

Forensic Medicine & Toxicology

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Our course is not only Forensic Medicine
there is Clinical Toxicology

- 60 % forensic medicine and 40 % toxicology.

Course lectures:

Forensic	Toxicology
<ol style="list-style-type: none">1- Wounds and Complications.2- Wound report. (تظهير)3- Identification.4- Asphyxia.5- Death and PM changes.6- Firearm injuries.7- Abortion.8- Child abuse.9- Death certificate.10- Sexual offences.11- DNA Fingerprint.	<ol style="list-style-type: none">1- General Toxicology: introduction.2- General toxicology: treatment.3- Organophosphorus.4- Paracetamol Toxicity.5- Animal poisoning: snake and scorpion.6- Toxic gases: CO and Cyanide.7- Alcohols: acute and chronic ethanol toxicity- methanol toxicity.8- hydrocarbon toxicity.9- Corrosive ingestion.

★ Wound reports & death certificates are written by arabic languages since we live in an arabic country so governmental sectors can use them.

Forensic Medicine & Toxicology

the usage of sciences to enhance the application of justice.

• **Forensic science** refers to a group of scientific disciplines which are concerned with the application of their scientific area of expertise to law enforcement, criminal, civil, legal and judicial matters.

one of the branches

the usage of medical knowledge for application of justice.

• **Forensic medicine:** application of medicine in administration of justice and law. Forensic comes from Latin word "forensis"; it means the forum that was the meeting place where civic and legal matters were discussed by people with public responsibility.

▶ Forensic doctor isn't supposed to know everything about each branch in medicine & he can use the help of other specialists.

▶ Homocidal / suicide / accident

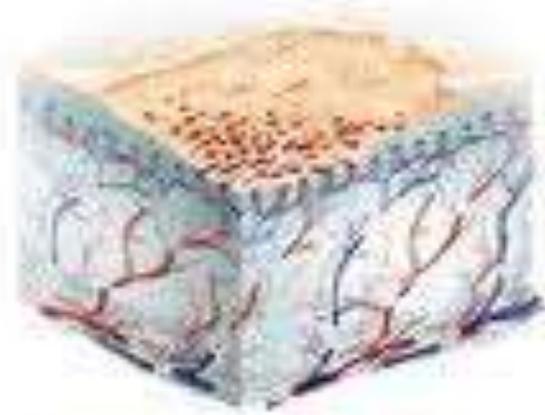
Medicolegal aspects of wounds



Cut



Laceration



Abrasion

Wound definition

it means any injury where there is breach of natural continuity of skin or mucous membrane.

It includes any damage, external or internal, caused by violence, with or without breach of continuity of skin.

Definitions of a Medico-legal Case

• Any case suspected to have a medicolegal aspect should be reported to authorities.

- It is a case of **injury** where an attending doctor after taking history and conducting clinical examination of the patient, thinks that some kind of investigation by **law enforcing agencies** is essential to fix responsibility regarding the case in accordance with the law of the land.
- Registration of a Case as Medico-legal
 - It is purely the responsibility of the attending doctor to register the case at the earliest.
 - If some delay occurs, the case can be made medico-legal at any time.
 - Doctor should not act as a detective. The main duty of the doctor is to observe and record things correctly ⇒ Job of a doctor
 - The request of the patient or relative/friend for not registering the case as medico-legal should not be obeyed.

CASES TO BE LABELED AS MEDICO-LEGAL

1. Roadside accidents, factory accidents or any other unnatural accidents.
2. Suspected or evident homicides or suicides including attempted ones.
3. Suspected or evident poisoning.
4. a victim in a criminal case.
5. Injury cases where there is a likelihood of death in near future.
6. Suspected or evident sexual offenses.
7. Suspected or evident criminal abortions.
8. Unconsciousness, when the cause of unconsciousness is not clear.
9. Cases brought dead with improper history.
10. Cases referred by courts.



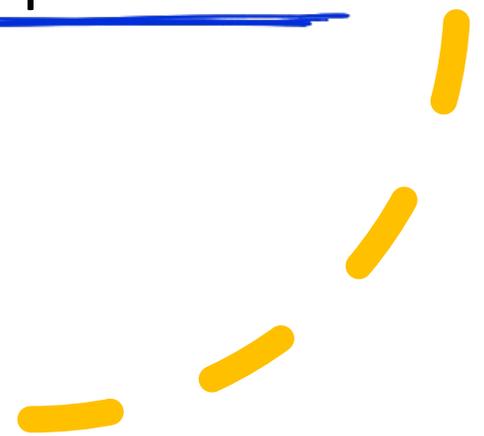
Classification

imp

permanent disability is an impairment that persists after an injury & no further medical improvement can be reached.

A- Legal: from legal point of view, according to the result of the wound and time needed for treatment.

- 1. Simple:** superficial not dangerous, heal in less than 21 days without leaving permanent infirmity.
- 2. Dangerous:** Severe wound that heal in more than 21 days and/or leave permanent infirmity. *loss of function or loss of organ*
- 3. Fatal:** result in death. *direct or due to complication*



B- According to circumstances: Homicidal, suicidal, accidental, defense,

fabricated. *يكون المدعى* → *بشكله وانما* *ويكون يفتن الدماء اليه بنفسه* / *superficial* / *No sign of resistance* / *simple tools* / *corresponding tear of clothes*

يؤدي ضربه
بصدف اتهام شخص بوقوع
اقتتال (مادحة)

C- Medical classification: according to the shape of the wound and instrument;
blunt force and sharp force injuries.

