Today's lecture is about bone fractures and bone disorders.

There are several types of fractures and the most common are long bone fractures; like femur, tibia, humerus, radius and ulnar fractures.

First we are going to talk about bone and its parts in general:

* Long bone parts:

-Diaphysis (the shaft) it's made of cortical bone.

- Epiphysis; it's made of cancellous spongy bone and articulating with neighboring bones.

-Metaphysis; it's the part between diaphysis and epiphysis; it contains the connecting cartilage for growth and disappears at adulthood.

* The primary construction units of the bone are osteons which consist of osteocytes, osteoblasts and osteoclast.
* Osteocytes are the dormant cells; it stays inactive until there is need for it to become osteoblasts which functions to deposit bone. The primary organic material in the bone is collagen so these osteoblasts function to build collagen. Osteoclasts are the cells responsible for bone resorption.
* The bone consists of cancellous bone and compact bone, the energy needed to cause fracture in cancellous bone is less than the energy needed to cause compact bone fracture because it's stiffer than cancellous.

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**Fracture**: is soft tissue injury with discontinuity of the bone.

* Types of fractures:

1- Simple fractures; it means single fracture line and it's of three types: **spiral**, **oblique** and **transverse**.

2- Complex fractures; more than one fracture line and it's a complete separation of bone because the energy was sufficient enough to cause more than one fracture line. Such as major blow, intra-articular, comminution and segmental (which is the worst).

3- Open and closed fractures.

Open fracture means the bone is exposed from the skin and it's very severe because of the soft tissue injury and contamination with bacteria that might reach the bone from soft tissue and causes osteomylitis which is very bad to be treated.



* **Spiral fracture: **

- On x-ray I can distinguish it as its fracture line is longer than the width of the bone.

- It's more than one plane of fracture.

- The mechanism that causes the fracture is **twisting** so the least amount of energy is needed to cause this type of fractures. In this type the soft tissue injury is the least with the highest healing because the surface area is big.

* **Oblique fractures:**

- It's one plane of fracture.

- The mechanism is **bending.**

- The energy needed to cause this type is more than spiral but less than transverse type.

* **Transverse fractures:**

- It has one fracture line perpendicular on the bone.

- The mechanism is **direct trauma** like these in road traffic accidents and crush injury.

- The energy needed is the highest between all the simple types of fractures. It's the worst type of the simple factures.

* Comparison:

- The complex is worse than simple and the energy needed is higher.

- Open fracture is worse than close fracture.

- The worst type in general is comminuted and segmental together.

* **Management of open fractures:**

1- Analgesics; give the patient strong pain-killers like; narcotics (morphine or pethidine) because the patient will complain of very severe pain.

2- Irrigation; use sterile normal saline (3-9 litres according to the wound size and the amount of contamination) don't give the patient glucose water or glucose derivatives because it provides a good medium for bacterial growth. If saline is not present use tap water for irrigation.

3- Antibiotic (prophylactic to reduce the susceptibility for infection). The most bacterial type responsible for bone infection is staph.aureus so you should give **augmentin** (which is a combination of amoxicillin and clavulanic acid) or **cephalexin** . If there was soil contamination we suspect a specific type of bacteria which is" clostridium tetani" so you should give penicillin with augmentin or penicillin with cephalexin then give booster dose of vaccine against tetani (the vaccine is given subcutaneously).

4- Sterile dressing (dry gauze).

5- Splint (جبيرة) to reduce movement.

* **Management of close fractures**: here there is no need for antibiotics

1- Analgesia

2- Splint

* **Special types of fractures:**

1- Avulsion fracture:

Occurs when a fragment of bone tears away from the main mass as a result of physical trauma.

- It mostly occurs with athletes at the tendon area due to a muscular contraction that is stronger than the forces holding the bone together.

2- Stress fracture:

Fatigue-induced fracture caused by repeated stress over time as a result of accumulated trauma such as running or jumping. It's described as crack in the bone.

* **Bone healing mechanism:**

1- Reactive phase:

 - Hematoma formation and inflammatory phase.

- Granulation tissue formation.

- It lasts for one week.

2- Reparative phase: starts after one week lasting for three months.

Deposition of soft callus ((كلس which is cartilage callus then deposition of lamellar bone (hard bone) through ossification.

3- Remodeling phase: 3 months up to years depending on factors such as age or general condition. In this phase there is deposition of compact bone to get the original bone contour.

* **Bone disorders:**
* Rickets:

Disorder caused by lack of vitamin D, calcium or phosphate leads to softening and weakening of bone.

* Note:

- Milk contains vitamin D ; adult person needs 1-1.5 liter of milk daily (4-6 cups).

- 1 liter of milk contains 400 IU of vit D (IU means international unit).

Vitamin D is responsible for calcium absorption from the intestine and deficiency in vit D causes low calcium level in the bone which results in less calcification of bone.

The organic material doesn't change it stays the same so we have bone but it's soft and weak bone due to low calcium level.

* Symptoms:

- Bone pain or tenderness.

- Dental deformities

- Bone deformities only in children not in adults.

* Treatment:

- Vit D supplement; 50,000 IU per week for 8 weeks.

* Osteoporosis:

- It's a silent disease with no symptoms until fracture occurance.

-Porous bone.

-The problem is in bone deposition not in calcification.

- It leads to fragile bone and increases the risk of fractures in cancellous bone (it's easier to break than cortical bone) mainly; hip, wrist, humerus, and vertebrae as it is composed of cancellous bone.

**High risk groups:**

-It mainly affects postmenopausal women because estrogen is reduced so collagen synthesis will be reduced in the whole body.

- Young women with" female athlete triad" are also at risk; it's seen in women participating in excessive exercises to lose weight.

 Women with age become shorter due to deterioration of vertebral support.

* Screening:

- After post menopause by 3 years using "dexa scan"; it measures the density of bone.

* Treatment:

- Bisphosphonate; it inhibits the osteoclasts activity and bone resorption; so it indirectly increase the amount of bone.

- Estrogen but it's dangerous because of its side effects; breast cancer and endometrial cancer.

* It's safer to use bisphosphonate although it has side effects but less than estrogen such as; gastroesophageal irritation.