

Identifying X-Rays

HASPI Medical Anatomy & Physiology 08d Activity

Background

Radiography

Medical radiography is the visualization and study of parts of the body using x-rays. The terms x-ray and radiograph are interchangeable. In 1895, German scientist Wilhelm Roentgen accidentally discovered the ability of an x-ray pulse to pass through the human body and create an image on a screen. There have been many improvements since then, especially once the lower-energy x-rays were found to be extremely harmful to human body tissues.

Modern x-ray machines send electron beams through the soft tissue of the body and are blocked by denser bone and tissues. What is left after the electron beam passes through the body is captured on a film, or more commonly a receiver, that creates a digital x-ray. X-rays are able to pass through the human body but are slowed down by denser material, like the calcium in bones. X-rays are primarily used to diagnose injury or disease to bones, joints, and internal organs.

Radiography is one of the most common diagnostic tests performed, and in 2010 more than 5 billion radiographs were taken in the U.S. There are many different types of radiographs, or images, that can be taken depending on the part of the body being viewed. Some of the most common examples include:

- Musculoskeletal radiographs used to diagnose fractures or dislocations
- Chest radiographs used to diagnose lung diseases like pneumonia
- Fluoroscopy during heart catheterization procedures
- Fluoroscopy used to diagnose disorders or blockage of the GI tract
- Mammograms
- Dental radiographs

Dislocation & Bone Fractures

The dislocation of a joint is a common musculoskeletal trauma diagnosed through radiography. Dislocation is the displacement of bones at the joint, and is often caused by impact trauma to that joint. Dislocations can often be more damaging and painful than fractures, since damage of the joint capsule and surrounding ligaments and tendons often take much longer to heal than bone tissue due to lack of vascularization.

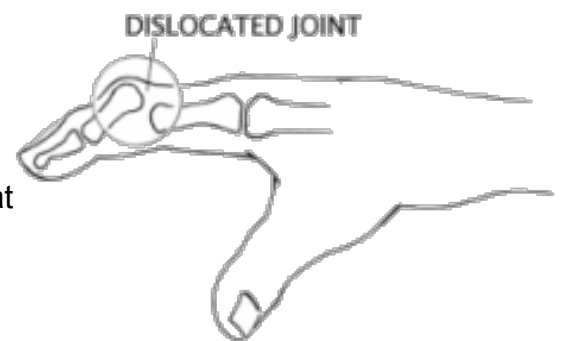
Fractures are a common occurrence and result when a physical force that is greater than the strength of the bone is exerted. On average, everyone will experience at least two fractures in their lifetime. Some general terms in reference to fractures are displaced, non-displaced, closed/simple, and open/compound. A displaced fracture occurs when the bone breaks and the ends no longer line up straight, while in a non-displaced fracture the bones still line up straight. A closed or simple fracture stays within the skin, while an open or compound fracture breaks through the skin surface. In addition to these terms, there are many different types of fractures that are categorized based on how the bone actually breaks.

Name(s): _____

Period: _____ Date: _____



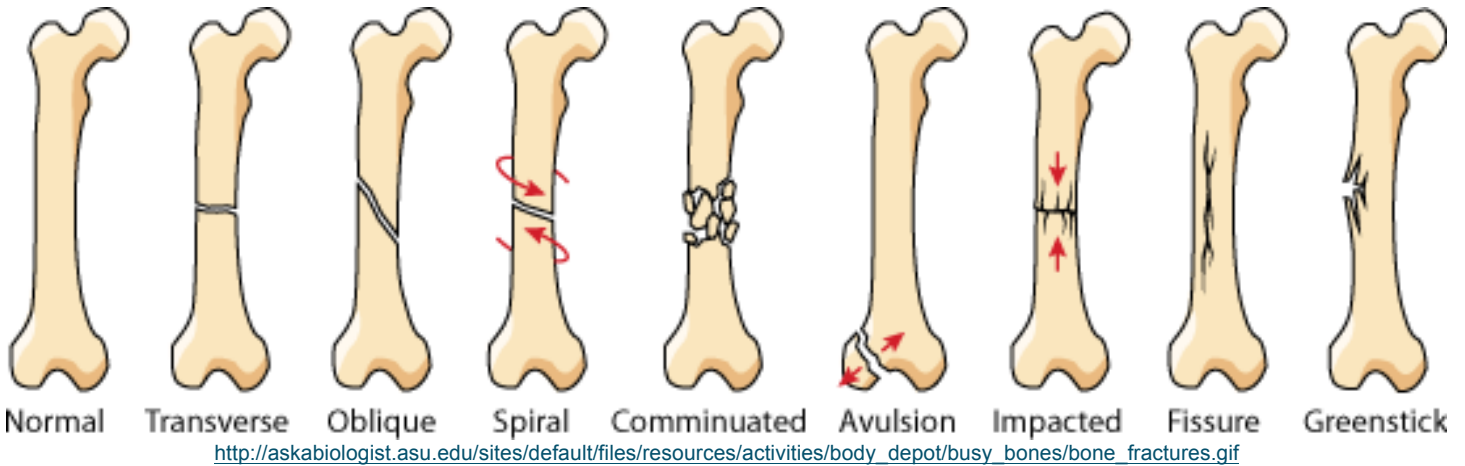
http://den-2.phys.uaf.edu/12_fall2003/web/dirkalton_stephan_cook%20hand%20xray.jpg



