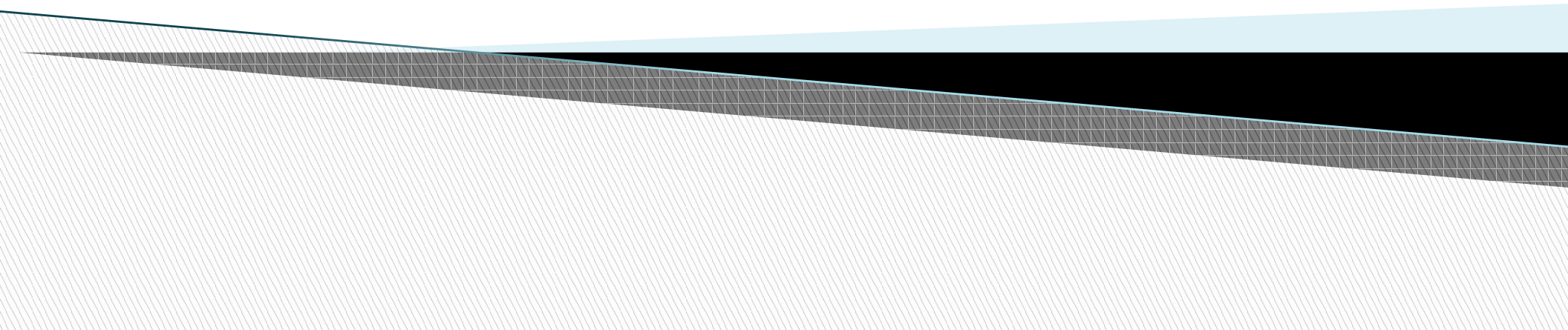


COMPLICATIONS OF FRACTURES

Razan Bassam



❓ *Local complications* can be divided into *early* (those that arise during the first few weeks following injury) and *late*.

EARLY COMPLICATIONS

❓ Early complications may present as part of the primary injury or may appear only after a few days or weeks.

