Anatomy

OSTEOLOGY

By: DR. AMMAR ISMAIL

Structure of bones

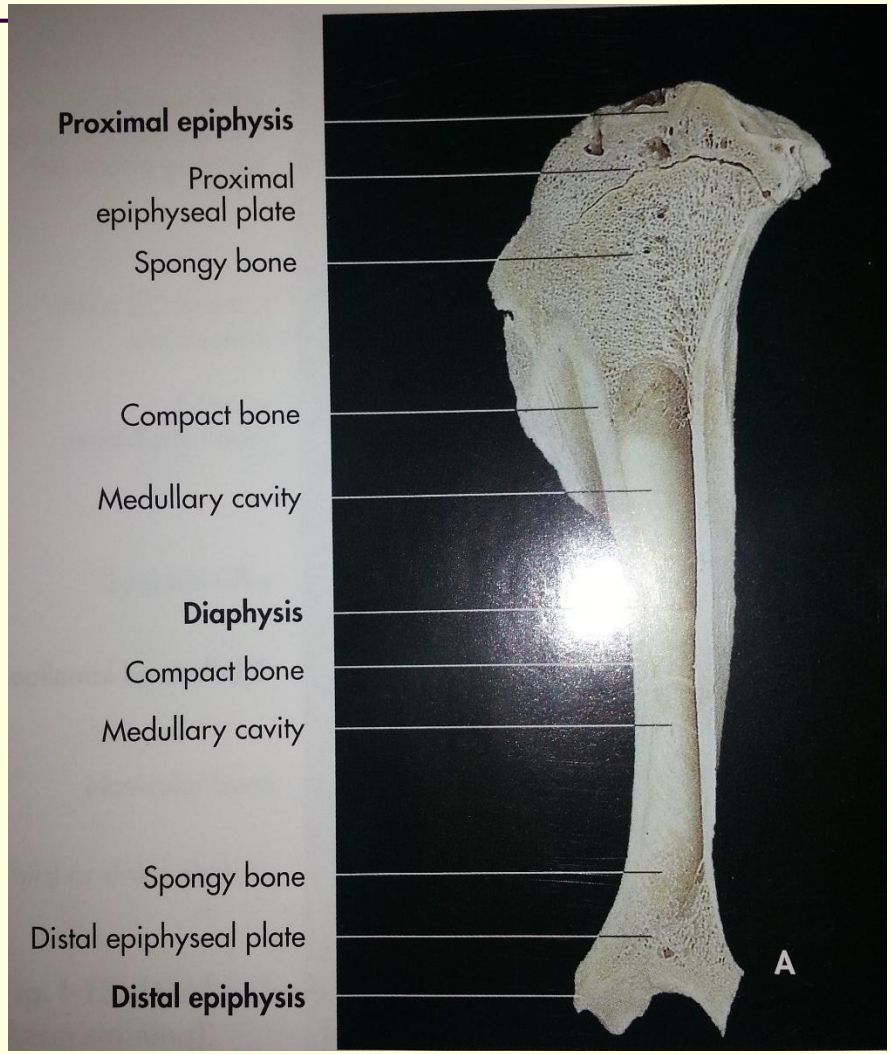
Bone is a living substance with blood, lymphatic vessels and nerves .The specific tissues of the bone is osseous tissue, which composed form :

A-compact substance:-

In the long bones a thickness in or near the middle part of the shaft, while the ends are thin it is formed the external shelf of whole bones consist of a compact osteocytes .

B- spongy substance :-

It is delicate tissue ,situated under the compact substance .it terms the bulk of short bones ,extremities of long bones and the bulk of flat , irregular bones sesomide bones .it is consist of delicate bony plate intercross to each other to form osseous network contained of marrow spaces which filled by a marrow .



Note :

- *1-some bones contain air spaces within the compact substances instead of spongy bone and the marrow are called pneumatic bones .the cavities of these bone are termed sinuses ,which are lining by mucous membrane .*

- *2- the flat bones of the cranium (skull) and sides are composed of an outer layer of ordinary compact substances the external lamina ,an inner layer of very dense bone the inner lamina and between these a middle layer of spongy bone called diploe*

* The study of longitudinal and transverse section of typical long bone, its appear consist

A-Periosteum: - membrane which covers the outer surface of bones except (the articular surfaces with the articular cartilages) It has osteogenic ,also it carries the blood vessels and nerves to the bones (superficial layer).

its consist of two layer:

a-outer fibrous layer

b- inner cellular osteogenic layer .

B- Endosteum :-a thin fibrous membrane ,which lines the medullary cavities and haversian canals.

Its responsible for bone formation and blood cell formation .

