التيم عبارة عن سلايدات المحاضرات بالإضافة إلى شرح الدكاترة

حاولنا تقديم المادة بأفضل ما نستطيع

لذا إن وجدتم أي خلل أو خطأ فاعذرونا و بلغونا حتى يتم تصحيحه

نتمنى لكم التوفيق و السداد

لا تنسونا من دعواتكم

Orthopedic Emergencies: Compartment Syndrome/Acute Joint Dislocation

•Ahmad Bin Nasser MBBS, FRCSC

Assistant Professor , Course 451, KSU

F1 lecture notes added by : Mashael Al-Towairqi

Notes are in GREEN and in boxes

Objectives Compartment Syndrome

1.To explain the pathophysiology of CS

2.To Identify patients at risk of developing CS

3.To be able to diagnose and initially manage patients with CS

4.To be able to describe the possible complications of CS

•What is a compartment?

parts of the body enclosed with non elastic fascia (do not expand!), so if the space volume increase in this compartment will increase the pressure inside the compartment ex. compartment around the leg(anterior,2posterior,lateral)

•What is the tissue pressure normally?

•artery>arteriol>capillary bed (diffusion of O_2/exchange of nutrient) >venule> vein

resting compartment pressure 0-8mmHg

inside the compartment runs : muscles, vessels and nerves , when the pressure inside the compartment increase will affect them.

•Pathophysiology:

.risk factor

.Elevated tissue pressure

.Absence of diffusion at the capillary bed

.Cell damage and swelling

.Further increase in tissue pressure

.Lack of oxygenation

.Vicious circle

normally pressure inside the compartment lower than the arterial pressure and higher than the venous pressure that help in diffusion and exchange under pressure gradient (from higher to lower):

from arterial side to the compartment and from the compartment to venous side

the problem in the compartment syndrome is that the pressure inside the compartment is higher than the arterial side

so what happens that the O2 coming through the arteriol cannot be diffused and exchanged and go to the venules

the cells in the compartment become ischemic because of that (no O2 or nutrient)→they will swell →pressure become higher and higher inside the compartment and the exchange stops.

•Threshold pressure:

•30 mm Hg (rigid)

•Less than 30 mm Hg difference between

compartment pressure and diastolic pressure

(clinically relevant)

Risk factors (local):

•Trauma, crush, fracture (**open** more serious as it caused by higher energy force/**closed**) .**how fracture increase the pressure?** when fracture occurs the muscles will be affected and traumatized (damaged)and will swell +bleeding from bone inside the compartment increasing the pressure→the capillary membrane pressure increase →decreased oxygenation

•Injection •Bleeding •Prolonged vascular occlusion (reperfusion injury)(**Ex.** thrombus in the leg , when vascular surgeon remove it, blood goes again to the affected cells and they will swell and causing CS immediately)

•Burns (because the fascia shrinks and fluid in 3rd space accumulate increasing compartment pressure)
•Venomous bite •Intra-osseous fluid replacement •IV fluid extravasation

•Tight bandage (increase the pressure) •Post surgery

how to diagnose CS? 2 ways

1-Rigid way : when we measure the pressure inside the compartment and the pressure inside it is = or >30mmgh because it will be equal or higher than the capillary pressure

2-the difference between diastolic pressure and compartment pressure is less than 30 because a difference less than that perfusion is impaired and the patient will start to develop CS

Risk factors (general):

•Head injury

•Decreased conciseness →Late diagnosis

•Hypotension**(how we can measure the difference? these patients at higher risk to develop CS faster and easier than normal ones)**

Diagnosis:

•Early:

•Pain!!! -→ severe and the most important sign

•Pain **increase with stretching** the involved compartment **why?** because the volume will decrease and the pain will increase

if the patient is LOC how to Dx?because he cannot complain of pain that caused by CS we Dx by compressing the compartment and if there is CS the compartment will be rigid

•Presence of risk factor

•High index of suspicion

•Measurement of compartment pressure is high

to over diagnose CS is safer than missing one!!

•Late:

•Paresthesia •Paralysis •Pallor

•Severely high pressure:

•Pulselessness (extremely RARE!) for this to happen the compartment pressure should be equal or more than the systolic , pulselessness is the **1st sign in leg ischemia** that is different from CS.

•Tight, woody compartment •Tender compartment

•Measurement: we do not depend on them , only if we suspect if there is CS

•Rarely necessary •Must be done at area of highest expected pressure

•May give false low result

Management:

when the permanent damage start to occur? at 6 hours it will start , so take the patient to OR as soon as possible.

