Compound fractures & war injuries

Prof .Dr. Alaa Al-algawy

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Learning objectives :

1- to define compound fracture .

2-to know classification of .

3-outline the principles of management.

4- to know the types of war injuries .

5- mechanisms of affection .

6-outline the management lines of .

Define compound fracture !

Mechanism of injury !

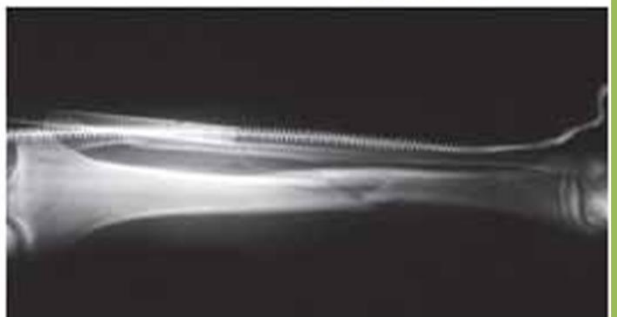
-(from out)

-(from within)

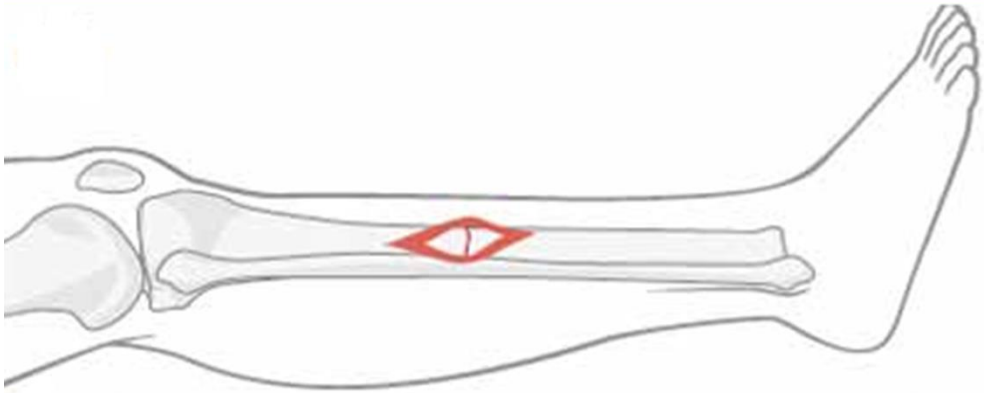
Compound fractures :

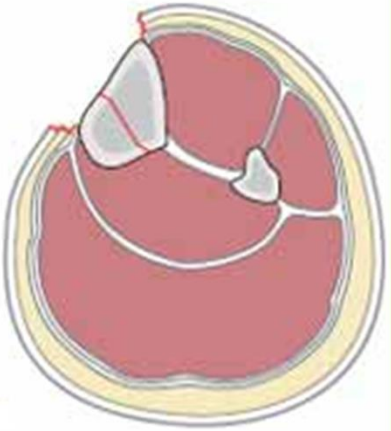
Gustilo classification

GI- the wound is small, clean &usually caused by bone spike



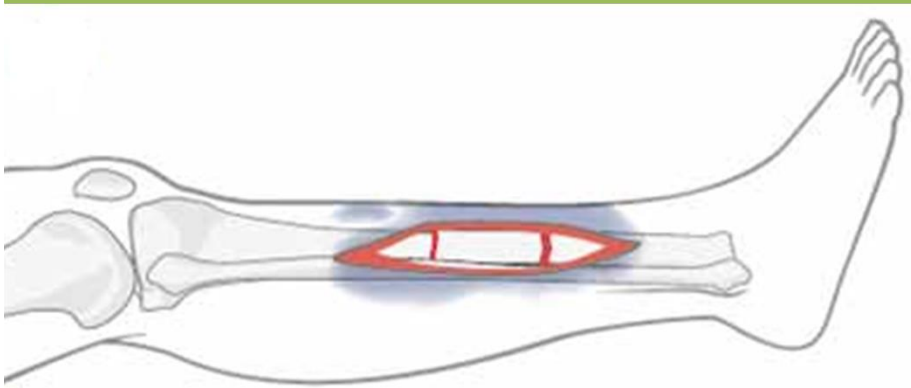
ГП - the wound is >1cm with moderate tissue damage (bone& soft tissue)

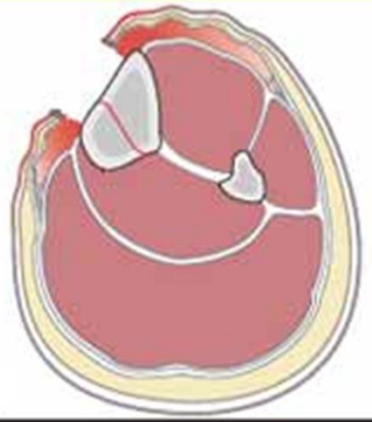




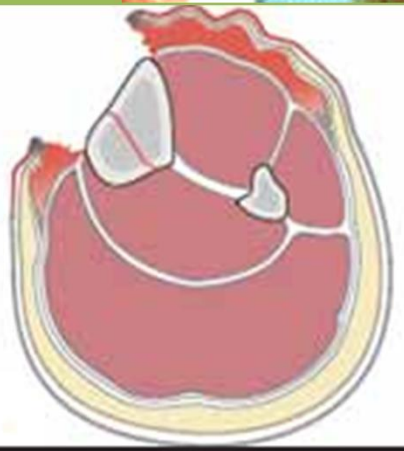
GШ- there is extensive skin, soft tissue damage & compromised vascularity, with considerable contamination

