PBL

Problem based learning; when you try to find a solution for the patient's problem, involves both clinical skills and knowledge of basic sciences.

- **Slides 3,4**

What is the meaning of Orthopaedics?
Orthos*:* straight
Paedis: children
They started treating the abnormalities/deformities in kids first, such as Rickets, hence the name.

This picture of a tree is the logo for all Orthopedics Associates in the world.
The difference between wood and trees is that the former is dead and the latter is alive, just like leather and skin.

Trauma: injury, fracture.
In the past, every village had a midwife داية and an orthopedist, for these specialties are the most common/crucial things in medicine.

- **Slide 5**

○ ***Quality of life***: Restoring the function.
Athletes want to be athletes again, and football players want to be football players again (Ronaldo was worth 80 millions before his Anterior cruciate ligament **ACL** injury that cost him 60 millions of his worth)

○ ***Life or death***: managing to save the patient's life.
▪ An Anatomist named Enes studied the anatomy of many species (elephants, camels, humans...) and he also CT-scanned *Lucy's knee* (from a skeleton named Lucy that is estimated to be 3 million years old), and noticed that the ACL now isn't different at all from the ACL 3 million years ago, so the best thing to do in order to reconstruct ACL is to replace it (*with a tissue graft*) in the same anatomical place. (We have to simulate correctly)

○ ***Pain***: we have to understand the physiology of pain, why we feel it and what it means.

○ ***Deformity***: abnormality.
In order to recognize the abnormal we have to know the normal.
The Femur has an anterior bow, if straightened, it becomes a deformity.
The Radius has a radial bow, if lost, the patient loses supination and pronation (a deformity as well)
So we have to know normal anatomy.

- **Slide 6**

This is the femur of a child. It's very vascular. Notice:
▪*The articular surface* ▪*epiphysis* (the rounded end of the long bone) ▪*epiphyseal growth plate* (if injured when still a kid, it'll cause crippling lameness and shortness) ▪*the greater trochanter*
(We have to know the anatomy and histology of the bones)
If there's any problem in the main blood vessel that supplies the head of femur > avascular necrosis and we lose the hip.

- **Slide 7**

Notice:
Osteocytes surrounded by a matrix
Canaliculi – notice how they are interconnected

- **Slide 8**

Notice:
Osteocytes as well

- **Slide 9**

This is an Osteoclast.
The gap: Hawships lacuna.
The prominent structures seen on the Osteaclast make up The Rough border (that has ribosomes that are a part of the process of forming enzymes which digest the bone, if these ribosomes were overly active they will cause osteoporosis (decrease in bone mass), but if they were insufficiently active, it leads to osteopetrosis, (a bone disease that literally means "stone bone") also known as marble bone disease which is related to the bone marrow, it is treated with a bone marrow transplant.

- **Slide 10**

This is the same Osteoclast in a histological view, a special stain was used. You can notice the multinucleated giant cells (formed by the union of monocytes), these osteoclasts are responsible for *bone resorption* (breaking down bone) and continuous remodeling of bone.
○ That's the difference between the living and the dead (e.g. trees and bones remodel themselves, there is no remodeling in dead bones)

- **Slide 11**

This slide is related to anatomy, you can see the inner medulla (central cavity of bone shafts) and the outer cortex... etc

- **Slide 12**

Notice the Trabeculae, which can be seen by the X-ray. These Trabeculae extend from the center of gravity to the medial cortex.

The medial cortex of the femur is the strongest part in the body; when we perform *straight grazing* (an exercise in which the individual is lying down and lifting their leg), the hip joint is exposed to 4 times the actual weight of the whole body, (if that person weighs 100 Kg , 400 kg are placed on this bone)
When *squatting*: 7 times that amount of weight is added on the Patellofemoral joint.
Deep squatting (when squatting lower): 20 times, (if a person weighs 100 kg > 2 Ton is placed on the Patellofemoral) that's why the articular cartilage on the patella is the thickest cartilage in the body.
(This is a matter of physics.)
If you have a patient and their job is all about squatting, standing, squatting repeatedly, it's very difficult for him to be normal again (it's very unlikely for his bones to go back to normalcy after fractures)

- **Slides 13 – 17** He only said that to know the abnormal we must know the normal and those are skills we will acquire throughout the course of our studying.