Local complications of fractures

Urgent

Local visceral injury

Vascular injury

Nerve injury

Compartment syndrome

Haemarthrosis

Infection

Gas gangrene

Less urgent

Fracture blisters

Plaster sores

Pressure sores

Nerve entrapment

Myositis ossificans

Ligament injury

Tendon lesions

Joint stiffness

Algodystrophy

Late

Delayed union

Malunion

Non-union

Avascular necrosis

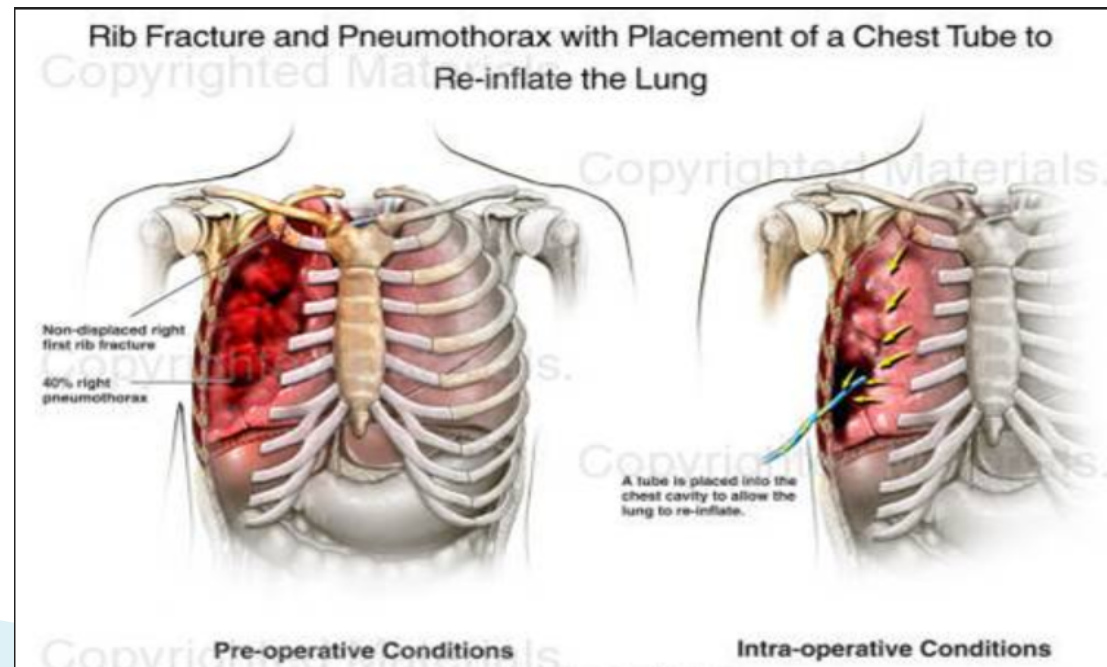
Muscle contracture

Joint instability

Osteoarthritis

VISCERAL INJURY

Fractures around the **trunk** are often complicated by injuries **to underlying viscera**, the most important being penetration of the lung with lifethreatening **pneumothorax** following **rib fractures**, and **rupture of the bladder or urethra** in **pelvic fractures**. These injuries require emergency treatment, **before** the fracture is dealt with.




NERVE INJURY

Nerve injury is particularly **common** with fractures of the **humerus** or injuries around the **elbow** or **knee**. The tell-tale signs should be looked for (*and documented!*) *during the initial examination and again after reduction of the fracture.*

In closed injuries the nerve is seldom severed, and spontaneous recovery should be awaited – it occurs in 90 percent of cases within 4 months. If recovery has not occurred by the expected time, and if nerve conduction studies fail to show evidence of recovery, the nerve should be **explored**.

In open fractures any nerve lesion is more likely to be complete; the nerve should be explored during wound debridement and repaired, either then or as a 'secondary' procedure.

Early exploration should also be considered *if signs of a nerve injury appear after manipulation of the fracture.*



Common nerve injuries

Injury

Shoulder dislocation

Humeral shaft fracture

Humeral supracondylar fracture

Elbow medial condyle

Elbow dislocation

Monteggia fracture–dislocation

Hip dislocation

Knee dislocation

Nerve

Axillary

Radial

Radial or median
(anterior interosseous)

Ulnar

Ulnar

Posterior interosseous

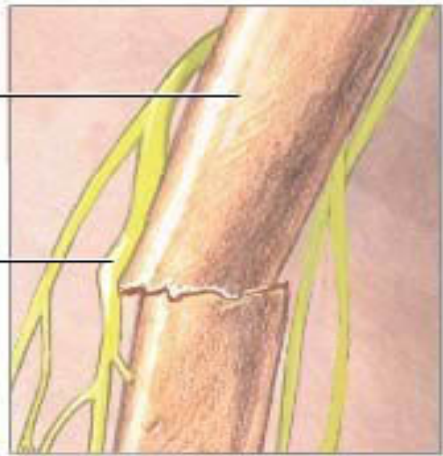
Sciatic

Peroneal



Humerus

Radial nerve



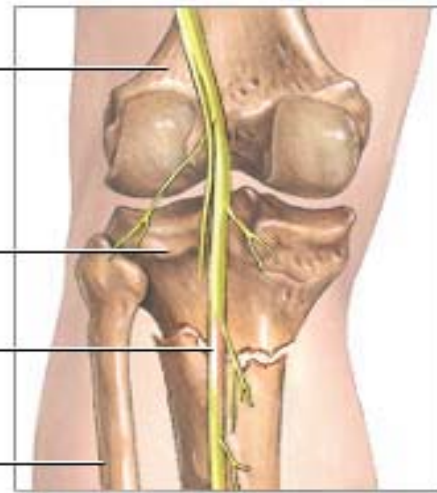
Break in humerus causes damage to radial nerve

Femur

Tibia

Tibial nerve

Fibula



Break in tibia causes damage to tibial nerve



ADAM.



