## Pathophysiology of skeletal injuries

• Bone is a living, well-organized, vascular form of connective tissue. It is largely composed of an organic protein, collagen, and an inorganic mineral, hydroxyapatite, which combine to provide a mechanical and supportive role in the body. Bone is a dynamic tissue that requires stress for normal development.

• Bones function as:

- Protectors of vital organs – provides mechanical protection for most of the body's internal organs, thereby reducing the risk of injury to them
- Supportive structures – the skeleton is the framework of the body it provides attachment for skeletal muscles
- Levers – the skeleton assists with movement
- Reservoirs for calcium and phosphorus – storage for minerals (calcium and phosphorus), which are released when needed into the blood
- Blood producing cells – develops red blood cells in the bone marrow.

# Bone structure

There are primarily three types of bone, namely: woven, compact and cancellous .

## Woven bone

Woven bone is normally remodeled and replaced with either compact or cancellous bone. Woven bone is found during embryonic development, during fracture healing (callus formation), and in some pathological states, such as hyperparathyroidism and Padget Disease.

## Compact bone

Compact bone is the outer structure and provides mechanical strength, while cancellous bone forms the inner structure and its function is the metabolic unit of the bone . Compact bone is dense bone and surrounds the cancellous bone. The primary structural unit of compact bone is an osteon, which is also known as a Haversian system.

Osteons consist of cylindrical shaped lamellar bone that surrounds longitudinally oriented vascular channels called Haversian canals; horizontally oriented vascular channels, which are known as Volkmann canals, connect adjacent osteons.

# Cancellous bone

Cancellous (spongy) bone consists of spicules of bone enclosing cavities containing marrow (blood-forming cells). This type of bone is strong but the spaces make it light and flexible. Cancellous bone is always covered and therefore protected by compact bone. In long bones, cancellous bone is found in the epiphysis (at the end of the long bone); in some it also extends down inside into the shaft. In all other bones, it forms the central mass of bone within a compact bone lining.

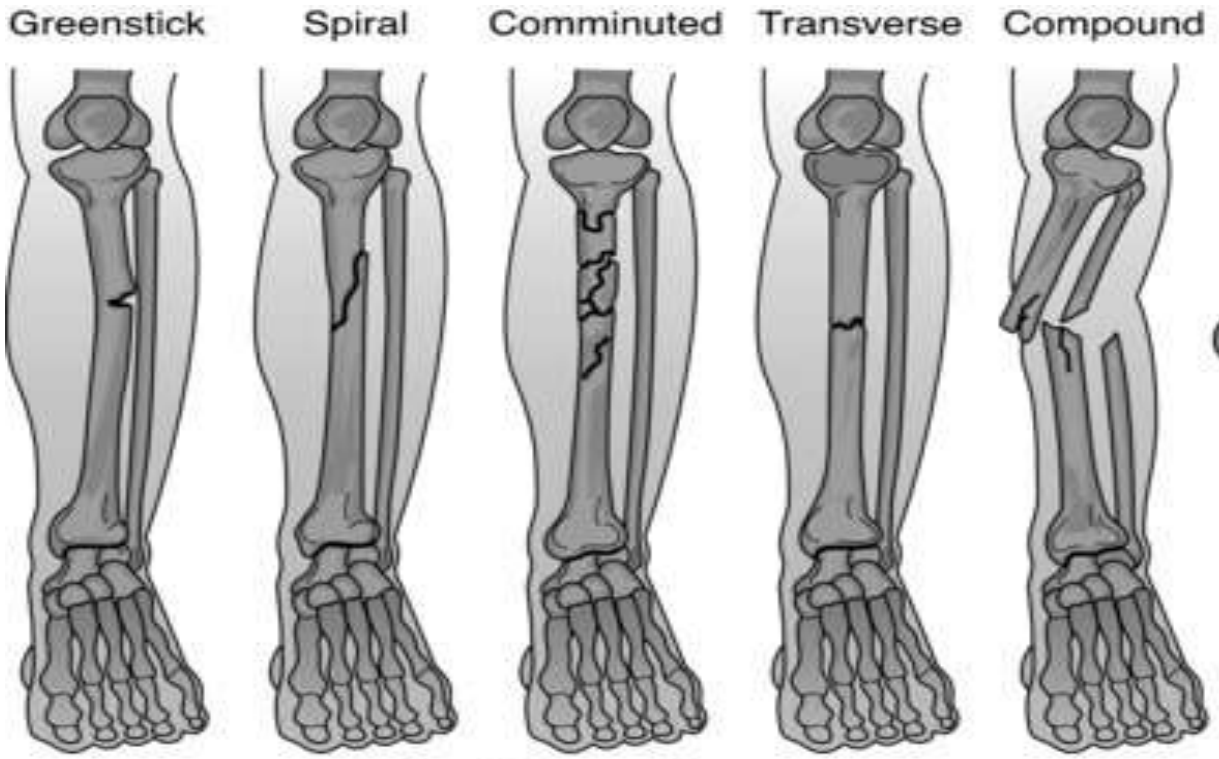
In adults, 80% of the skeleton is compact bone. However, the relative proportions of compact and cancellous bone vary in different parts of the skeleton. For example, in the lumbar spine, cancellous bone accounts for about 70% of the total bone tissue, whereas in the femoral neck and radial diaphysis, it accounts for about 50% and 5%, respectively .