<http://www.fdmadison.org/uploads/images/health/dislocation.gif>

Types of Fractures

The type and severity of a fracture is dependent on the strength and direction of the forces that cause a bone to break. The following table summarizes the common types of fractures and the type of force that could be the cause. The image below shows a visual of each fracture type.



Type of Fracture	Definition	Cause
Transverse	The fracture occurs at an exact 90° horizontal angle.	Caused by a bending force that causes the bone to snap (like snapping a carrot.)
Oblique	The fracture occurs sloped down/up at an angle or curves.	Trapping of one bone while the other twists over it (foot caught in a rock and the leg twists.)
Spiral	The fracture spirals around the bone.	Caused by twisting force.
Comminuted	The fracture breaks into multiple pieces.	Caused through crushing force.
Avulsion	A ligament or tendon pulls away from its attachment on the bone, and a fragment of bone breaks off with it.	A muscle contraction or stretch that is stronger than the force that holds the tendon/ligament to the bone.
Impacted	The fracture occurs in the middle of a bone when it is driven into itself and buckles.	Compression of the bone from end to end.
Fissure or Hairline	An incomplete bone fracture; multiple small lines are often visible, but do not pass through the entire bone.	Any force that could cause any of the other types of fractures, but is not great enough to completely break the bone.
Greenstick	The bone bends rather than breaks, much like a green tree branch.	Occurs most often in children in bones that have not completely ossified and still contain cartilage.

AAOS. 2012. Types of Fractures and Dislocation. American Academy of Orthopedic Surgeons, www.aaos.com.

WebMD. 2012. Understanding Bone Fractures—The Basics. WebMD, www.webmd.com.

Materials

Patient X-ray Charts (14)

Normal X-ray Charts (14)

Procedure

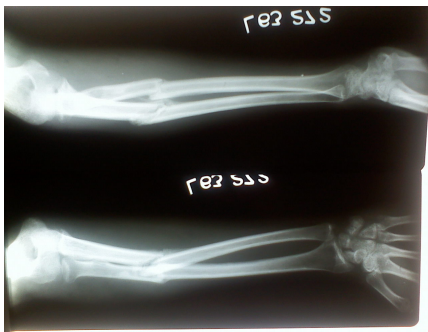
Scenario

You are a radiologist for HASPI Hospital and it is a busy day! Fourteen patients are waiting for you to view their x-rays. The x-rays are spread throughout the room, and a normal x-ray has been included with each x-ray for comparison. A mini version of each x-ray has been included on this lab sheet for reference. Analyze each patient x-ray and answer the questions in the boxes provided. Remember, interpreting x-rays is not simple and you will only get better with practice, so don't get frustrated!

Use the following steps when analyzing x-rays:

1. **Where am I?** Start by identifying the part of the skeleton you are viewing and the bones involved. The outer cortex of bone is denser than the inner medulla. This means the outer cortex will appear whiter than the inner medulla on an x-ray film.
2. **Compare it to the normal or opposite side.** If you are unfamiliar with normal skeletal anatomy, use normal x-rays for comparison. A normal x-ray has been provided for each patient as comparison. Remember that every individual is different, so x-rays of the same area from two different people will not look identical.
3. **Is everything aligned?** Look at the joints. A dislocation will be obvious, but often a fractured bone will cause the joint to be misaligned. Check to see if the joint is uneven, narrowed, or widened.
4. **Check the outer cortex.** Systematically look over the whiter outer cortex (edges) of each bone. Is there an obvious misalignment of the outer cortex, slightly darker areas, a difference in bone texture, or portions of the bone missing? Even if a fracture is present in the inner medulla, it will normally start at the outer cortex.