Humerus

Ulna

Radius

Ulnar nerve

Ulnar nerve damage from fracture

ADAM.

VASCULAR INJURY

Fractures most often associated with damage to a **major artery** are those around the **knee** and **elbow** and those of the **humeral and femoral shafts**. The artery may be cut, torn, compressed or contused, **either by the initial injury or subsequently by jagged bone fragments**.

Even if its outward appearance is normal, the intima may be detached and the vessel blocked by thrombus, or a segment of artery may be in spasm. The effects vary from transient diminution of **blood flow** to profound ischaemia, tissue death and peripheral gangrene.

Common vascular injuries

Injury

First rib fracture

Shoulder dislocation

Humeral supracondylar fracture

Elbow dislocation

Pelvic fracture

Femoral supracondylar fracture

Knee dislocation

Proximal tibial fracture

Vessel

Subclavian

Axillary

Brachial

Brachial

Presacral and internal iliac

Femoral x popliteal

Popliteal

Popliteal or its branches

Clinical features

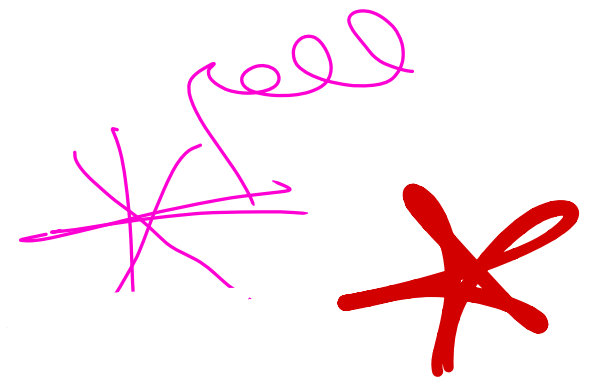
The patient may complain of **paraesthesia or numbness in the toes or the fingers**. The injured limb is **cold and pale**, or **slightly cyanosed**, and the **pulse is weak or absent**. X-rays may show one of the 'high-risk' fractures mentioned above.

If a vascular injury is suspected, an angiogram should be performed immediately; if it is positive, emergency treatment must be started without further delay.

Treatment

All bandages and splints should be removed. The fracture is re-x-rayed and, if the position of the bones suggests that the artery is being compressed or kinked, prompt reduction is necessary. The circulation is then reassessed repeatedly over the next half hour. If there is no improvement, the vessels must be explored by operation – preferably with the benefit of preoperative or peroperative angiography. A torn vessel can be sutured, or a segment may be replaced by a vein-graft; if it is thrombosed, endarterectomy may restore the blood flow. If vessel repair is undertaken, stable fixation is imperative; where it is practicable, the fracture should be fixed internally.

COMPARTMENT SYNDROME



Fractures of the arm or leg can give rise to severe ischaemia **even if there is no damage to a major vessel.**

*Bleeding, oedema or inflammation (infection) may *increase the pressure within one of the osteofascial compartments; there is *reduced capillary flow which results in *muscle ischaemia, *further oedema, still *greater pressure and yet more *profound ischaemia – a vicious circle that ends, after 12 hours or less, in necrosis of nerve and muscle within the compartment.

treatment: fasciotomy

← Depending on the sheath if intact or not

Nerve is capable of regeneration but muscle, once infarcted, can never recover and is replaced by inelastic fibrous tissue (*Volkman's ischaemic contracture*). A similar cascade of events may be caused by swelling of a limb inside a tight plaster cast.