The periosteum is a membrane that lines the outer surface

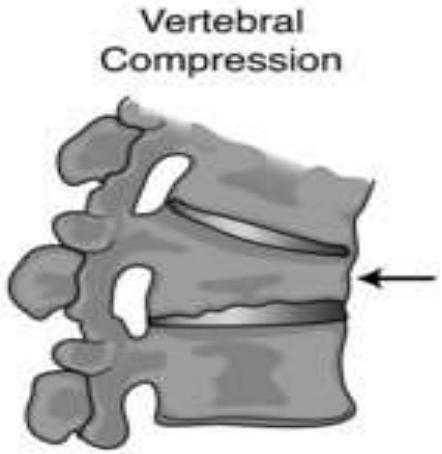
## Common Bone Disorders

- Fractures.

Fractures are potentially serious injuries, damaging not only the bone but also the soft tissue in the surrounding area, bone fracture can be very painful, due to (1) the breaking in the continuity of the periosteum; (2) oedema of nearby soft tissues, caused by bleeding of torn periosteal blood vessels, evoking pressure pain; and (3) spasms in muscles trying to hold bone fragments in place.




Typical Bone Fractures



- Osteoporosis.

This common disease occurs when bones become weak due to changes in bone mineral density and mass, causing a higher risk for fractures.

Osteoporosis develops when more bone is broken down than replaced. The inside of a bone looks something like a honeycomb. When someone has osteoporosis, the bone, which forms the “walls” of the honeycomb, get smaller, and the spaces between the bone grow larger. The outer shell of the bone also gets thinner.

- Paget's disease. ...

Paget's disease of bone disrupts the normal cycle of bone renewal, causing bones to become weakened and possibly deformed. It's a fairly common condition in the UK, particularly in older people. It's rare in people under 50 years of age

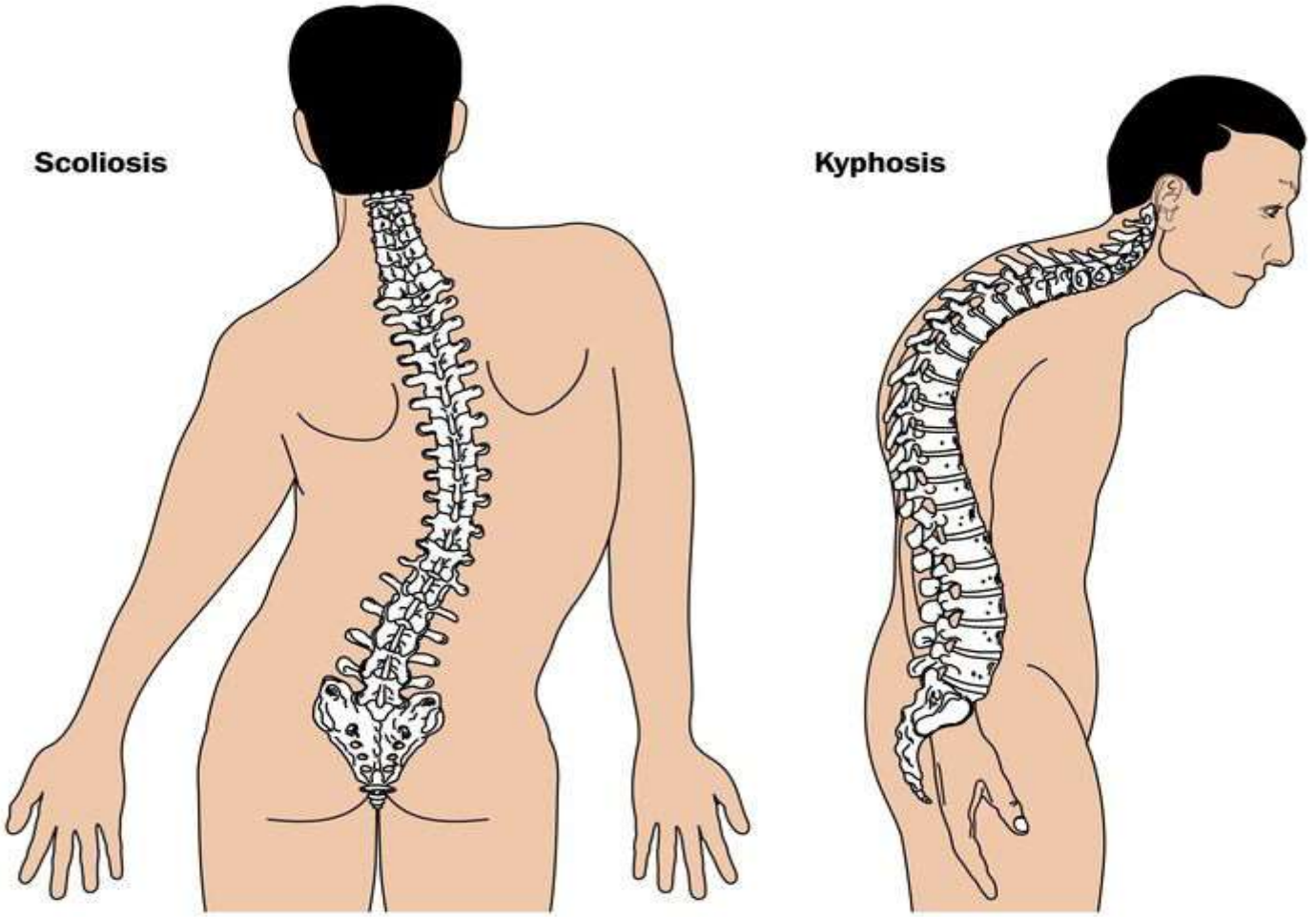
The cause of Paget's disease of bone is unknown. Scientists suspect a combination of environmental and genetic factors contribute to the disease. Several genes appear to be linked to getting the disease.