GШA- If the fracture can be covered by soft tissue

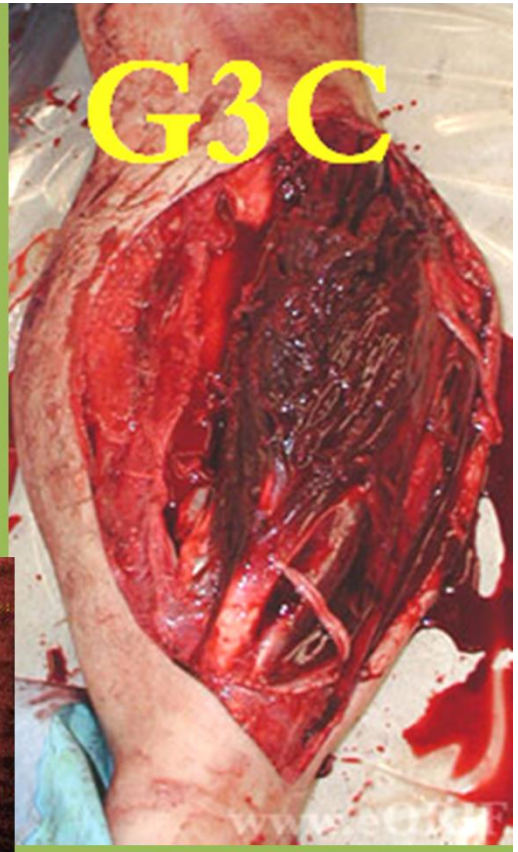


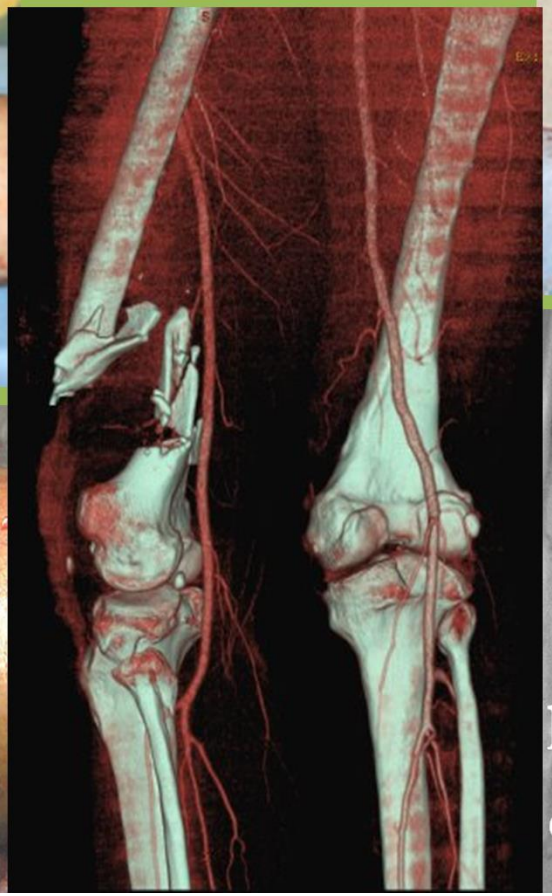


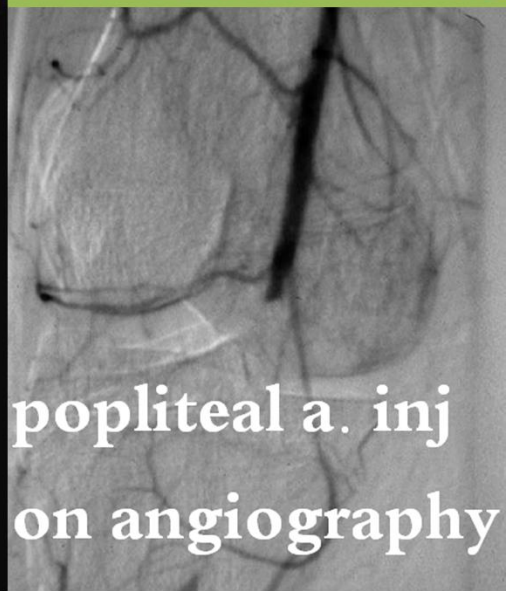
G3 B- If the # require reconstructive surgery for coverage



G3 C- If there is arterial injury requiring repair even if there is little tissue damage







Management: open fracture is an emergency

At the scene : ensure clean airway, stop bleeding, cover the wound, splint the # &transfer to the hospital

In the hospital :

emergency room

IV line blood sample

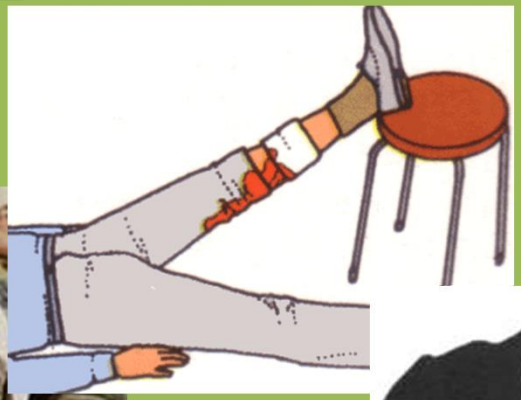
Airway Breathing Circulation

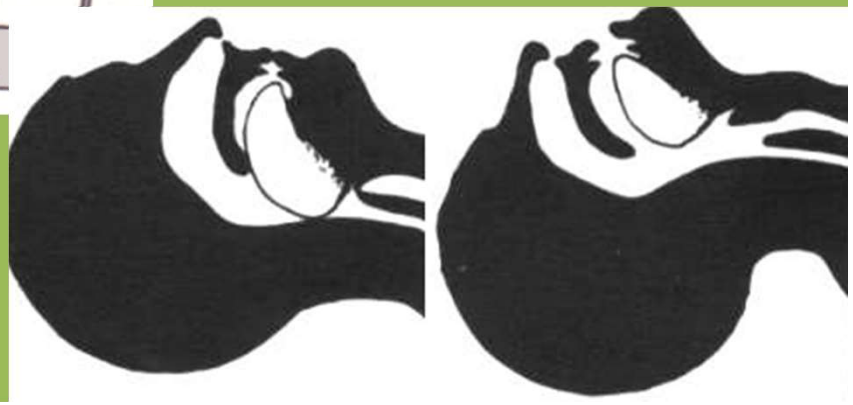
level of consciousness

neck &back, the abdomen

pelvis and limbs for wounds &fractures

more stable→ investigations & X-rays



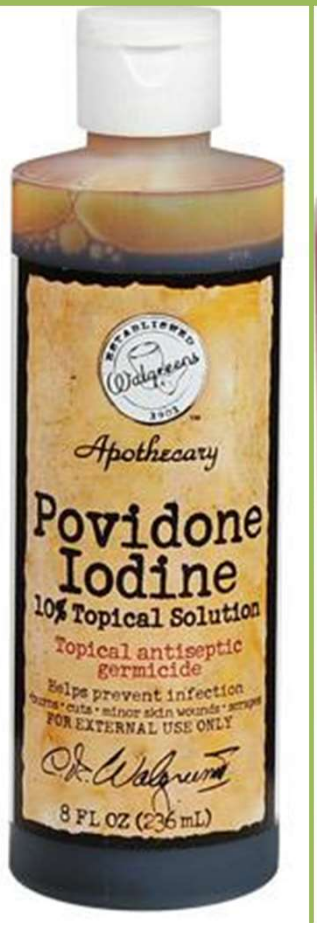


Local treatment of open fracture

immediate broad spectrum AB & tetanus prophylaxis

In the theater:

clean the limb with soap &water, shave the skin around the wound and sterilize it with antiseptic like chlorhexidine or povidone iodine; then expose the wound and clean it with physiological saline mixed with antibacterial agent several times



debridement:

Skin: dead edges are excised till get oozing skin

Subcutaneous tissue: excise all dead subcut. tissues

Muscles: all dead muscles should be excised

A dead muscle is bluish in color

does not contract if pinched & if cut it will not bleed

Bone: bone ends are cleaned, bone fragments are not removed unless they are small and totally detached.