* if compartment pressure is $> (30-40)$ which is more than the capillary pressure the lymphatic sheath (---)] The 1st irreversible changes occur in the muscle
After 4 hours and then nerves after 6 hours

we depend on the capillary pressure to be blocked to become compartment syndrome



Clinical features

* اکثر سبب عھلانہ ہے
مساجد، صحنہ

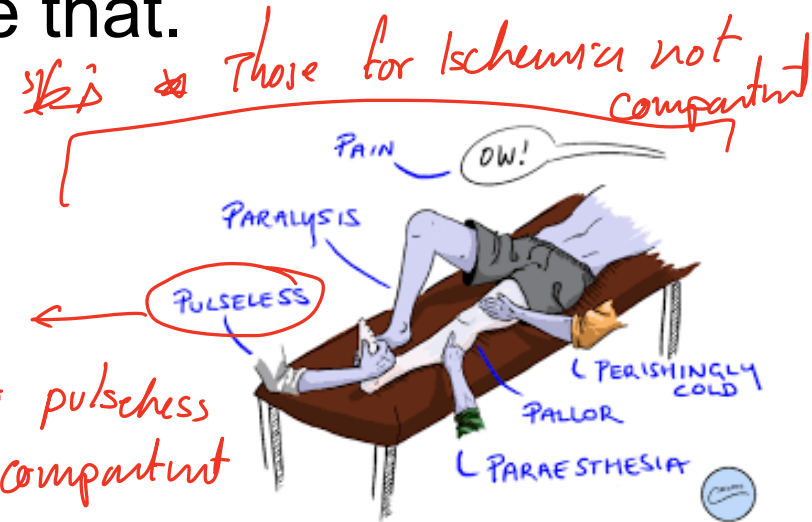
High-risk injuries are fractures of the **elbow**, the **forearm bones** and the **proximal third of the tibia**. Other precipitating factors are operation (usually for internal fixation) or infection.

The classic features of ischaemia are the five Ps:

^{دست سبب} **pain**, ^{دست سبب} **paraesthesia**, **pallor**, **paralysis** and **pulselessness**. → *not necessarily*

But it is criminal to wait until they are all present: the diagnosis can be made long before that.

⇒ pain is present in passive hyperextension & hypoflexion



you never want until its pulseless to name it compartment

The earliest symptoms are **pain** (usually described as a 'bursting' sensation) and altered sensibility. **Skin sensation** should be carefully and repeatedly checked.

Remember that *the presence of a pulse does not exclude the diagnosis.*

Ischaemic muscle is **highly sensitive to stretch**.
When the toes or fingers are passively hyperextended, there is increased pain in the calf or forearm.

*عائنه صان بوسيله
حرك اصابعه
بالتالي
عنه المبره

The most IUP
Signs

② Tense Swelling
"non Compressable"

* Pain *

unexplained / not responsive to opioids
progressive / continuous

Symptoms

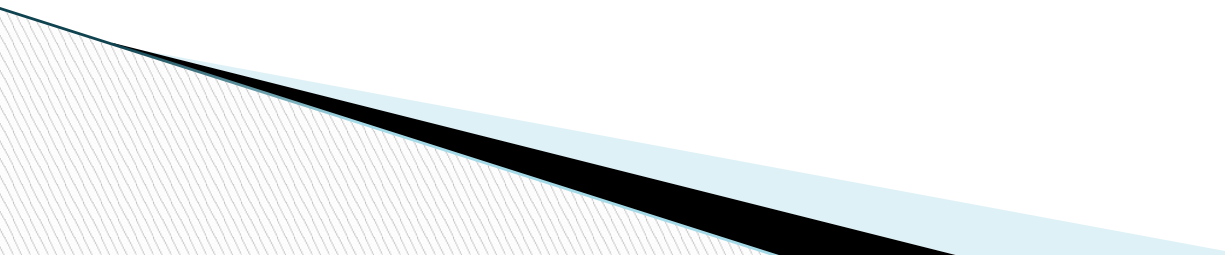
Compartment
syndrome

In doubtful cases, the diagnosis can be confirmed by measuring the pressure in the fascial compartment.

A catheter is introduced into the compartment and the pressure is measured close to the level of the fracture. A differential pressure (ΔP) – the difference between diastolic pressure and compartment pressure – of less than 30 mmHg (4.00 kPa) is an indication for immediate compartment decompression

more than 30 !

? Don't wait for the obvious signs of ischaemia to appear. If you *suspect an impending compartment* syndrome, start treatment straightaway.