Initial (undeveloped CS):

•Maintain normal blood pressure

•Remove any constricting bandage

•Keep limb at heart level

•Regular close monitoring (15-30 minute intervals)

•Avoid nerve blocks, sedation and strong analgesia

to obtain patients feed back

Fully developed CS

•Maintain normal blood pressure

•Remove any constricting bandage

•Keep limb at heart level (because if we rise it the arteries will work more to deliver the blood and if we keep it below venous congestion will happen)

•Diuresis to avoid kidney tubular injury if late

, after all of these done and the patient is stable we monitor the patient for 1-2 days carefully , do not give nerve block or epidural anaesthesia for pain because we are monitoring the patient by this pain

•Urgent surgical decompression (Fasciotomy) (if all the above measurements did not work or the patient came late)

Fasciotomy:

•Releasing the compartment fascia

•Allows swollen muscles to expand in volume

•Results in decreased compartment pressure

•Avoids further damage

•Does not reverse already occurred damage

•Ideally should be done as soon as diagnosis is made

when muscle cells exposed to ischemia what will happen? they will die and the myoglobin inside them spread→to kidney causing kidney failure and rhabdomyolysis so they need hydration.

•Should be done as long as there is still viable tissue (so if there is muscle cells died as result of ischemia we still do the fasciotomy to save the rest of the cells)

•Should not be done if there is no expected viable tissue, Otherwise infection is likely (we do not do it if we confirmed that all the muscles in compartment are died because doing it at this stage will 1-not benefit the patient and 2-it will kill him 99% as it will be a place for infection→sepsis and die, so we leave it)

.Debridement of all necrotic tissue is necessary

.Second and third look surgeries are often required

.Closure of skin is usually achieved after swelling has subsided

ليش نخلي رجله بدون ما نفتحها إذا كانت العضلة ميتة؟ يصير يستخدمها و يتسند عليها بدل ما يركبوا له رجل صناعية و يحطوا عليها splintعشان تثبتها -- الحالة هذي نادرا ما تصير لأن المريض يجي بدري بسبب الألم .<

.Skin grafting is often required (because the edges separates immediately after opening the skin for fasciotomy)

Fasciotomy Indications:

•6 hours of total ischemia time (ex: arterial embolism)

•Significant tissue injury

•Worsening initial clinical picture

•Delayed presentation with a picture of developed CS

•Absolute Compartment pressure >30 mmHg or <30 mm Hg difference from diastolic pressure

Fasciotomy:

•Is a prophylactic procedure

•Does not reverse injury to permanently damaged tissue

.so better to have a low threshold! any moment you suspect CS do fasciotomy do not wait

Complications:

1.Myonecrosis> myoglobenemia>myoglobinuria> kidney tubular damage

2.Loss of function of the involved compartment:

1.Flexion contracture 2.Paralysis 3.Loss of sensation

Leg:

when fasciotomy done it will be for all compartment even if not affected

•Anterior compartment:

Drop foot

•Deep posterior compartment:

Clowed toes

Loss of sensation in the sole

Forearm:

•Volar compartment: Volkman contracture → Volkmann's ischemic contracture is a permanent flexion contracture of the hand at the wrist, resulting in a claw-like deformity of the hand and fingers.

Acute Joint Dislocation

•Objectives:

1.To describe mechanisms of joint stability

2.To be able diagnose patients with a possible acute joint dislocation

3.to be able to describe general principles of managing a patient with a dislocated joint

4.to describe possible complications of joint dislocations in general and in major joints such as the shoulder, hip and knee

Acute Joint Dislocation

Joint stability:

•Bony stability : Shape of the joint (ball and socket –as hip joint vs round on flat -as glenohumeral joint it is less stable because it is like a ball in flat)

•Soft Tissue :

- Dynamic stabilizer: Tendons/Muscles (soft tissue you can control)
- Static stabilizer: Ligaments ±meniscus in knee/labrum in hip and glenoid in shoulder (soft tissue you cannot control)

•Complex synergy leading to a FUNCTIONAL and STABLE joint

boney stability is stronger than soft tissue stability ex.hip joint dislocation require higher energy than shoulder joint

•It takes higher energy to dislocate a joint with bony stability than a joint with mainly soft tissue stability

•Connective tissue disorders may lead to increased joint instability due to abnormal soft tissue stabilizers.