D- according to the time of death: (why and how)

1. Antemortem (AM) wound: occurs before the time of death.
2. Postmortem (PM) wound: occurs after the death.

others :- • How to differentiate between AM and PM wound ???.

E. Skin intact or not : Abrasion or bruises → intact

F. Time of healing : imp. in age of wounds

G. site, size, Depth...
→ 20 days → dangerous
< 20 days → simple

AM versus PM wound

How to differentiate between them.

	AM wound	PM wound
Hemorrhage	Profuse v.D	Very small or absent
Wound edge	Retracted, swollen with gapping	no
Blood clot <u>vital process</u> لازم الجسم يكون متعال	Present, firm	Absent, if present soft
Vital reactions	Shows signs of inflammation + pus ✓	No vital reactions

المتفوية في الجثة - examples
 2- P.M. hanging → Suspension → neck الحبل على ال
 بعد الوفاة



PM



AM

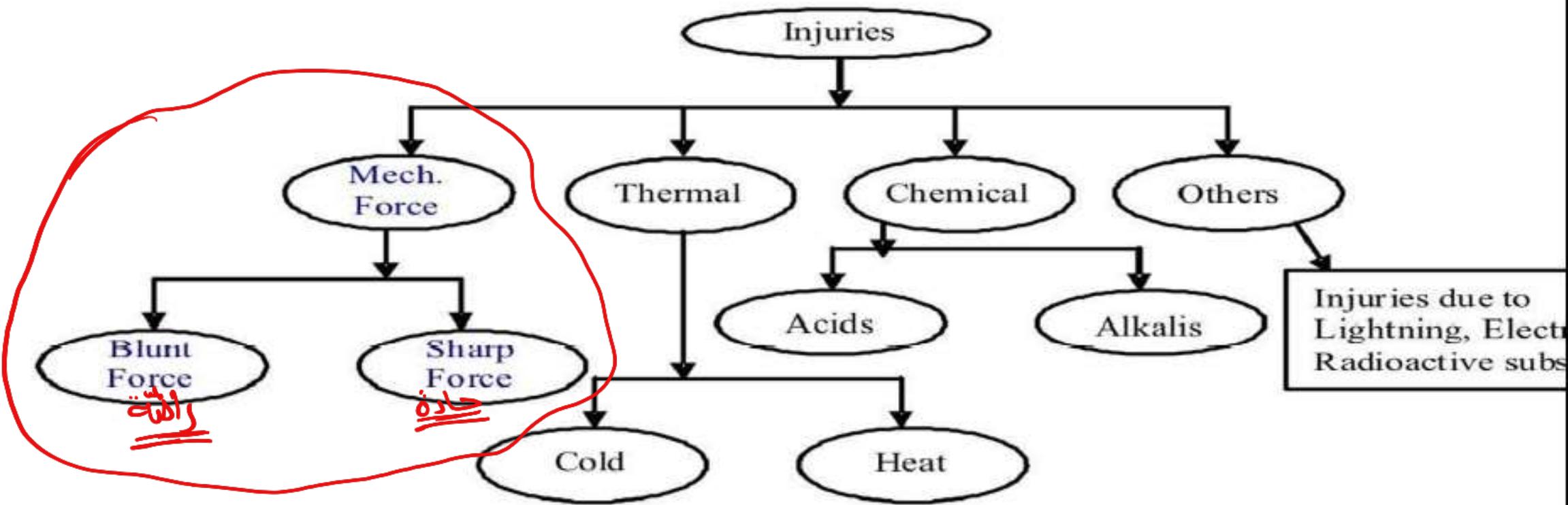
1. What is the legal classification of this wound and why?

Simple & heals in less than 21 days
& leaves no permanent disabilities.