Treatment

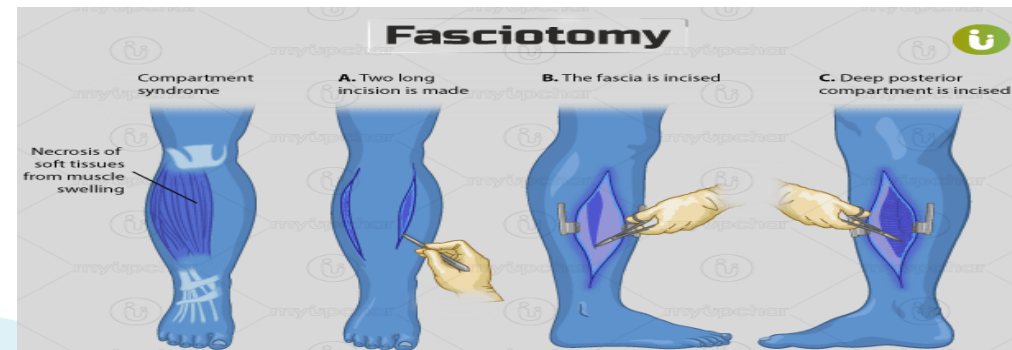
✦ Keep the leg flat + remove dressings, bec if you raise it there will be ↓ Blood flow and if put it down

The threatened compartment (or compartments) must be promptly decompressed.

↑ blood flow → ↑ swelling
so keep it flat

Casts, bandages and dressings must be completely removed – merely splitting the plaster is utterly useless – and the limb should be nursed flat (elevating the limb causes a further decrease in end-capillary pressure and aggravates the muscle ischaemia).

The ΔP should be carefully monitored; if it falls below 30 mmHg, immediate open fasciotomy is performed. *In the case of the leg, 'fasciotomy' means opening all four compartments through medial and lateral incisions.*



The wounds should be left open and inspected 2 days later: if there is muscle necrosis, debridement can be done; if the tissues are healthy, the wound can be **sutured** (without tension), or **skin-grafted** or simply allowed to **heal by secondary intention**.

If facilities for measuring compartmental pressures are not available, the decision to operate will have to **be made on clinical grounds**.