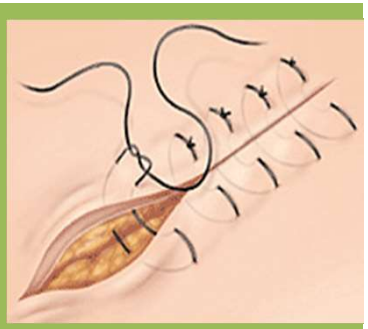
Then stabilize the # with external fixator

Blood vessels: large vessels are repaired, while small bleeders are ligated or clamped

Nerves: approximate nerve ends with sutures for later repair

Wound closure:

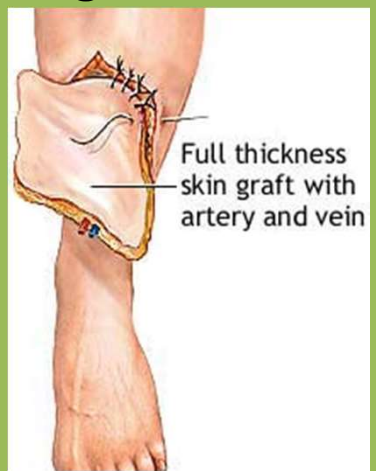
small, clean and debrided within few hours, you can close it

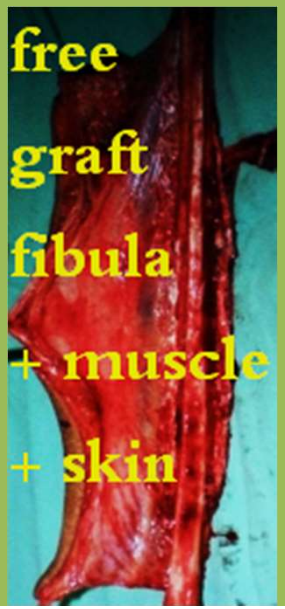


if not → left open for daily dressing until it become clean with healthy granulation tissue → close it (secondary suture)

Skin loss can be replaced by skin graft (partial or full thickness)

pedicle graft or free graft (cutaneous, myocut. or osteomyocut.)





Complications of fracture:

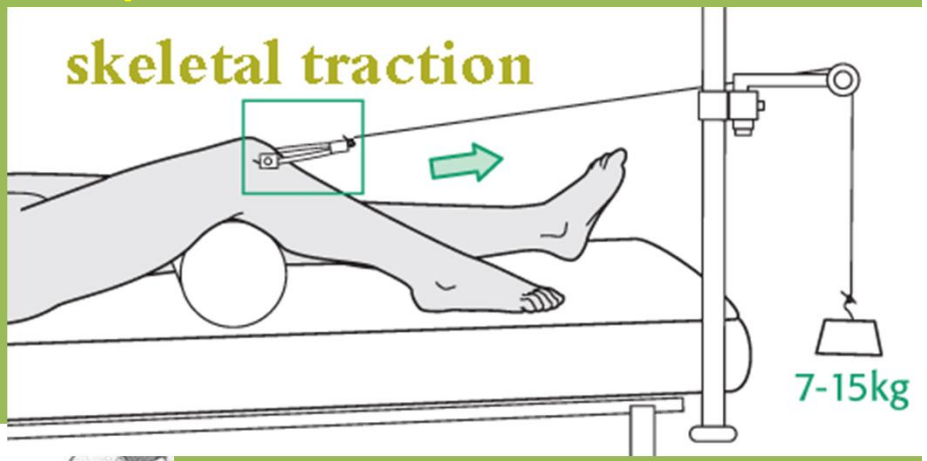
General complications

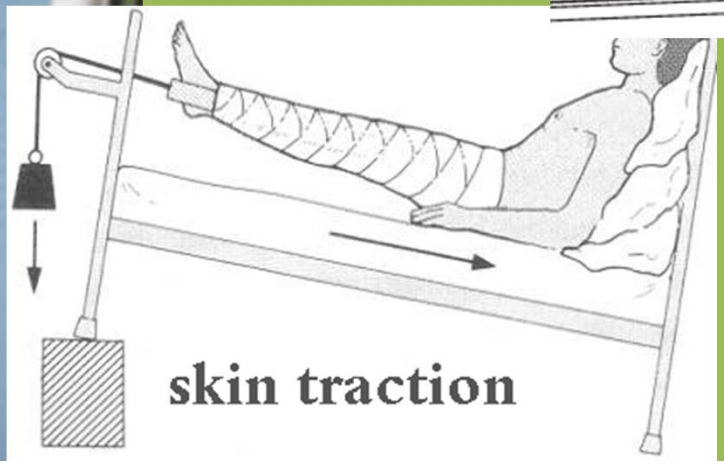
1- shock

state of ↓ tissue perfusion which if persist → damage to vital organs

Neurogenic shock: pain→ blood will pool in skeletal m.