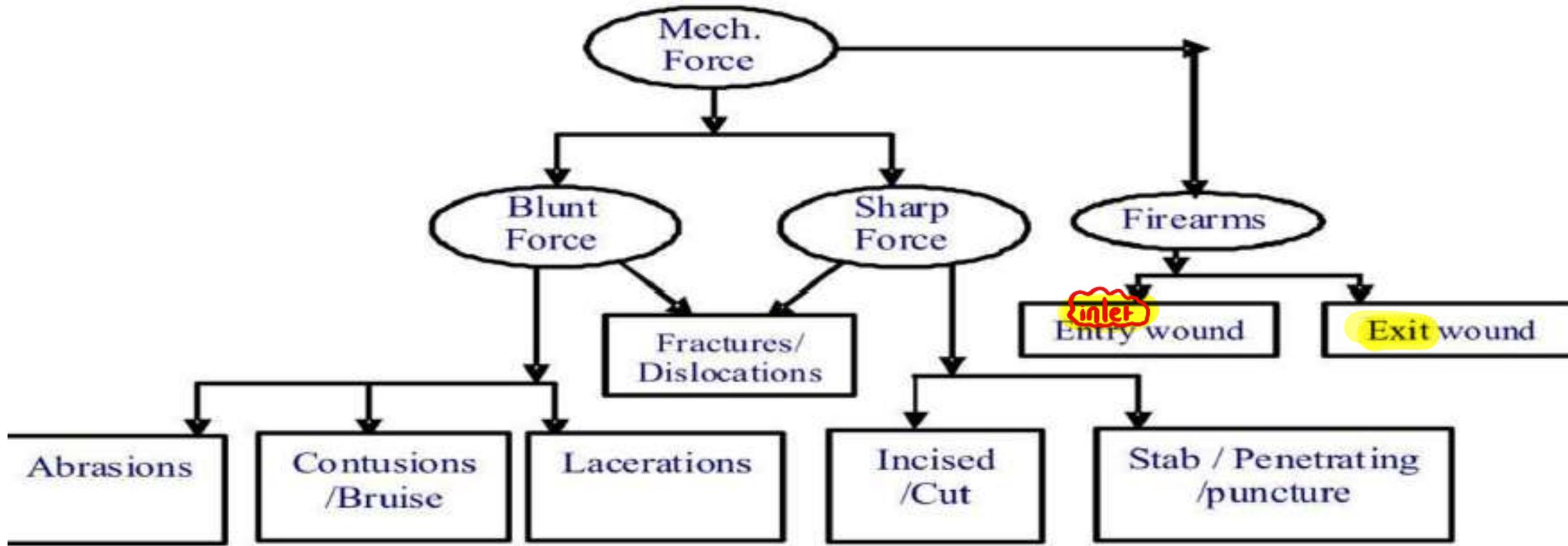
Is this wound AM
or PM and why?

Antimortem





Medical classification (Types of wounds)



Blunt force injuries

1. Abrasions (سحجات) → *أصابة بسيطة*
2. Contusions (bruises) (كدمات) → *ضربة أكبر من (1) بين من كفاية فتح الجلد injury to subcutaneous vessels w/ abrasion*
3. Lacerated (contused wound, contusions) جرح راض او تهتكى

intact skin

splitting of skin

irregular in case of blunt objects & regular in case of sharp objects.

1-Abrasion

سحجات

- Destruction of the **superficial layer** of the skin (**epidermis only**) due to pressure or friction with a rough **blunt object** or dragging against a rough surface.
- (the **simplest form of wounds**) usually occurs with other **blunt force** injuries). *⇒ As bruises*
- As injury is in the **epidermis**, usually there is **no bleeding**.

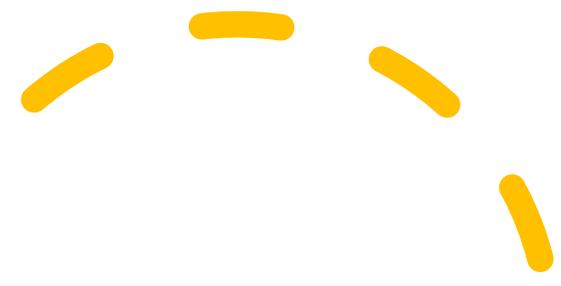
▶ Some sharp objects can cause abrasion (finger nails).

Types of Abrasions:
Depending upon the mechanism of the pressure and nature and movement of the weapon/agent involved against the skin surface, abrasions may be classified as follows.

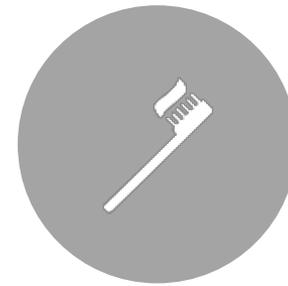
→ impact or impression abrasions

1. **Pressure (Pattern) abrasions:** These are caused by pressure by blunt object such as ligature abrasions.
2. **Sliding (Dragging) abrasions:** These are caused by friction against a rough surface such as sliding abrasions in car accidents.





3- Scratches: They are caused by passing an object across the skin such as fingernails, claws of animals and pins.



4- Grazes or brush abrasions: They are multiple parallel linear scratches which are caused when a broader surface of the skin



Abrasion : scratch

- * No scare
- * sign of infl....
- * clotting



(a)

(a) Fingernail abrasion on the lateral neck of a 33-year-old man who committed rape homicide 6 days before.



(b)

(b) A partially healed injury caused by the victim in self-defence.

◀ قد نزل على دفاع عن النفس
في حالات الإغتصاب

Abrasion :
impact
(impression or
patterned)





(Ligature mark)

Pressure abrasions

- Rope in hanging
- Showing contusion

Linear parallel abrasions resulting from striking an automobile windshield



→ Brush abrasions

▶ when abrasions are parallel linear & multiple.





Large yellow anemic postmortem abrasion.

Medicolegal importance of abrasions:

► Because the bullet has big inertia when invading skull it may cause abrasions at the entry site or inlet, when exiting the inertia will be lost so no abrasions.