**Marrow :-*

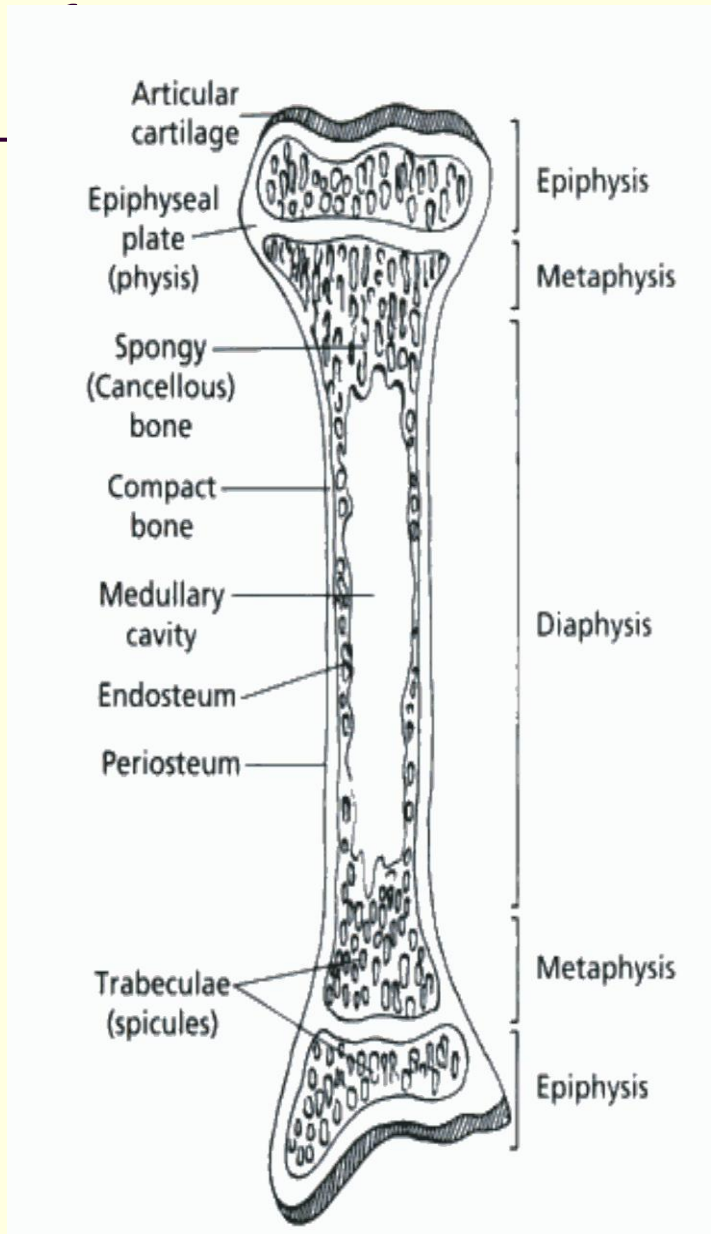
It is adipose tissue occupies the spaces of spongy bone and medullary cavity of long bones

There are two types of :-

1-red marrow

2- yellow marrow .

In adult animals red and yellow marrows are present, while in a young the red marrow is present only .



Blood supply of bones:

Two sets of arteries :-

1-periosteal artery:- numerable small branches supplied the larger part of compact substances of bone also the spongy substances in the ends long bones and bone marrow .

2- nutrient or medullary artery :- present in case of large bones specially the long bone .it usually divided into two branches

(proximal ,distal)which are formed anastomosis with periosteal arteries .

Note :-

It also present :-

1-metaphyseal and epiphyseal vessels arises from arteries near the joints

2-articular arteries supplied the ends of bones near the joints .

Development and growth of bones (ossification)

- *Bone is a connective tissue, supplied with blood lymph vessels and nerves. the primitive embryonic skeleton consist of a cartilage and fibrous tissue in which bones are developed .*
- *The process which the mesenchymal cell differentiate to bone producing cell is called ossification or osteogensis .its depend on the bone producing cell (osteoblasts)*
- *Osteoblast:- any cell that has the property of being able to calcify with dying called Osteoblast.*
- *Membrane bones :- which are developed in fibrous tissue like roof and sides of cranium and the most bone of the face (skull)*
- *cartilage bones :-which are developed in a cartilage like most of the skeleton ,long ,short ,irregular bone*

they are two types of ossification :-

1-intramembranous ossification:-

In this way the bone directly formed in the primitive connective tissue .

It is the simplest form of bone formation .

In the area will be became bone ,consists from (undifferentiated mesenchymal cells, few fibroblast and collagen fibers) these groups of undifferentiated cells becomes gradually differentiated to Osteoblast .

(group of osteoblast &collagen fibers &undifferentiated mesenchymal tissues) called center of ossification .

- *Some osteoblast surrounded themselves with a deposit of bony substances to form osteocytes .The osteoblast in the center of ossification began divided into osteogenic cells& osteoblast*
- *Some bony pieces form extend from the center of ossification to the periphery of the future bone ,these bony form substances called bony speculs ,which produced a network of bony trabeculae .these trabeculae rapidly increase in the thickness to form a large bony plates ,which are separated from adjacent bones by present fibrous tissue .the bone which consist from trabeculae called trabecular bone or spongy bone .the spongy bone converted to compact bone by adding bony plates from the mature bone {osteocyte +deposit bony substances } to the immature bone (large number of osteoblast +collagenous fibers +few deposit bone element).*
- *The superficial part of the original tissue (fibrous) became Periosteum ,the blood vessels also share with the developmental process of ossification*

2 –Endochonderial or intracatilagenous ossification :

The hyaline cartilage extended grow in many directions .The chondrocyte in the center become hyper atrophy and calcified . Matrix surrounded these cells , then the cells produce alkaline phosphatase .

This calcification prevent the cells from their nutrition , so they become degenerated , then dying , also their matrix .

The condrogenic cells invested by blood vessels to form the osteoblast instead of the chondroblasts .

The osteoblast formed a delicate bony shell around the cartilage to form the bony collar or periosteal band and then form the primary center of ossification , in this area the osteoblast also surrounded the degenerated cartilage to form the bony trabiculae .

The chondrocytes in the ends of bones increase in numbers and causes the increase in length of bone and extension of osseous substance in most sides of cartilage due to the invasion of blood vessels , also occurring secondary centers of ossification in most bones .

Composition of the Bone

- Adult bone is consist of approximately 25% water, 45% minerals and 30% organic materials. Calcium constitute 37 % of mineral content and phosphorus about 18.5. On dry weight basis the mineral content is between 65% and 70% whereas the organic friction is 30% and 35%.The organic friction is about 90% collagen. Which is converted to gelatin when heated with aqueous solution