Patient 1: 24 y/o male experiencing forearm pain after a skateboarding fall



Are these bones axial, appendicular, or both?

If it is a fracture, what type?
If it is not a fracture, what is the injury?

List ALL of the bones present.

What are the abnormal findings?

What may have caused this abnormality?

Patient 2: 38 y/o male experiencing knee pain after slipping on ice and hitting his knee on a rock



Are these bones axial, appendicular, or both?

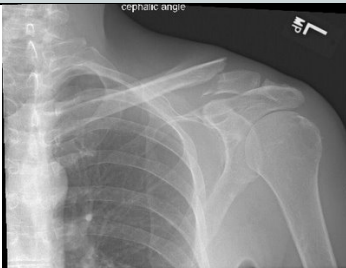
If it is a fracture, what type?
If it is not a fracture, what is the injury?

List ALL of the bones present.

What are the abnormal findings?

What may have caused this abnormality?

Patient 3: 52 y/o female experiencing severe shoulder pain after being slammed into the sand by a wave, learning how to boogie board while on vacation



Are these bones axial, appendicular, or both?

If it is a fracture, what type?
If it is not a fracture, what is the injury?

List ALL of the bones present.

What are the abnormal findings?

What may have caused this abnormality?

Patient 4: 15 y/o male experiencing hand pain after playing with a nail gun in his garage



Are these bones axial, appendicular, or both?

If it is a fracture, what type?
If it is not a fracture, what is the injury?

List ALL of the bones present.

What are the abnormal findings?

What may have caused this abnormality?

Patient 5: 16 y/o female experiencing shin pain after getting kicked directly in the shin during soccer practice



Are these bones axial, appendicular, or both?

If it is a fracture, what type?
If it is not a fracture, what is the injury?

List ALL of the bones present.

What are the abnormal findings?

What may have caused this abnormality?

Patient 6: 23 y/o female experiencing wrist pain after falling while skiing



Are these bones axial, appendicular, or both?

If it is a fracture, what type?
If it is not a fracture, what is the injury?

List ALL of the bones present.

What are the abnormal findings?

What may have caused this abnormality?

Patient 7: 64 y/o female who has been experiencing an increasing amount of pain in the calcaneal region over the last few months



Are these bones axial, appendicular, or both?


If it is a fracture, what type?
If it is not a fracture, what is the injury?

List ALL of the bones present.

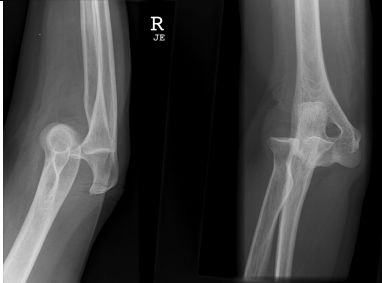
What are the abnormal findings?

What may have caused this abnormality?


Patient 8: 18 y/o male experiencing severe neck pain after diving into the shallow end of a pool and hitting his head on the bottom

	<p>Are these bones axial, appendicular, or both?</p>	<p>If it is a fracture, what type? If it is not a fracture, what is the injury?</p>
<p>List ALL of the bones present.</p>	<p>What are the abnormal findings?</p>	<p>What may have caused this abnormality?</p>

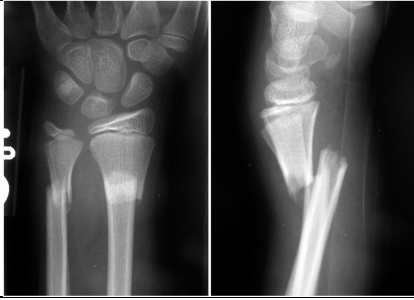
Patient 9: 17 y/o male experiencing elbow pain after being tackled and getting his arm caught at a “funny angle” during a football game

	<p>Are these bones axial, appendicular, or both?</p>	<p>If it is a fracture, what type? If it is not a fracture, what is the injury?</p>
<p>List ALL of the bones present.</p>	<p>What are the abnormal findings?</p>	<p>What may have caused this abnormality?</p>

Patient 10: 72 y/o female experiencing hip pain following a misstep off of a curb

	<p>Are these bones axial, appendicular, or both?</p>	<p>If it is a fracture, what type? If it is not a fracture, what is the injury?</p>
<p>List ALL of the bones present.</p>	<p>What are the abnormal findings?</p>	<p>What may have caused this abnormality?</p>

Patient 11: 19 y/o male experiencing wrist pain after a failed dunk attempt during a basketball game; the patient fell to the ground landing on his hands



Are these bones axial, appendicular, or both?