- **Slide 18**

Causes of orthopaedic diseases:

○ Congenital: acquired before birth
Could be due to:
- Congenital Infection: Infection occurred intrauterine
- Autosomal (genetic) problem
- Position in the uterus
- Drugs, Radiation

○ Developmental: with time, due to repeated use of a certain joint, or shifting in a certain position that leads to a certain anomaly.
○ Acquired: could be trauma, infections, tumors… etc

- **Slide 19**

These are congenital cases.
- Picture on the left: this is a case of Polydactyly (having extra digits/fingers) (it's an autosomal dominant disorder, or could be associated with a single mutation)
- Picture on the bottom: this is a case of Club feet: the feet appear to have been rotated internally at the ankle. This is very common.
- Picture on the left: you can notice a connected area and an open area and these are due to failure of segmentation and failure of fusion (either two different segments fused together, or one mesenchymal block which is then divided/differentiated)

- **Slide 20** wasn't mentioned.

- **Slide 21**

This little girl is missing a hand, a disease called phocomelia which is a result of the use of drugs (especially birth control pills that were used in the 60s such as *Thalidomide*).

- **Slide 22**

This is a normal X-ray. As a doctor, you must be able to recognize the ilium, the ischium, the pubis, and the symphysis pubis (You must know that it is still cartilaginous because it's an x-ray of a child's hip). Notice the triradiate cartilage between the 3 bones, notice the ossific nucleus of the head of the femur; notice the growth plate… etc
You must know the normal anatomy to know if there is an anomaly.

- **Slide 23**

This is an example of a trauma. Notice the external rotation of the hip joint. This indicates hip fracture caused by trauma; seen most often in older patients.

- **Slide 24**

This is an example of a deformity. Notice the bend in the coronal view. This curve in the spine is known as ***Scoliosis***. (Could be painful/painless depending on the diagnosis)

- **Slide 25**

Notice this case of *GenoVarus*, which is also known as *bow legs*. This is due to osteoarthrosis in the knee (disorder of synovial joints). It's very common between Arabs (genetic), (in western countries Genovalgus is more common).

- **Slide 26**

Notice this huge hematoma (bleeding). It is enlarged because patient was on Warfarin which is a blood thinner and hence can lead to severe bleeding.

- **Slide 27**

A case of **Developmental Dysplasia** (**DDH):** a female with limited abduction**. (Very common).**

- **Slide 28**

This is an abnormal hip. One side is normal and the other isn't, you should be able to compare. The relation of the head to the acetabulum must be checked. Notice the head of femur on the right is very small and distant from the acetabulum, it also doesn't grow (It has to be inside to get blood supply and grow), the acetabulum is small as well. We have to treat this case as soon as possible to avoid getting a malfunctioning destructed hip which performs the wrong function. (It starts painless then becomes very painful)

- **Slide 29, 30**

Hands affected by rheumatoid arthritis which is a chronic inflammation in the synovial. (Metacarpophalangeal joints are affected the most.)

- **Slide 31**

This is an X-ray of a patient affected by rheumatoid arthritis.

- **Slide 32**

This is rheumatoid arthritis of the foot. Patients suffer deformities, nodules, splenic problems, and anemia. (we have to understand the anatomy and physiology to diagnose).

- **Slide 33, 34**

A case of *Ankylosing Spondylitis/Bamboo Spine*: complete fusion of the spine.
The spine in this case was normal and **then acquired** the disease.

○ *Congenital Scoliosis* (if the spine anomaly was congenital) is caused by failure of segmentation very early in the development.