Ṛ→ splint the # & give anaelgesia: morphine or pethidine

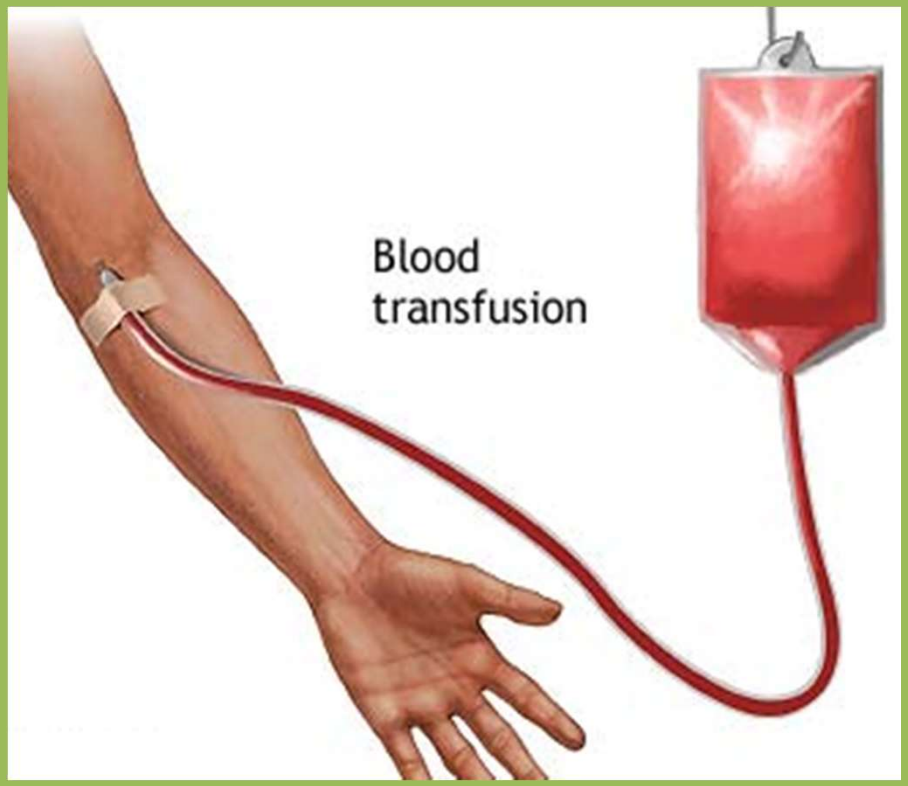


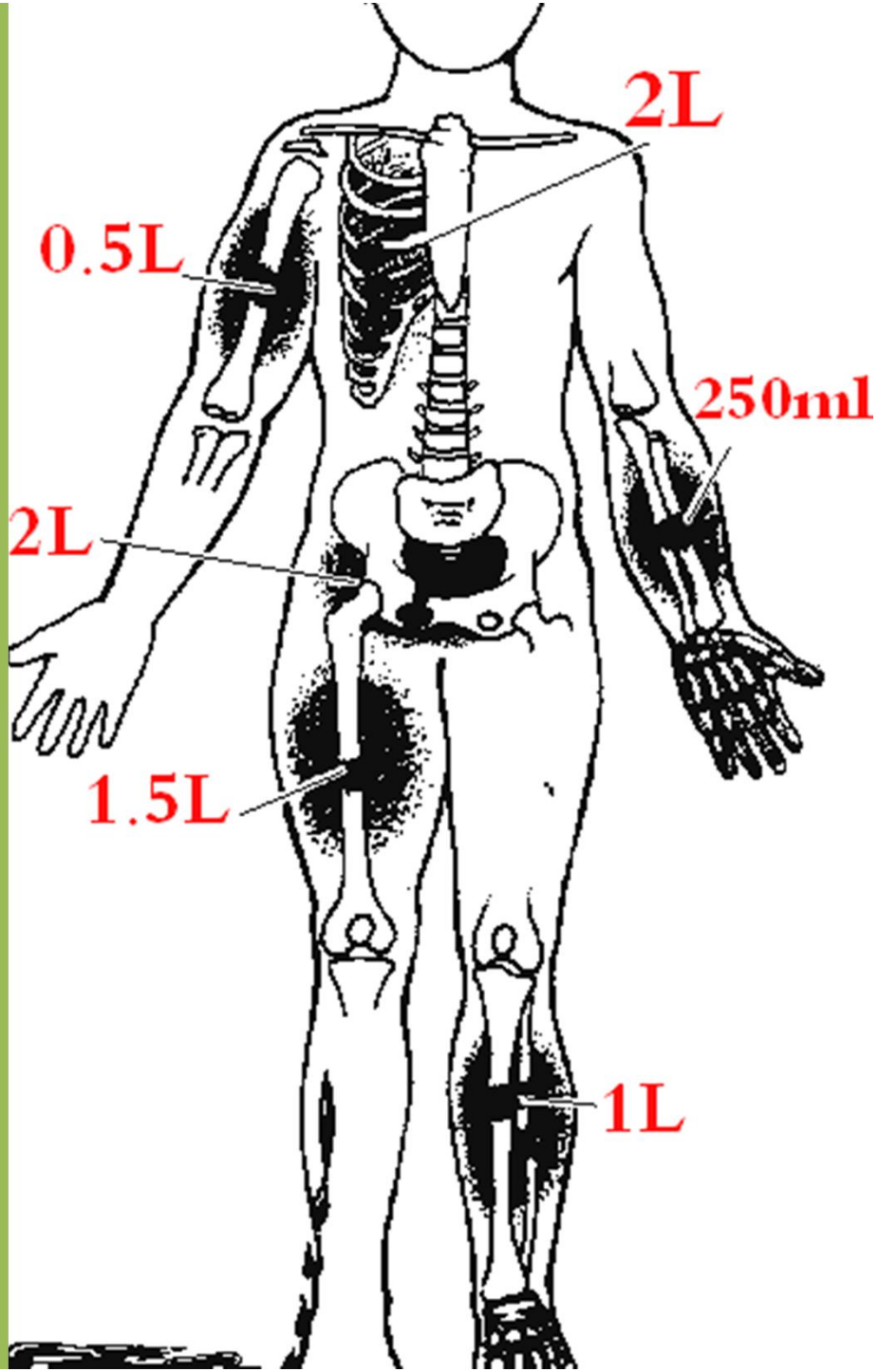


Hypovolaemic shock :

blood loss from bone ends, nearby soft tissue &injured blood vessels

Ṛ → arrest the bleeding & restore the lost blood.





2- Crush syndrome

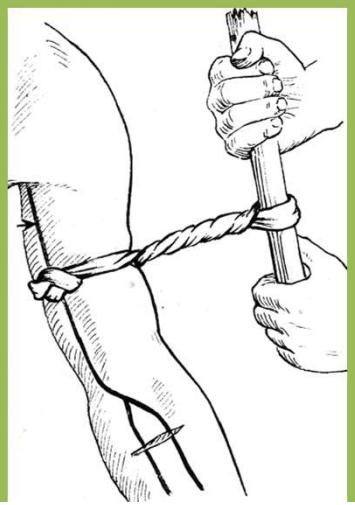
large bulk of muscles is crushed

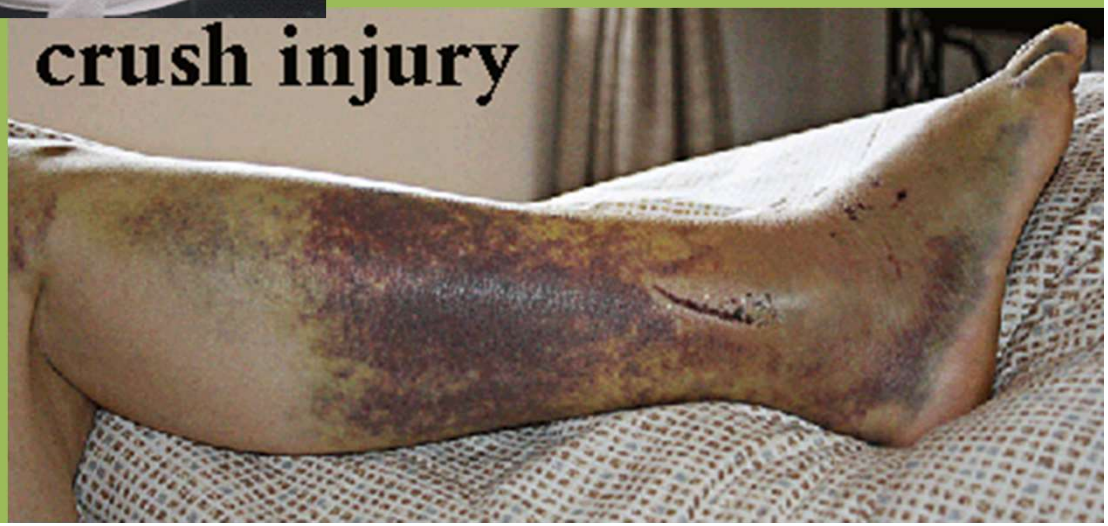
or if a tourniquet was unreleased for > 6 hours

acid myohaematin→ released into the circulation

→block renal tubules → acute renal failure

Prevention: amputated above the level of the forgotten tourniquet and before releasing it