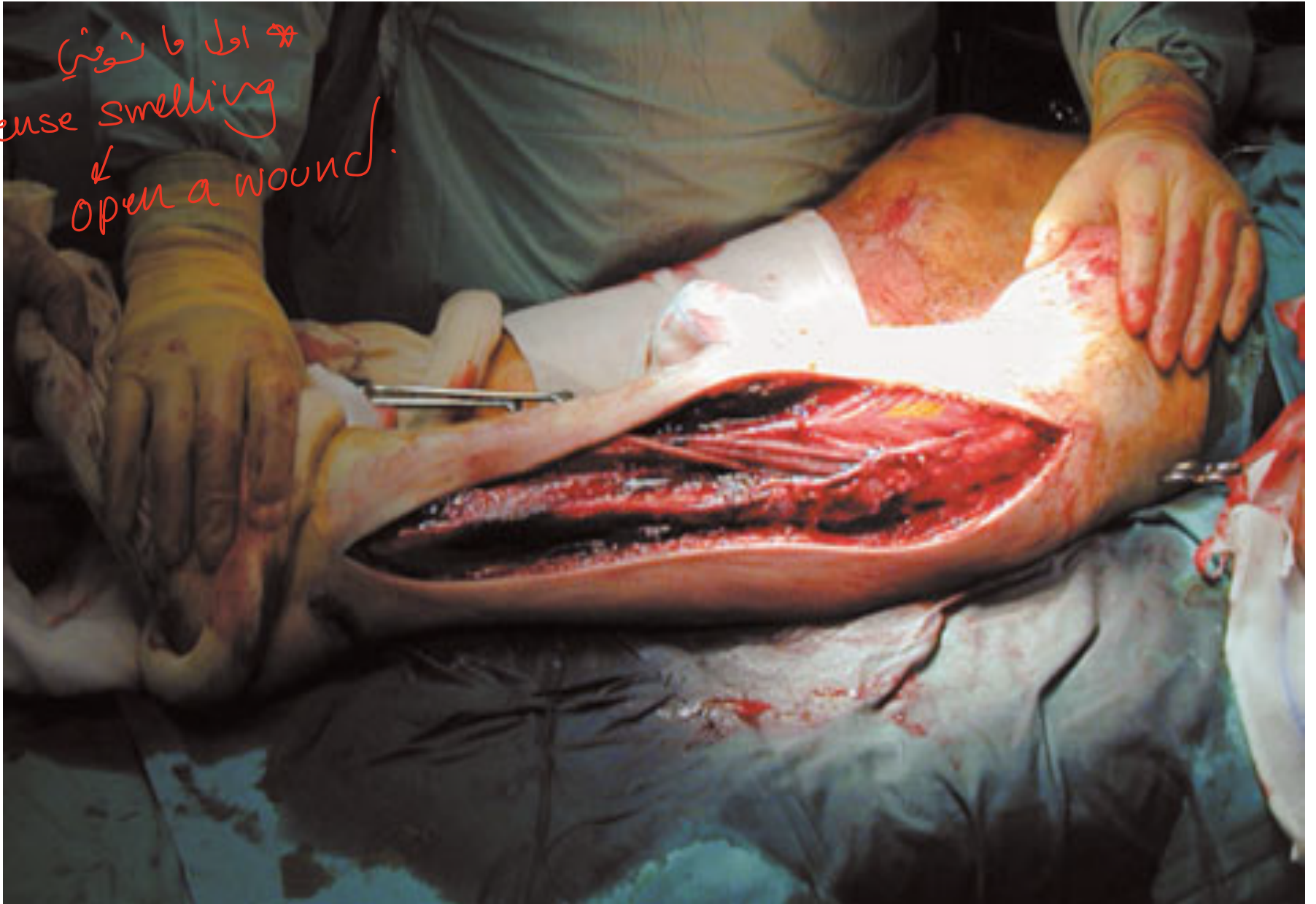
The limb should be examined at 15-minute intervals and, if there is no improvement within 2 hours of splitting the dressings, fasciotomy should be performed.

Muscle will be dead after **4–6 hours** of total ischaemia – there is no time to lose!

* once you do fasciotomy you will decide if its compartment or not
if yes → muscle will go out of the wound
bec the swelling is within the

crisshe
not in the vessels

* اول ما توفري
Tense swelling
↓
open a wound.



HAEMARTHROSIS

Fractures involving a joint may cause acute haemarthrosis. The joint is swollen and tense and the patient resists any attempt at moving it. The blood should be aspirated before dealing with the fracture.

↑ compartment Risk

* more in → Transverse fracture

than oblique and spiral

1- bec direct injury on the
wound → smelling



Also in young (Masaline) than in old

INFECTION

more in open fracture than closed bec
↑ force trauma ←

Open fractures may become infected; closed fractures hardly ever do unless they are opened by operation. Post-traumatic wound infection is now the most common cause of chronic osteomyelitis. This does not necessarily prevent the fracture from uniting, but union will be slow and the chance of re-fracturing is increased.

Highest area of complaint?
forearm
bulky muscles + ↓ circumference
+ fractures caused by ↑ force
Trauma

Clinical features

Following an open fracture or operation, the wound becomes inflamed and starts draining seropurulent fluid. A sample should be submitted immediately for microbiological investigation; while awaiting the result, intravenous antibiotic administration can be started.

* any segment of bone without soft tissue on it → we should do debridement

Treatment

All open fractures should be regarded as potentially infected and treated by giving **prophylactic antibiotics** and meticulously excising all devitalized tissue. If there are signs of acute infection and pus formation, the tissues around the fracture should be opened and drained; the choice of antibiotic is dictated by tests for bacterial sensitivity.

If internal fixation has been used, this does not necessarily have to be removed; even worse than an infected fracture is one that is both infected and unstable. However, if the infection does not respond to antibiotic treatment, it may be necessary to remove the implants and replace them with external fixation.

