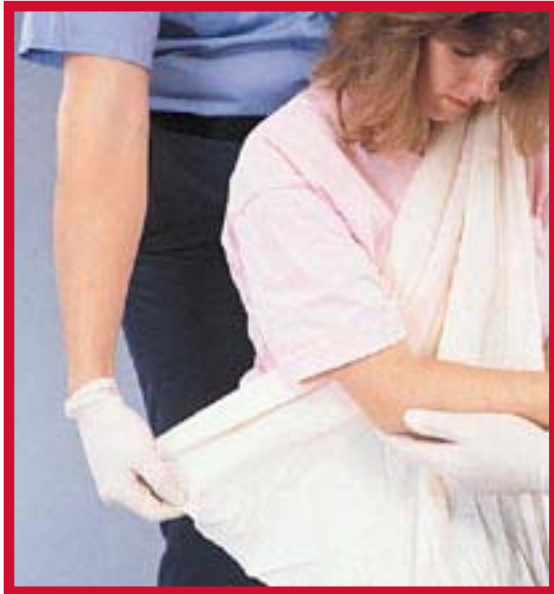
Positioning a Sling.



What's wrong with this picture??



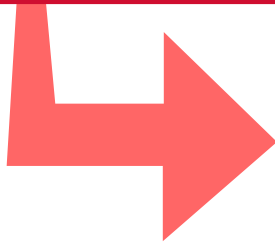
Forming a Sling.



What's wrong with this picture??

Fasten sling.

Will pad this area under the knot.



Leave fingertips exposed. Check distal PMS.



CRT

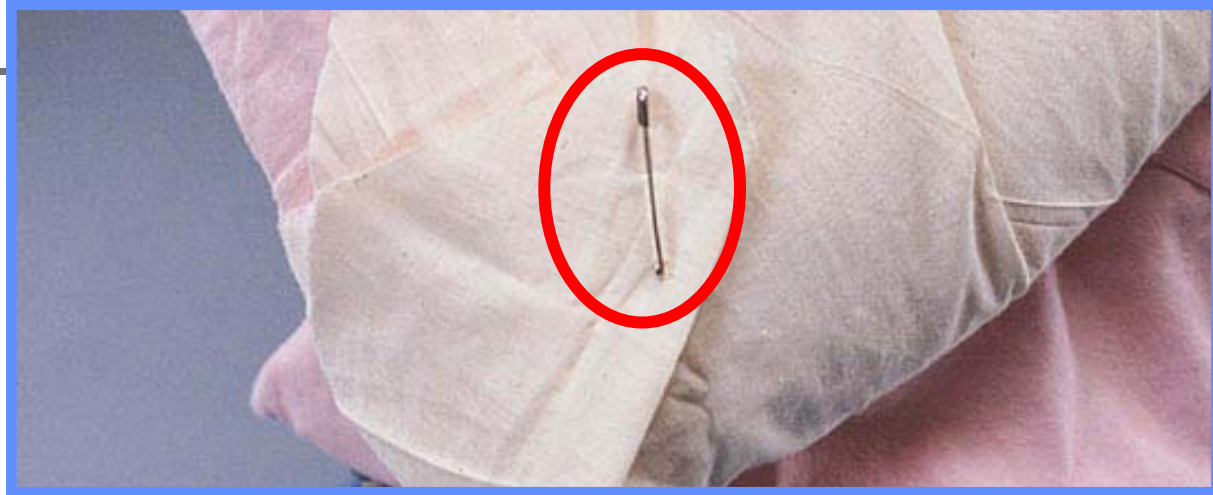
Distal Pulse check



Secure corner of sling.

Will show you techniques that do not use the safety pin.

We will tie the knot before applying the sling.



Tie swathe around sling.



Splint for Injured Forearm



Roller gauze should have come further down the hand to include most of the fingers.

The splint should have been placed more distally.



Splint for Injured Fingers or Toes



Tape to the finger or toe next to the injured one.



The Consequences of Improper Use of Splinting

- Splints applied improperly can cause numerous long-term or permanent problems:
 - Limited use of an extremity.
 - Total loss of the use of an extremity.
 - Chronic lifelong pain.
 - Loss of an extremity – necessary amputation.
 - Loss of livelihood due to reduction or loss of function.
 - When talking about the spine – death or paralysis.



Summary

- Fracture management calls upon you to be creative and very observant.
- Always check PMS & CRT before & after splinting.
- Remember to manage fractures in route to the hospital with “load and go” patients.
- Treat for shock.
- Do no further injury.
- Some fractures will be severely deformed.
- Splint in the “position of function”.
- Contact Medical Control when you have questions about managing fractures.



Summary

- Manage complex (joints, open fractures) before simple fractures.
- Bilateral femur fractures are potentially lifethreatening due to the amount of blood that can be lost in the expandable tissues of the thigh. These are Priority 1 patients. It take tremendous force to fracture a femur.
- Always consider other injuries when managing fractures – especially pelvic and rib fractures.
- **BONES TYPICALLY WEAKEN WITH AGE** – especially with post menopausal women (around the late 40's early 50's).