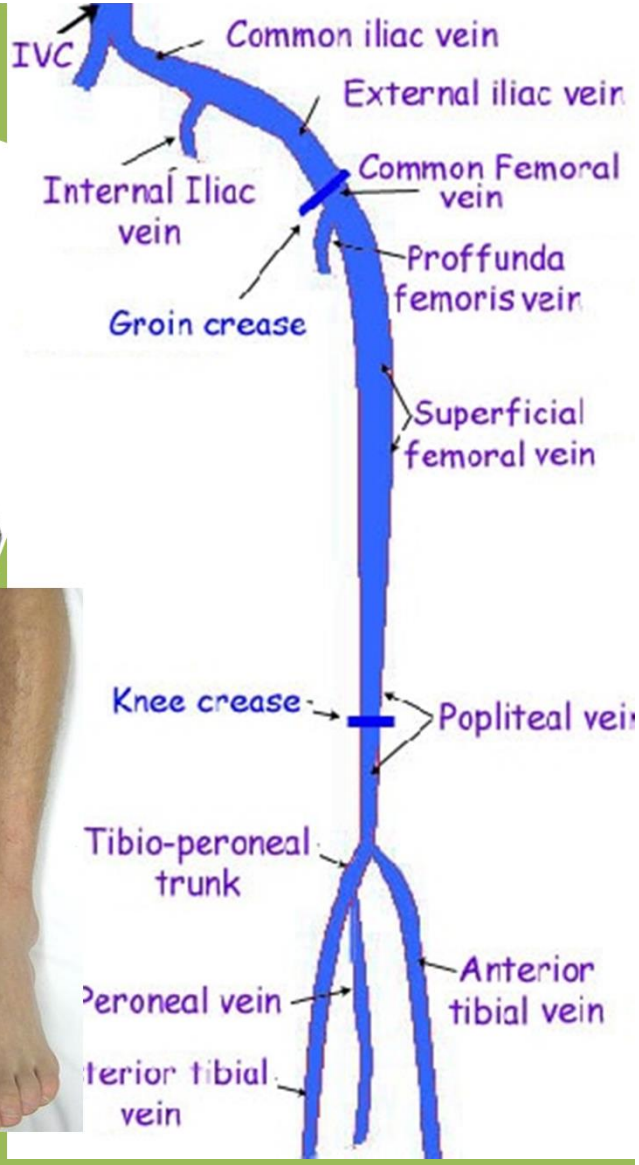
3- venous thrombosis & pulmonary embolism

Causes of DVT

1-activation of factor 10
2-blood stasis
3-endothelial damage
4- ↑ no. &stickiness of platelets

Risk factors:

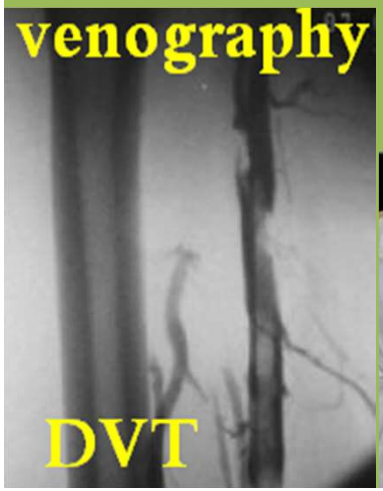
1-old patients. 2-Card.Vascu. Dis.
3-Bed ridden pat. 4- hip surgery



Prevention: 1- early mobilization &exercise.
2-limb elevation. 3-elastic bandage.
4-anticoag.: aspirin , heparin or enoxaparin

CF: ↑body temp &pulse rate, swollen tender calf

Diagnosis: venography or U/S

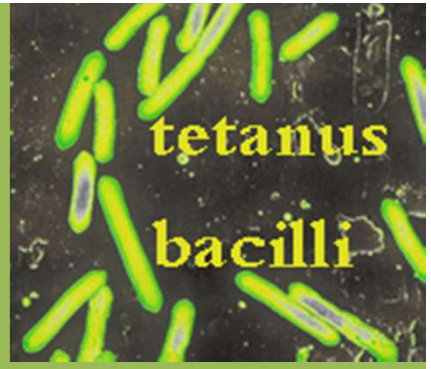


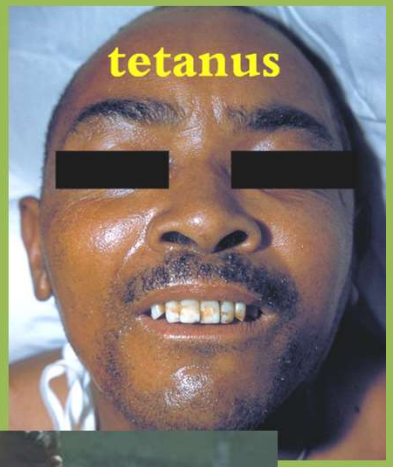
4- Tetanus

organism require dead tissue to grow
exotoxin reach CNS via blood & lymphatics
where it become fixed to AHC

CF: early tonic and later clonic m. contraction
jaw, face, around wound &later neck and back

if diaphragm & intercostal m. affected→ asphyxia

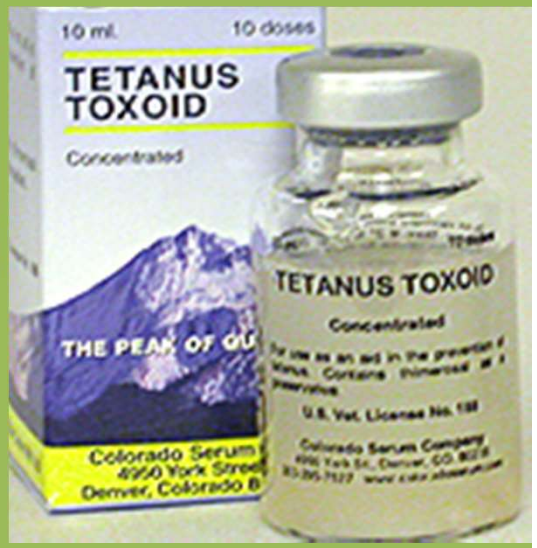




Prophylaxis: good wound toilet &
active immunization using toxoid

Ṛ of established tetanus:
IV antitoxin, sedation, muscle relaxant

(diazepam), antibiotics (penicillin)
&if required, assisted ventilation



5- gas gangrene

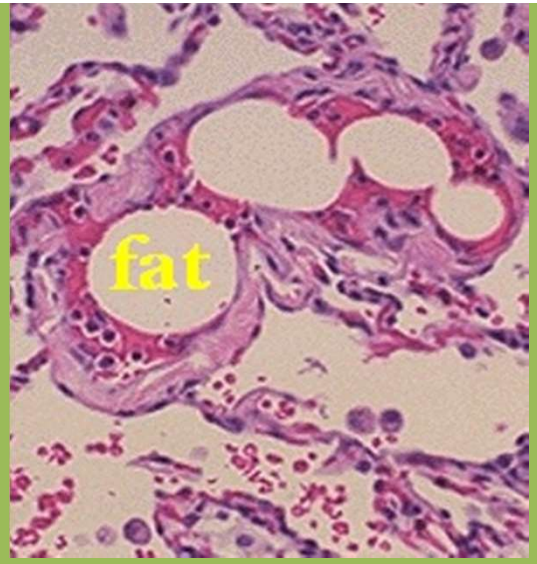
Clostridia perfringens (welchii), anaerobic gram +ve rods growing only in tissue with low oxygen tension, so the usual site is dirty wound with dead muscle that has been closed with inadequate debridement !!!