(Differentiation between inlet & exit of bullets)

1. It may be the only evidence of a crime or violence i.e. signs of resistance.
2. Its site may indicate the type of the crime. e.g.
 - smothering, throttling, strangulation, rape.
3. It can give an idea about the instrument used from its shape e.g. fingernails, radiator of a motor car, rope mark.
4. Differentiate incised and contused wounds, inlet and exit of firearm, hypostasis and contusion.
5. The age of abrasion gives an idea about the date of the crime.
 - Bright red lesion—freshly produced
 - Soft red scab—12 to 24 hours
 - Scab turns brownish—2 to 3 days
 - Scab dries, shrinks and falls off—7 days..

► Abrasions can help to differentiate between
1. bruises (present) & hypostasis (absent).

2. Inlet & Exit
(present) (absent)

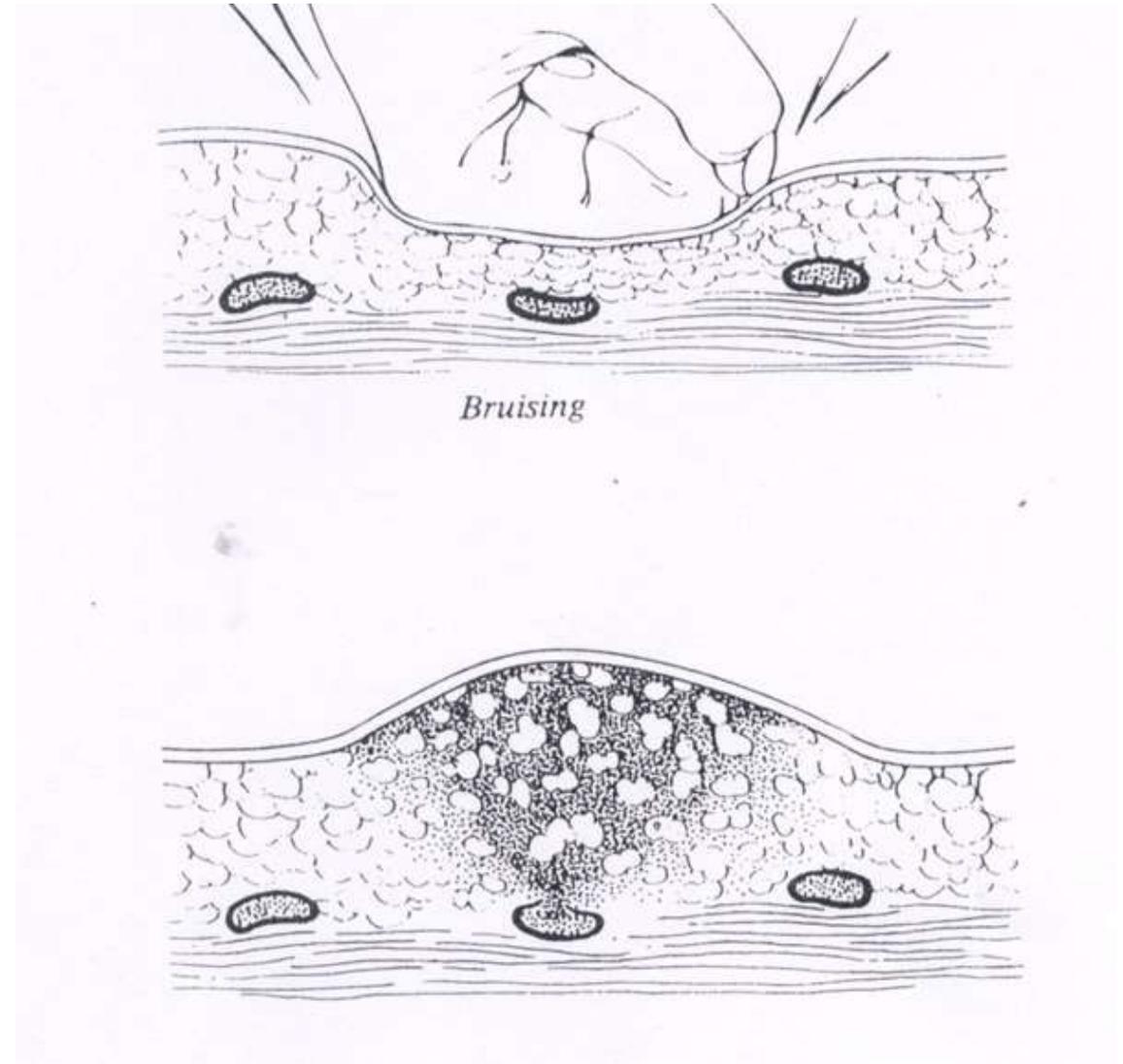
↑ energy during entry ↓

Item	A.M. abrasions	P.M.
Redness	Due to presence of underlying bruises (due to circulating blood)	Absent May be yellow
Bruises	Usually accompanied by bruises (due to circulating blood)	Absent
Vital reaction	Evidence of tissue reaction may be found as healing, sepsis, and cellular infiltration	Absent



2-Contusions (bruises) كدمات

- **Definition:** *splitting of B.Vs with intact skin*
infiltration of **extravasated blood** into the **subcutaneous and/or subepithelial tissues** resulting from rupture of small blood vessels due to application of **blunt force**. It occurs in **skin** and **internal organs**.
- **Instrument:**
Blunt object e.g. stick or big stone