- Scoliosis.

Scoliosis is a sideways curvature of the spine that most often is diagnosed in adolescents. While scoliosis can occur in people with conditions such as cerebral palsy and muscular dystrophy, the cause of most childhood scoliosis is unknown. Most cases of scoliosis are mild, but some curves worsen as children grow

# Kyphosis

is a spinal disorder in which an excessive curve of the spine results in an abnormal rounding of the upper back. The condition is sometimes known as round back or — in the case of a severe curve — as hunchback. Kyphosis can occur at any age but is common during a ' '



- Osteoarthritis.

  Osteoarthritis (OA) is the most common form of arthritis. Some people call it degenerative joint disease or “wear and tear” arthritis. It occurs most frequently in the hands, hips, and knees. With OA, the cartilage within a joint begins to break down and the underlying bone begins to change

- Rheumatoid arthritis. ...

  Rheumatoid arthritis, or RA, is an autoimmune and inflammatory disease, which means that your immune system attacks healthy cells in your body by mistake, causing inflammation (painful swelling) in the affected parts of the body. RA mainly attacks the joints, usually many joints at once

- Gout.

  What is gout? Gout is a common form of inflammatory arthritis that is very painful. It usually affects one joint at a time (often the big toe joint). There are times when symptoms get worse, known as flares, and times when there are no symptoms, known as remission

- Bursitis.

  Bursitis happens when the fluid-filled sacs (bursa) that cushion your joints become inflamed. You might have bursitis if 1 of your joints is: painful – usually a dull, achy pain. tender or warmer than surrounding skin.

# Common cartilage injuries

## Cartilage

Cartilage is a non-vascular connective tissue that is divided, according to its minute structure, into:

- hyaline cartilage (articular) – covers joint surfaces
- fibrocartilage – knee meniscus, vertebral discs
- elastic cartilage – outer ear

These different forms of cartilage are distinguished by their structure, elasticity, and strength.

In general, cartilage is a tough, fibrous and blood vessel-free connective tissue that forms flexible linkages, supporting structures and acts as a shock absorber in joints such as the knee.

## Osteoarthritis (OA)

It is well known that lesions which are confined to the hyaline cartilage alone have little or no capacity to heal . In general, the individual becomes symptomatic and a significant progression to osteoarthritis is possible .

Osteoarthritis (OA) is the most common form of arthritis, which is a leading cause of physical disability, increased healthcare usage and impaired quality of life . The term OA also applies particularly to the degeneration and excessive wear of cartilage. This condition develops and progresses with an increase in age. Epidemiological studies have demonstrated that participation in certain competitive sports increase the risk for OA . Moderate regular running has low, if any risk leading to OA . Sport activities that appear to increase the risk for OA include those that demand high-intensity, acute, direct joint impact as a result of contact with other participants, playing surfaces or equipment .

**neuromuscular disorders**

## Muscular dystrophies

are a group of muscle diseases caused by mutations in a person's genes. Over time, muscle weakness decreases mobility, making everyday tasks difficult.

What is myasthenia gravis?

Myasthenia gravis is a chronic autoimmune, neuromuscular disease that causes weakness in the skeletal muscles (the muscles that connect to your bones and contract to allow body movement in the arms and legs, and allow for breathing).

## Myositis

means inflammation of the muscles that you use to move your body. An injury, infection, or autoimmune disease can cause it. Two specific kinds are polymyositis and dermatomyositis. Polymyositis causes muscle weakness, usually in the muscles closest to the trunk of your body.

What are muscle cramps?

Muscle cramps are sudden, involuntary contractions or spasms in one or more of your muscles. They are very common and often occur after exercise. Some people get muscle cramps, especially leg cramps, at night. They can be painful, and they may last a few seconds to several minutes.