CF: within 24 hrs,
wound → swollen, painful, brown discharge with specific smell, gas in the tissue,
rapid pulse, little fever & later,
pt → toxic and comatose

Ṛ: excision of all dead tissue,
IV antibiotic,
hyperbaric oxygen may limit infection.
In severe cases, amputation.

6- fat embolism

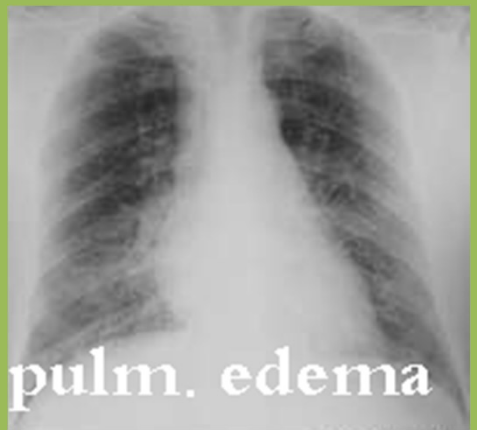
liberation into circulation of fat globules larger than 10µm, the aggregation of them may obstruct capillaries especially in the lungs

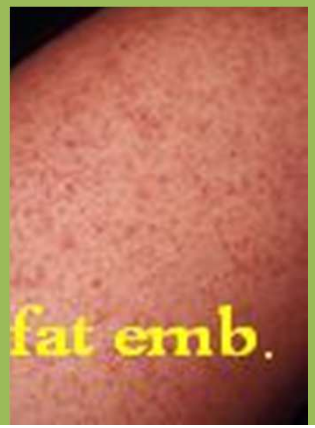


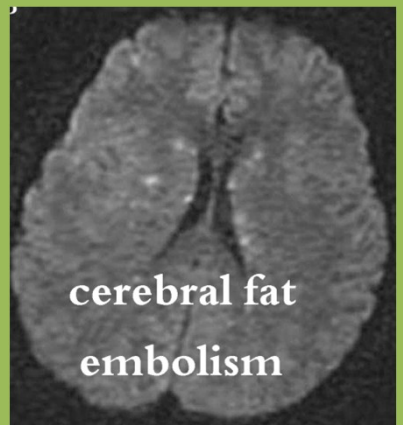
CF: a young adult, within 72 hrs of injury, gets slight fever, rapid pulse, dyspnea, confusion, skin petechiae and in severe cases, respiratory distress and coma

Diagnosis: is suspected if blood Po2 is < 60 mmHg

R→ assisted ventilation, fluid balance, heparin to prevent thromboembolism and steroid to decrease pulmonary odema





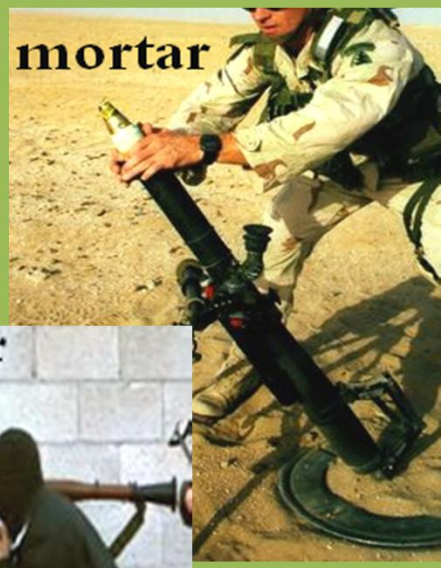


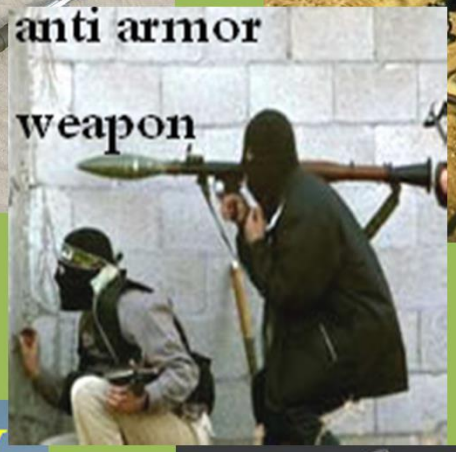
War injuries

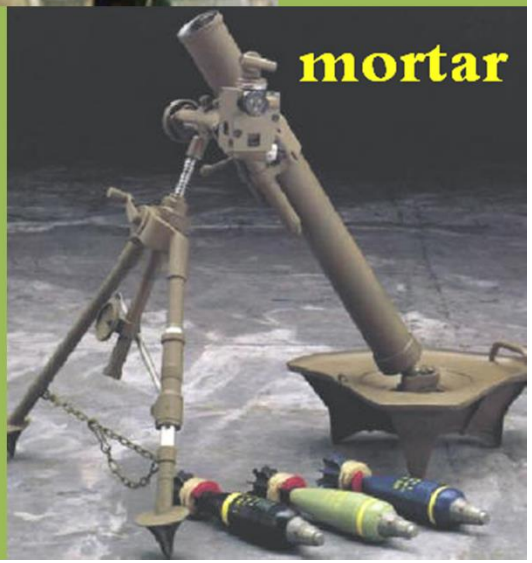
(Ballistic injuries)

1- Small arms: like pistols, rifles and machine guns

2-Explosive munitions: like artillery, grenades, hand grenades, mortar, bomb, mine & anti-armor weapon