Factors affecting bruises

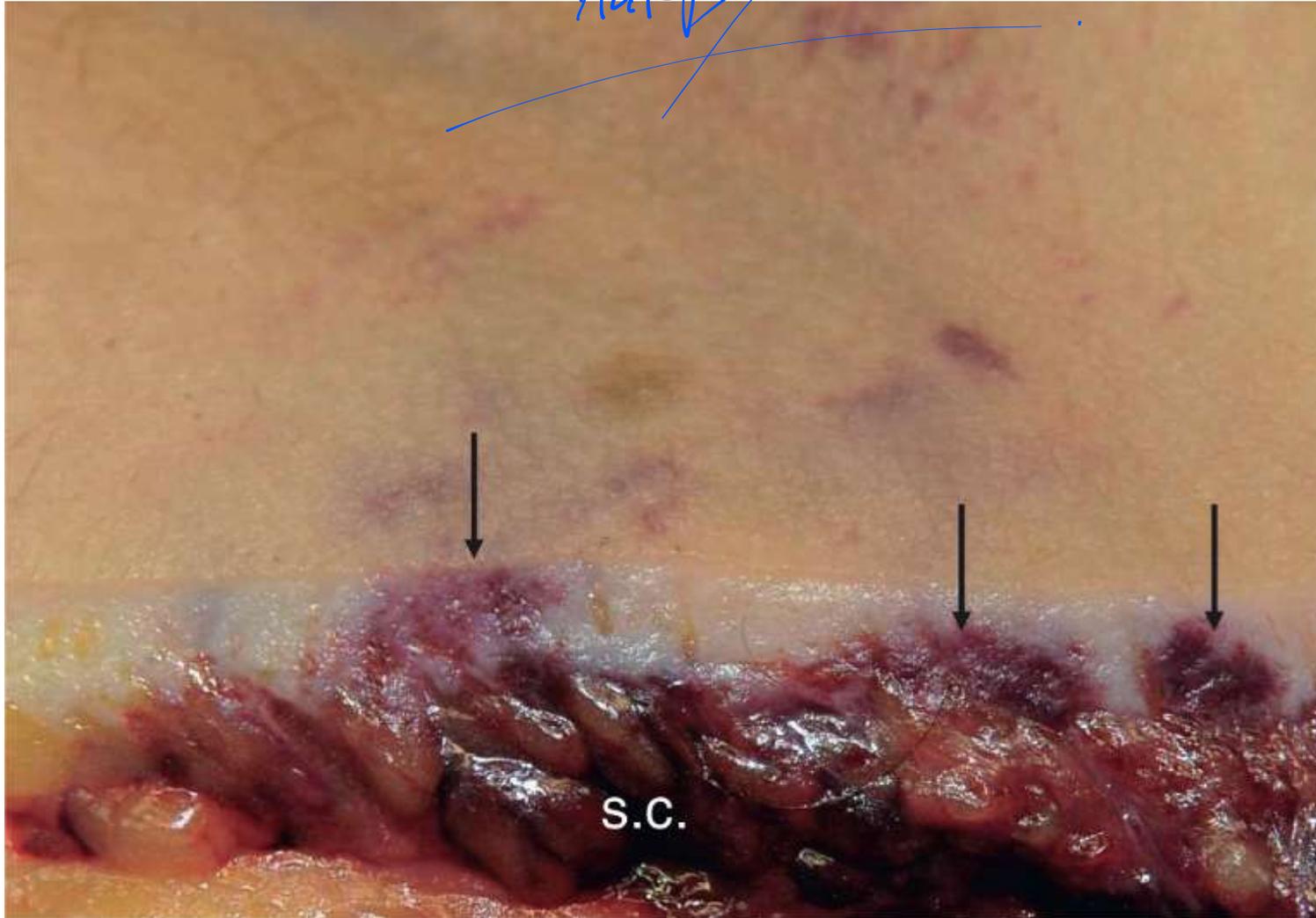
1. The amount of violence applied to the body.
2. The instrument used.
3. Site. *skin with underlying bone is more likely to have bruises.*
 - a) Vascular and lax areas having very thin skin (eye lids and labia majora). Minimal blows: severe bruises.
 - b) Tough areas (palm and sole): Minimal bruises.
 - c) Underlying tissues: muscles: minimal bruises;
bones: severe bruises
4. Texture and color of the skin: Bruises are more apparent in fair people than dark people.
5. Age: Children and old peoples tend to bruise easily

Factors affecting bruises

► Some injuries can cause bruises at different sites from the site of trauma but the original site of trauma may have abrasion that can help us to know the actual site of bleeding.

6. **Sex:** Women bruised more easily than men due to delicacy of tissues and presence of subcutaneous fat especially if obese.
7. **Certain diseases:** Patients suffering from hypertension, cardiovascular degenerative changes, purpura, hemophilia, leukemia and survey are more easily bruised.
8. **Gravity:** basal skull fracture. bruises can appear at places away from the site of violence e.g. a blow on the forehead → bruise round the eye, a blow on the abdomen → bruise in the scrotum.