** Biofilm forms on it preventing the antibiotic from reaching it.*

GAS GANGRENE

This terrifying condition is produced by clostridial infection (especially *Clostridium welchii*). These are anaerobic organisms that can survive and multiply only in tissues with low oxygen tension; the prime site for infection, therefore, is a dirty wound with dead muscle that has been closed without adequate debridement.

Toxins produced by the organisms destroy the cell wall and rapidly lead to tissue necrosis, thus promoting the spread of the disease.

Clinical features appear within 24 hours of the injury: the patient complains of intense pain and swelling around the wound and a brownish discharge may be seen; gas formation is usually not very marked.

There is little or no pyrexia, but the pulse rate is increased and a characteristic smell becomes evident (once experienced, this is never forgotten). Rapidly, the patient becomes toxaemic and may lapse into coma and death.

It is essential to distinguish **gas gangrene**, which is characterized by myonecrosis, from **anaerobic cellulitis**, in which superficial gas formation is abundant but toxemia usually slight.

Failure to recognize the difference may lead to unnecessary amputation for the non-lethal cellulitis.



Prevention

Deep, penetrating wounds in muscular tissue are dangerous; they should be explored, all dead tissue should be completely excised and, if there is the slightest doubt about tissue viability, the wound should be left open. Unfortunately **there is no effective antitoxin against *C. welchii*.**

Treatment

The key to life-saving treatment is early diagnosis. General measures, such as fluid replacement and intravenous antibiotics, are started immediately. Hyperbaric oxygen has been used as a means of limiting the spread of gangrene. However, the mainstay of treatment is prompt decompression of the wound and removal of all dead tissue. In advanced cases, **amputation** may be essential.



? Clinical picture of gas gangrene.

? X-rays show diffuse gas in the muscles of the calf

FRACTURE BLISTERS

These are due to elevation of the superficial layers of skin by oedema, and can sometimes be prevented by firm bandaging. They should be covered with a sterile, dry dressing

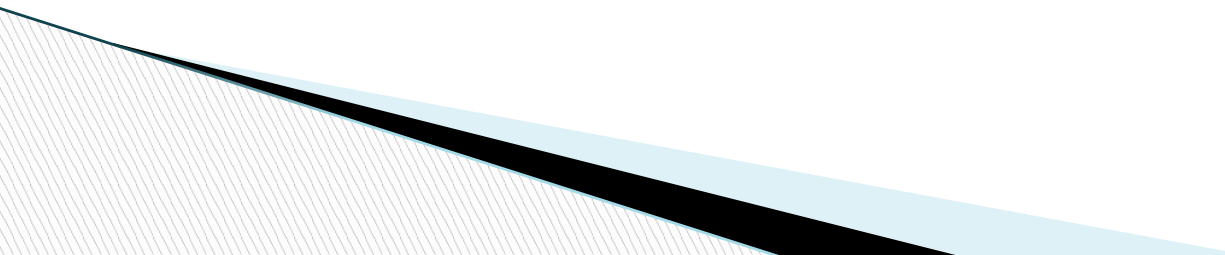
Don't pump them

PLASTER SORES AND PRESSURE SORES

Plaster sores occur where skin is pressed directly onto bone. They should be prevented by padding the bony points and by moulding the wet plaster so that pressure is distributed to the soft tissues around the bony points. While a plaster sore is developing, the patient feels localized burning pain.

A window must immediately be cut in the plaster, or warning pain quickly abates and skin necrosis proceeds unnoticed. *Pressure sores may be produced by splints and other appliances. These should be checked at frequent intervals to ensure that they fit correctly and comfortably.*

Bed sores are liable to occur in elderly or paralysed patients. The skin over the sacrum and heels is especially vulnerable. Bed sores can usually be prevented by careful nursing and early activity; once they have developed, treatment is difficult and it may be necessary to excise the necrotic tissue and repair the defect by means of plastic surgery.



Thank you