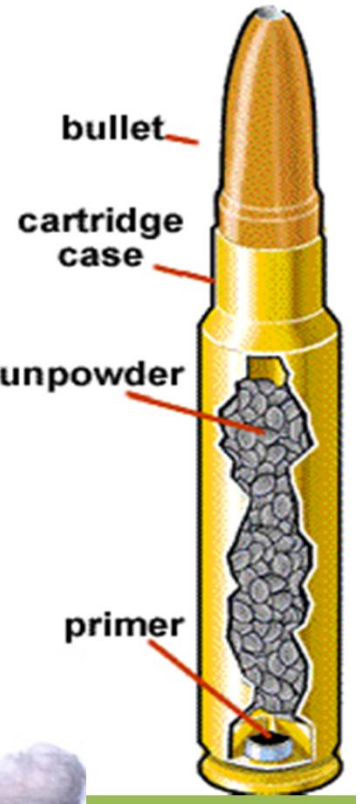


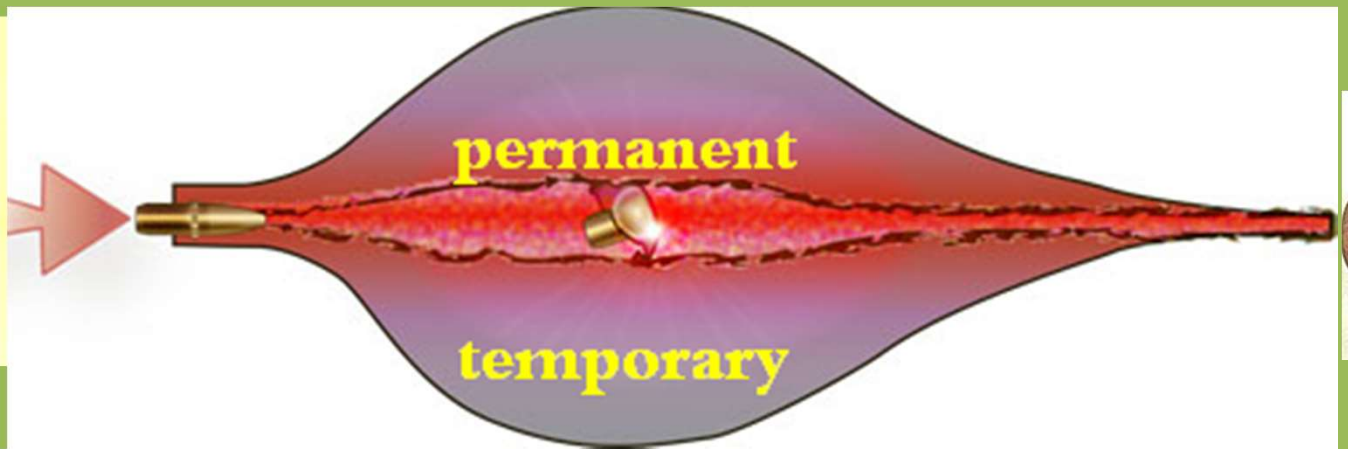
* Small arm injuries

Small arms (both high velocity missile >600m/s and low velocity missile < 600m/s): cause two areas of tissue injury:

1- permanent cavity: is a localized area of cell necrosis caused by direct injury of the missile along it's path

2- temporary cavity: is a transient lateral displacement of tissue surrounding the permanent cavity





Treatment:

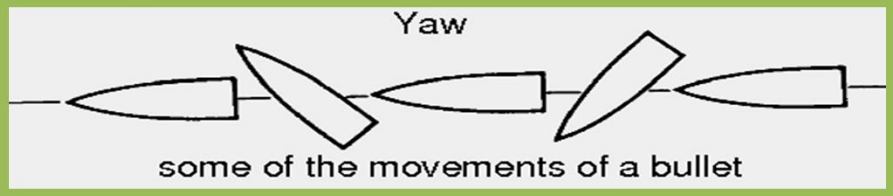
I- Emergency Ṛ: 1- stop bleeding &general resuscitation;
2- cover with sterile dressing;
3- start AB & anti tetanus

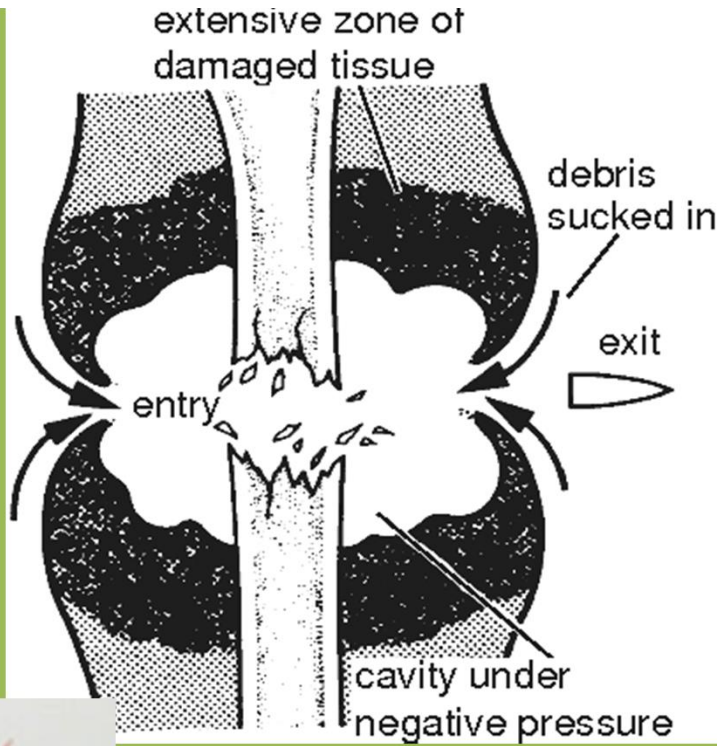
Π- Definitive treatment:

***# soft tissue injury*:**

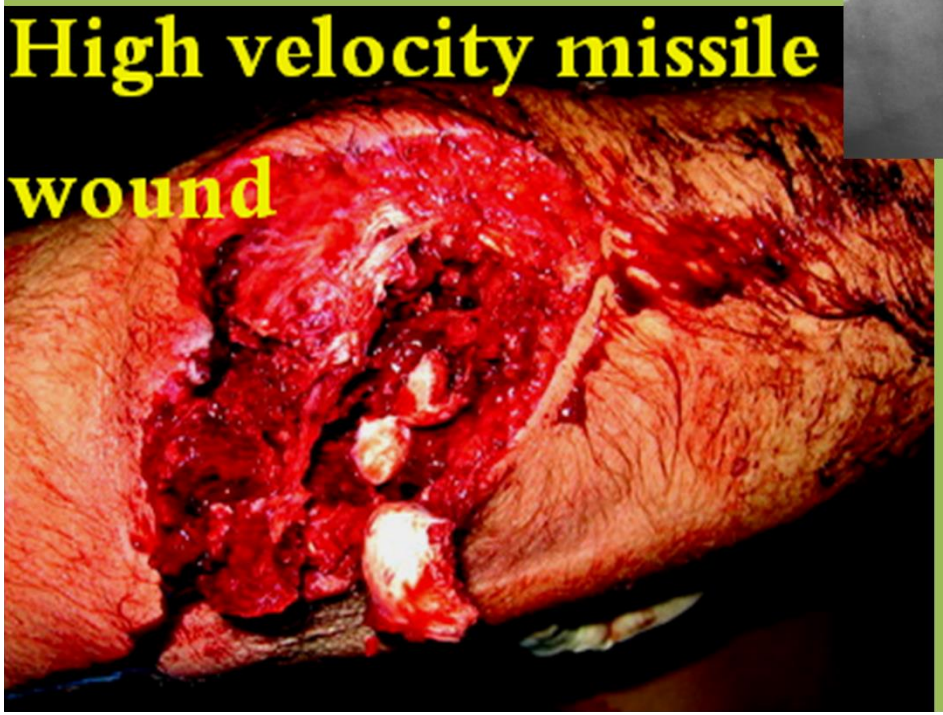
Low velocity missile injury (pistol): there is little tissue destruction and cavitations. So, superficial debridement is enough provided the entry and exit wounds are clean

High velocity missile injury (**rifle**): there is **marked** tissue **destruction** &**cavitation**, which should be cleaned by thorough **debridement** &excision of all **dead** tissue leaving the wound **open** for daily **dressing** till become **clean** before **closure**