Autopsy



- Mixed bruise consisting of intradermal (arrows) and subcutaneous (SC) hemorrhages. View from above (upper half of the image) and cut section (lower half)

Black or raccoon eye



An example of [redacted], or bruising behind the ear due to basal skull fractures



Grey Turner's sign, bruising of the flanks, indicating extensive internal (retroperitoneal) hemorrhage



An area of red bruising
around the umbilicus,
so-called **Cullen's sign**,
associated with intra
and retroperitoneal
hemorrhage



► Color of bruises can indicate their ages

1) Red & oxyhemoglobin.

2) Blue & deoxyhemoglobin.

3) Yellow & Billirubin.



Medicolegal Importance Of Bruises:

► Multiple bruises with different sites & different colors may indicate an abuse.



1. Shape of bruise: A bruise usually takes the shape of the causal instrument: e.g.:

1. Bite: 2 curved rows of bruises in human bite, 2 parallel rows of bruises in animal bite .
2. elongated bruises in blows by stick.
3. curved around the body if by a whip.

2. Site of bruise: indicate the crime type and cause of death e.g. smothering & throttling, rape, Strangulation & hanging (Rope bruises on the neck).

3. may shift under the effect of gravity: a bruise in temple may sink over cheek, a deep bruise in hip fascia may appear at knee.

4. Bruises differentiate cut from contused wounds: Bruises present around the edges of contused wounds.

Numerous patterned injuries produced by an electrical cord "loop" that was used as a "whip." Notice that some of the marks have a "tram-track" appearance



Numerous patterned injuries produced by an electrical cord “loop” that was used as a “whip.” Notice that some of the marks have a “tram-track” appearance





Recent purple contusion of arm.



Older yellow-brown contusion.

5- AGE

- **Age of a bruise:** Age of bruises can be compared with the date of a crime from the color changes (healing) during life
 - ★ • **Red:** oxy HB. recent
 - **Violet:** Gradual reduction of oxy HB.
 - ★ • **Blue :** complete reduction of oxy HB.
 - **Brown:** iron- containing pigment (hemosiderin).
 - **Green:** biliverdin.
 - ★ • **Yellow:** Bilirubin. old
 - **Normal color:** when all pigments are removed by phagocytes.
- due to the action of tissue enzymes and phagocytes on extravasated hemoglobin
- The age of a bruise usually depends on its size and depth. (range from 2-4 weeks). The color changes occur from the periphery inwards.

★ اللون الذي يمتد وهو عليه يظل زياً ما هو
ما يني healing (الشفاء) ما يني color change
as simple as...♡

6- DIFFERENTIATION BETWEEN HYPOSTASIS AND BRUISES:

easy

Item	Hypostasis <i>pooling of blood</i>	Bruises
(1) Time	Sure sign of death	Traumatic A.M. sign
(2) Site	In most dependent parts	Site of trauma
(3) Swelling	absent	present
3) edges	Ill defined edge	Well defined edge
(4) Color	One color (<i>Bluish</i>)	Color changes (<i>depending on age</i>)
(6) Abrasions	Absent	Present
(7) Blood	Intra vascular	Extra vascular
(8) Cut - wash	Washable	Not washable
(9) Microscopic Exam.	No blood cells	Blood cells

*No clotting
Fluid*

Clotting

BRUISES



BRUISES



► Bruises heal from the periphery to the center so there may be a variation in the color for the same bruises.
(gradual healing)

BRUISES

Butterfly



BRUISES



Black eye , contusion



BRUISES



Basal skull fracture

↳ under the effect of gravity
so there will be a variation
in time. ✓





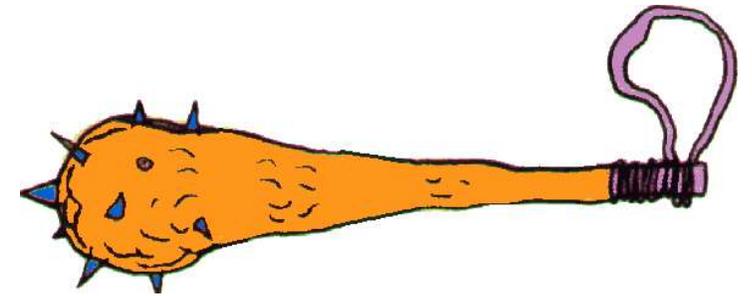
**Contusion
(Showed colour changes)**

3-Contused wound (lacerated wound) (متهتك) الجرح الرضي

* Contusion → Bruises
* Contused → Laceration

- **Definition:**
- laceration refers to tearing or splitting of tissues from blunt force or acceleration/deceleration injuries. *or open skin is not cut*
- **Instrument:**
- **blunt object** e.g. heavy stick or big stone.