If it is a fracture, what type?
If it is not a fracture, what is the injury?

List ALL of the bones present.

What are the abnormal findings?

What may have caused this abnormality?

Patient 12: 41 y/o female who is experiencing foot pain after her horse stepped on her foot



Are these bones axial, appendicular, or both?

If it is a fracture, what type?
If it is not a fracture, what is the injury?

List ALL of the bones present.

What are the abnormal findings?

What may have caused this abnormality?

Patient 13: 44 y/o female in a severe car crash. Patient is currently comatose



Are these bones axial, appendicular, or both?

If it is a fracture, what type?
If it is not a fracture, what is the injury?

List ALL of the bones present.

What are the abnormal findings?

What may have caused this abnormality?

Patient 14: 29 y/o male experiencing hand pain after attempting to break a board with his hand during a martial arts exhibition


	<p>Are these bones axial, appendicular, or both?</p>	<p>If it is a fracture, what type? If it is not a fracture, what is the injury?</p>
<p>List ALL of the bones present.</p>	<p>What are the abnormal findings?</p>	<p>What may have caused this abnormality?</p>

Image References

- Patient 1: http://2.bp.blogspot.com/_Jw1LQHbym9w/TAiNAZdmZUI/AAAAAAAAAfM/xgteDaXPcMU/s1600/122409113206.jpg
- Patient 2: http://caseconnector.jbjs.org/data/Journals/JBJSCC/1913/CC_01_01_00048fig2.jpg
- Patient 3: http://1.bp.blogspot.com/_VuWB2k7zrJU/Sf-PQZOS1nI/AAAAAAAAA9s/0DJ2K276ZCc/s400/Before.jpg
- Patient 4: <http://cdn.oddstuffmagazine.com/wp-content/uploads/2011/09/X-rays-2.png>
- Patient 5: <http://images.radiopaedia.org/images/25340/bda64c7cbb2df2a212785f2df62550.jpg>
- Patient 6: <http://lifeinthefastlane.com/wp-content/uploads/2010/07/volar-barton-3-in-1.jpg>
- Patient 7: http://images.radiopaedia.org/images/266499/7e78b4347f53078e3724796dd0581b_big_gallery.jpg
- Patient 8: http://www.radiologyassistant.nl/data/bin/a5097978c7f0a2_flex7.jpg
- Patient 9: http://lifeinthefastlane.com/wp-content/uploads/2010/01/Anterior_Elbow_Dislocation.jpg
- Patient 10: http://www.brighamandwomens.org/Medical_Professionals/education/publications/ppd/2012/July2012/Images/hip-fracture.jpg
- Patient 11: <http://jbjs.org/data/Journals/JBJS/8191/246fig2a.jpg>
- Patient 12: http://farm5.static.flickr.com/4057/4412516621_beec20bfce.jpg
- Patient 13: http://www.healio.com/~media/CurbSide/Fracture_Management/fig131.jpg
- Patient 14: <http://lifeinthefastlane.com/wp-content/uploads/2010/04/Bennett-Fracture-L.jpg>

Review Questions - on a separate sheet of paper complete the following

1. Who discovered x-ray technology? When?
2. Explain how a modern x-ray is able to create an image of bone and tissues.
3. Give three examples of the medical uses of x-rays.
4. What is a dislocation? Why can they sometimes be more damaging than a fracture?
5. What is a fracture?
6. What are the differences between a displaced and a non-displaced fractures?
7. What are the differences between closed/simple and open/compound fractures?
8. For the following injuries, list the most likely type of fracture(s) the individual will experience.
 - a. A man's leg is crushed between two cars.
 - b. A weightlifter has pain in his hamstring after trying to deadlift 600 lbs.
 - c. A woman gets her foot caught in a gopher hole and twists when she falls.
9. Identify the type of fracture from the following images.



http://www.atlantaspineinstitute.com/assets/images/spine_thoracic/image_04b_dpusa223.gif
<http://ed101.bu.edu/StudentDoc/Archives/ED101sp08/marcario/segmented%20fracture.jpg>
<http://fibulafracture.org/wp-content/uploads/2012/02/fibula-fracture-1.jpg>