 # Bone injury: any associated # should be stabilized using either traction, splintage or external fixation (definitive fixation or temporary external fixation for few weeks then internal fixation)

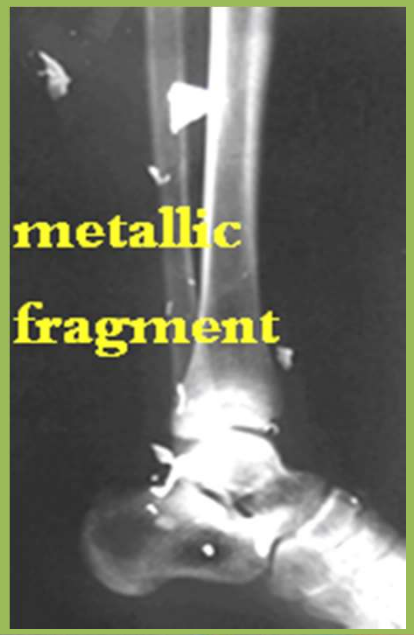


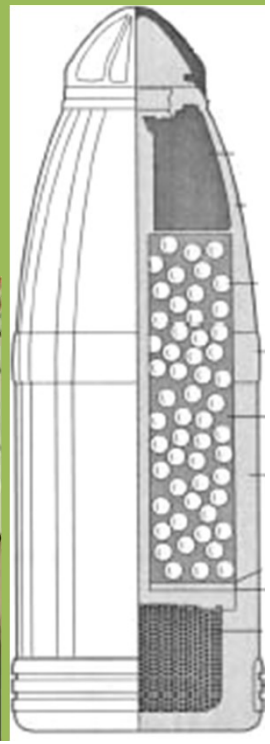
*** Explosive munitions injuries: common in war time &terrorist attacks. They cause blast injuries which are divided into 4 types**

1- Primary blast (wave) injury: caused by the direct effect of blast over pressure on the tissue leading to

a- complete or incomplete amputation (usually irreparable).
b- injury to any gas containing organs like lungs , tympanic membrane and bowel

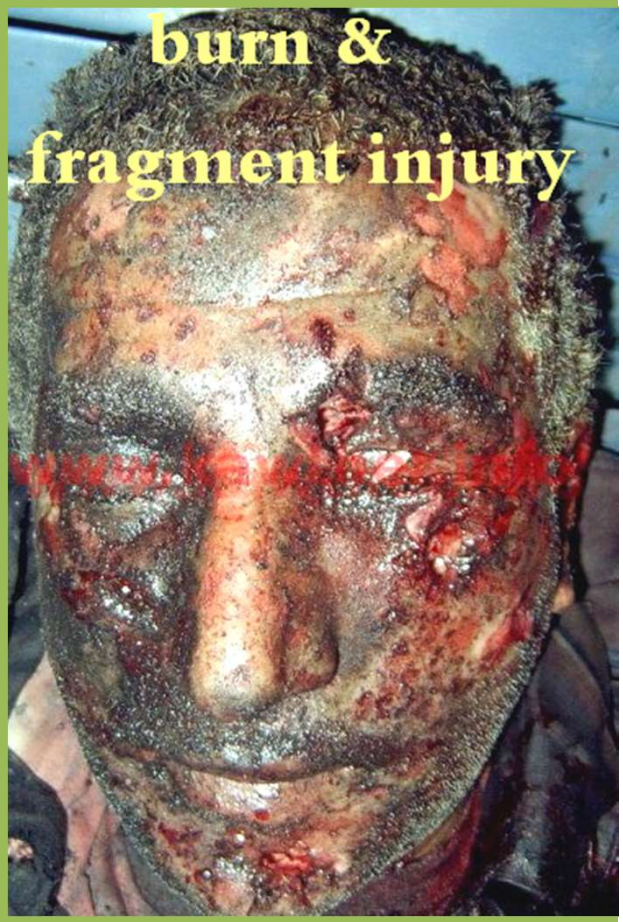
2- Secondary blast injury: is the penetrating injuries caused by the weapon shell & shrapnel (primary fragment injuries) &the fragments resulting from explosion (secondary fragment injuries)





3- Tertiary blast injuries: caused by displacement of the body by shock wave striking other objects that may cause #

4- Quaternary blast injuries: are injuries resulting from building collapse & fire like burn & toxic chemicals poisoning



The most common pattern of injury seen is

multiple small fragment wounds of the extremities

Treatment: ***(Treat the wound, not the weapon.)***

Start with: history, physical exam., radiological evaluation &classification of wounds & # (Gustillo's system), then either: non-operative (rare) or usually operative Ṛ which includes:

1- AT prophylaxis, 2- AB., 3- Wound irrigation &meticulous debridement (usually 2nd, 3rd look debridement).
4- Fracture stabilization which is critical for wound healing & to ↓ the risk of infection. 5- definitive wound cover

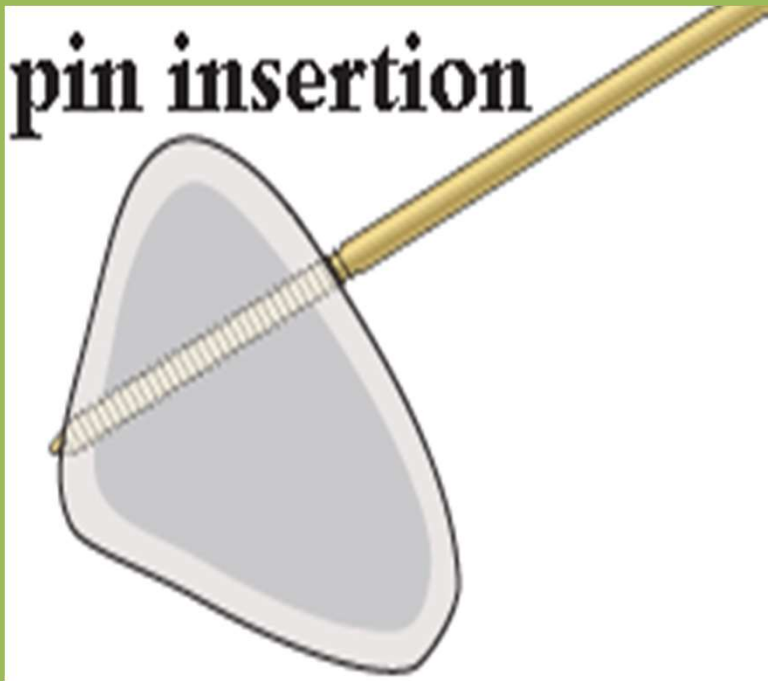

finger amputation

Fracture stabilization:

1- Traction: has limited use nowadays.

2- Splintage: used for closed # and for low energy open # of the leg, ankle & upper limb (G I & П)

3- **External fixation**: is the method of choice for high energy open # (G П & Ш). It ↓ the systemic effect of injury in multiply injured patients by ↓ hemorrhage &↓ the release of inflammatory mediators



END of L1