Laceration

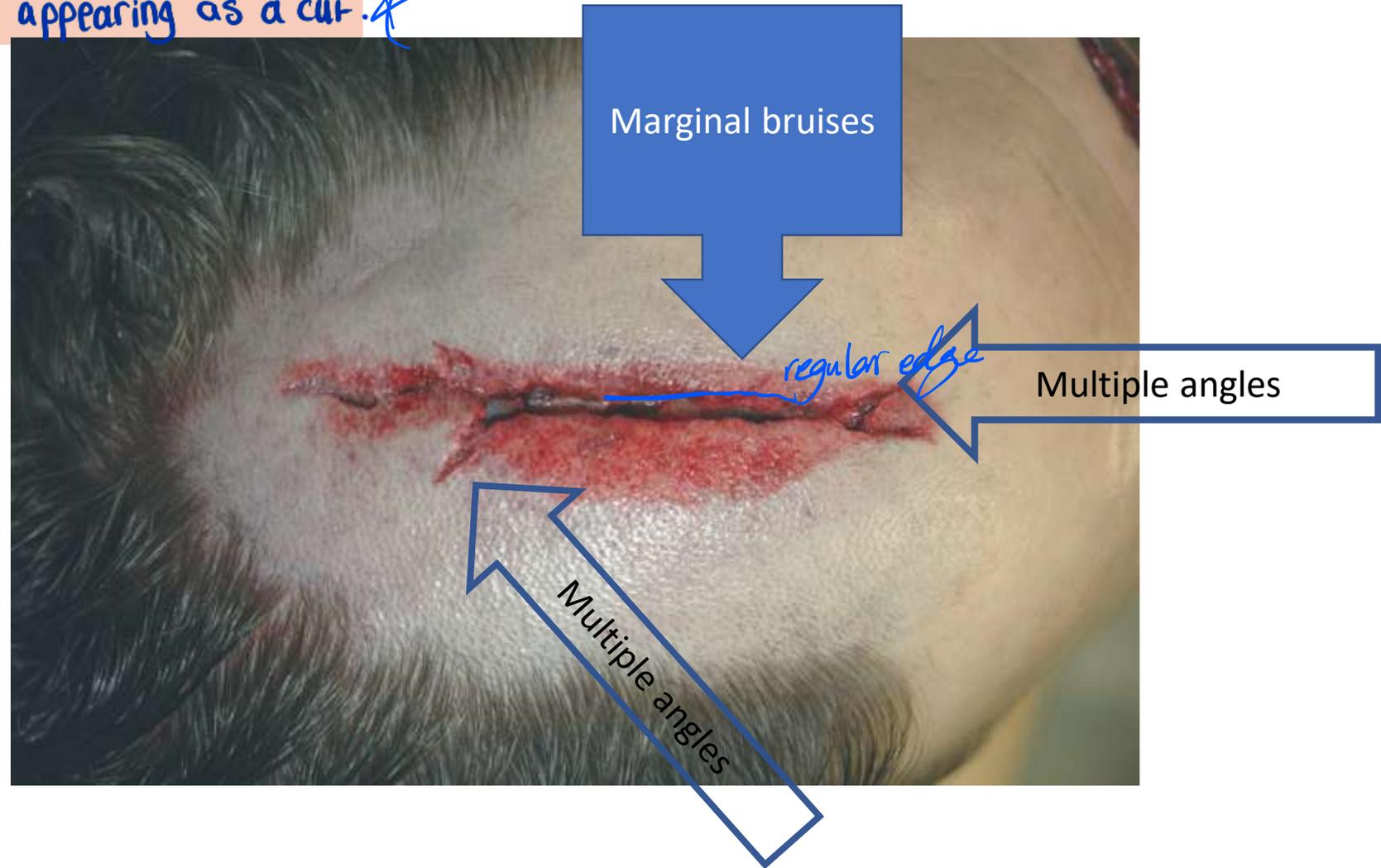


Characters of Contused Wounds :

1. Irregular edges (with angles which may be multiple and irregular) except in skin stretched over bone (scalp, skin of tibia), the edges are more or less regular. *multiple angles -*
2. Abrasions & bruises at the edges (on examination with a lens).
3. Crushed hair at the edges (on microscopical examination). *not cut*
4. Bridging of tissues across the edges (remnants of intact nerves, vessels, or fibers).
5. Little bleeding because the vessels are crushed cut.
6. More liable to sepsis because of tissue destruction.
7. Contused wounds take longer time to heal.

★ • Contused wound may be mistaken by cut wound in two sites & skull & chin of tibia because the skin is tensed by underlying bone so it tear by trauma appearing as a cut. ★