•Dislocation of a major joint should lead to considering other injuries.

At risk group:

•Major trauma victims

•Athletes and sport enthusiasts

increase the flixability →increase the risk for joint dislocation

•Connective tissue disorder patients: ligament laxity

•When a joint is subjected to sufficient force in certain directions it might sustain a fracture, a dislocation or a fracture dislocation

•Different joints have different force victors that may lead to a dislocation

•A joint might dislocate in different directions

•A joint dislocation is described by stating the location of the distal segment

•Anterior shoulder dislocation: anterior displacement of the humeral head relative to the glenoid

•Posterior hip dislocation: posterior displacement of the femoral head relative to the acetabulum

Dislocation: Total loss of contact between the articular surfaces of the joint

Sublaxation:partial loss of contact between the articular surfaces of the joint

•Acute joint dislocation

•Chronic joint dislocation

Diagnosis:

•History of a traumatic event (major trauma or any trauma with the limb in high risk position)

•Pain and inability to use the limb

•Deformity

•Shortening

•Malalignment

•Malrotation

ex. if someone came to ER internally rotated hip and short leg →posterior hip dislocation.

in case of hip fracture it will be externally rotated and short .

•Should check for other injuries (distracting injury)

•Should always check the distal neurovascular status.

•Should check for compartment syndrome.

•X-rays:

•Should be done urgently without delay if dislocation is suspected

•Two perpendicular views of the involved joint

in shoulder dislocation also axillary view is done

•Occasionally, special views are required such as the axillary view for shoulder dislocation

•X-rays to the joint above and below

Management principles:

•Must rule out other injuries

•Pain relief and muscle relaxant

•Urgent reduction

•Check stability and safety zone (The range of motion with stability (no danger of dislocation) For example, 10 degrees flexion and 20 degrees extension. If the patient goes beyond that, the joint will get unstable and might be dislocated)

•Check neurovascular status after before and after

reduction

•X-rays after reduction (to confirm if reduction is correct and there are no small fragments)

•Protect the joint (avoid movements outside the safety zone)

•Rehabilitation

•Follow for late complications

Reduction:

•Monitor vitals

•IV analgesia (opiod)

•IV sedation (to relax the muscles)

•Gradual traction to distract the joint

•Realignment and rotation to reduce the joint based on direction of dislocation

•A palpable clunk well be felt

•Check ROM and stability of the joint

•Once joint is felt to be reduced, check distal NV status

•If it was intact before but not after, farther urgent management is needed→surgery

•If it was not present before but intact after, check again later to confirm

•Observe patients vitals until medications wear out

•Stabilize joint and get X-rays

•If irreducible or partial reduction only

.Urgent closed reduction under general anesthesia and possible open reduction if closed reduction fails

.Usually due to

.insufficient muscle relaxation

.Entrapment of soft tissue

Special considerations:

•A fracture dislocation is usually reduced in an open fashion in the operating room (this case do not follow the usual steps taken for closed reduction of dislocation so operate directly)

•Must confirm concentric reduction on the x-rays, otherwise an open reduction should be performed

Early Complications:

•Heterotopic ossification = myocitis ossificans → calcification in the muscles around the dislocated joint.

•Neurological injury (reversible or irreversible)

•Vascular injury

•Compartment syndrome

•Osteochondral fracture/injury

Late complications:

•Stiffness

•Heterotopic ossification

•Chronic instability (as shoulder dislocation if happened once it will reoccurs)

•Avascular necrosis (specially hip joint)can be diagnosed early by MRI

•Osteoarthritis

Special considerations, Hip joint:

•Posterior dislocation is commonest

•Major trauma with hip flexed (dashboard injury)

•Sciatic nerve injury common

•High incidence of late avascular necrosis

•An orthopedic emergency!!

Special considerations, Shoulder dislocation:

common

Anterior dislocation is more common

Patients with seizures prone to posterior dislocation

May cause chronic instability

Can result in axillary nerve injury

Special considerations, knee dislocation:

Three or more ligaments

Severe (high energy) trauma

May be associated with popletial artery injury----Limb threatening

Very serious emergency

Needs accurate vascular assessment (Ankle Brachial Index normally =1 , if it is <0.9 suggesting injury to the vessel even if you feel the pulse)

May be associate with peroneal nerve injury

May be associated with fracture/ compartment syndrome

Most require surgery either early or late or both

present with normal X-ray perfectly aligned