- **Slide 35**

The primary function of bone is calcium storage (attachment of muscles, locomotion, and protection of vital structures such as brain inside cranium and the heart and lungs inside the ribcage are all secondary functions)

Maintaining the homeostasis of calcium is important, for it has a major role:

  - In muscle contraction
  - In nerve impulse conduction

- As a Secondary messenger
- As a complement system
- As factor 5 in coagulation cascade
- In tight junctions

When blood calcium levels drop:

1. Body starts using the ionized form.
2. then uses the calcium that is bound to the albumin
3. and then it starts releasing calcium from the bones

The parathyroid hormone **PTH** regulates calcium levels, so hyperparathyroidism leads to renal failure and loss of calcium from the body through urine, this calcium is compensated for by increased bone resorption and leads to metabolic bone disorder.

- **Slide 37**

This is the skeleton of the pharaoh who had *Osteogenesis Imperfecta* which is a collagen disorder. His sclera (white of the eye) was most likely blue. (He couldn't walk, obviously).

- **Slide 38, 39**

This case is known as *Gamekeeper's Thumb* (it's traumatic: he must have bumped into a door or something). In this case the thumb is unstable and weak due to the disruption of a certain ligament in the thumb. So we have to put the ligament back in its position and we must stabilize it to prevent permanent weakness of the thumb.

- **Slide 40**

This is a female, you can tell by the width of the hip and the angle. Picture on the left: the patella is dislocated laterally. The patella tends to sublaxate laterally towards the direction of the quadriceps muscle (the Q angle) therefore the lateral femoral condyle has to be more prominent to keep the patella from sublaxating, and vastus medialis more distal. There are both static and dynamic stabilizers.

- **Slide 42**

Dislocation of the shoulder and loss of function.

- **Slide 43**

This patient suffers from instability in the knee joint (loose joint)
We need to stabilize her knee, (this is a case of a failed total knee replacement that lead to osteolysis, she must undergo a revision knee replacement)

- **Slide 44, 45**

Patient has *Hip Arthritis*; degenerative joint disease.

- **Slide 46**

This is the same kid, all grown up with this end result; *Hip Dysplasia*.
(Patient suffers from destruction of hip, loss of function, loss of joint space (cartilage), inability to walk and pain)

- **Slide 47**

Notice: the destructed knee, loss of knee cartilage (space), and osteophyte formation. (Osteophytes: Small spurs that form in and around the knee joint as a result of chronic inflammation.)

- **Slide 48, 49**

This is how total knee replacement surgeries are performed, using masks and antibiotics, especially pre-operative antibiotics, which must be at the peak level during the incision, and hence must be given an hour before surgery, to prevent infections. (We must know our bacteriology, our pharmacology and our antibiotics well. We have to know toxic doses and durations).

500-400/year total knee replacements in Jordan 0.5 Million total knee replacements in America (total knee replacements in America are expected to reach 4.5 million/year in 30 years' time).

- **Slide 50**

A total hip replacement
This patient had leukemia and he took high doses of steroids that lead to him having avascular necrosis in the femoral head.
On one side they performed metal-on-metal replacement, and the other metal-on-polyethylene replacement (these two replacements differ in their cost, age, body reactions…)

- **Slide 51**

This total hip replacement got dislocated because the patient had a stroke that lead to muscle weakness and dislocation of the joint, so we want something to make it more stable.

- **Slide 52**

An operation known as: **Arthrodesis**. This is a case of very painful hip tuberculosis. The joint is completely destructed and infected. We have to attach the bones together through this surgery. We lose the motion but the patient is able to walk without pain.

- **Slide 53**

Ankle replacement

- **Slide 54**

Shoulder replacement

Question asked during the lecture: How do x-rays work?
X ray beams penetrate certain areas and not others. The more loose the tissues are (e.g. flesh), the more they are penetrated by beams and the darker the film. The denser the tissues are and the higher their calcium content is (e.g. bones, nails) the lighter the film is. What you see depends on the density and the calcium content of the tissue.

I tried to make it as comprehensible as possible. Good luck.