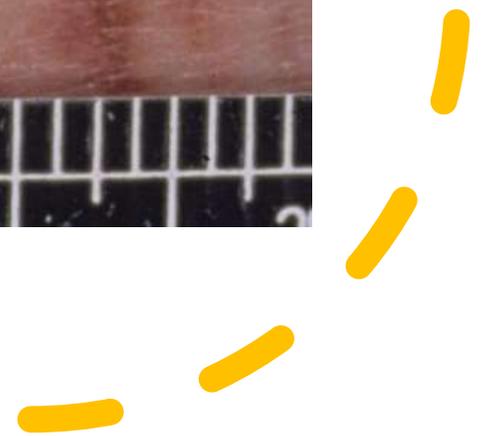
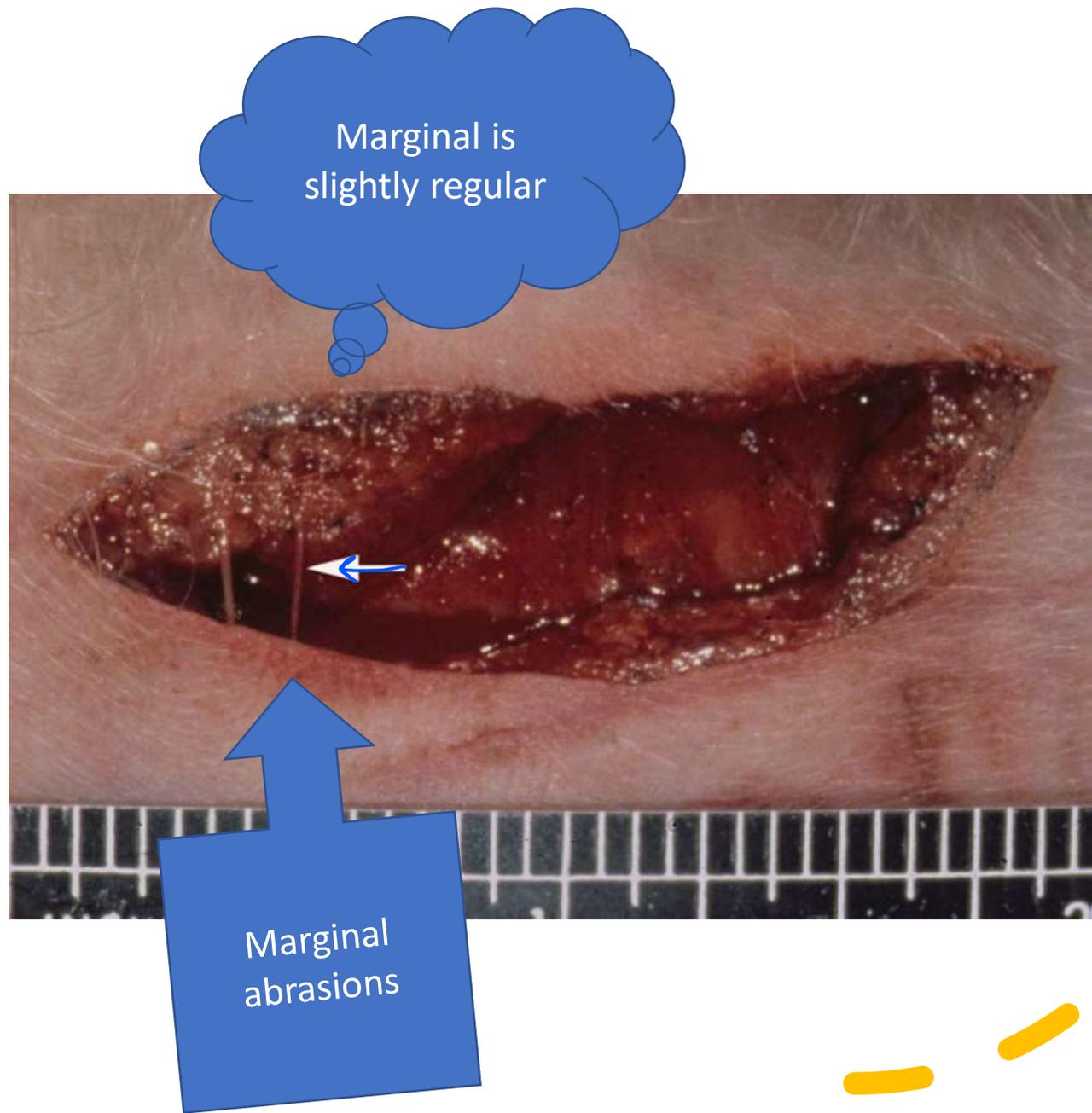
* Cut more bleeding than contused
حسب الكوع
contused wound in scalp more bleeding (more vascular)
* Cut more healing than contused



A laceration
with extensive
associated
abrasions



A scalp laceration with minimal marginal abrasions but with tissue bridging toward the left end (arrow)



Scalp lacerated wound

Contused wound = Lacerated wound

Lacerated wounds in the scalp may simulate cut wounds in:

- *The edges of contused wounds are more or less regular*
- *More bleeding due to increased vascularity of the scalp.*

Abrasion also can be found

subtypes

A-Contused

B- Lacerated wound (underlying tissue damage) ^{to MS}

C- Crushed (fracture in bone)

D- Tear laceration (جنزیر) multiple flaps

E- Cut laceration

• جرح رضی

• جرح رضی متهتك

• جرح هرسی

• جرح مزعی

• جرح قطعی متهتك

a. Contused wound





this elderly women had a history of an unsteady gait associated with parkinson's disease and remote stroke. she was found in her apartment with several impact injuries to her scalp. it was initially thought by investigators that she had fallen several times and possibly suffered a heart attack. Further examination of her scalp revealed more lacerations and impacts that were initially not observed at the scene due to poor lighting and dried blood matted in her scalp hair. these scalp lacerations were produced by being struck with a hammer head.

Contused wound in the face



(a)



(b)

Crush

Bone should be involved



Lacerated wound



Amputation

(may be caused by blunt or sharp objects)



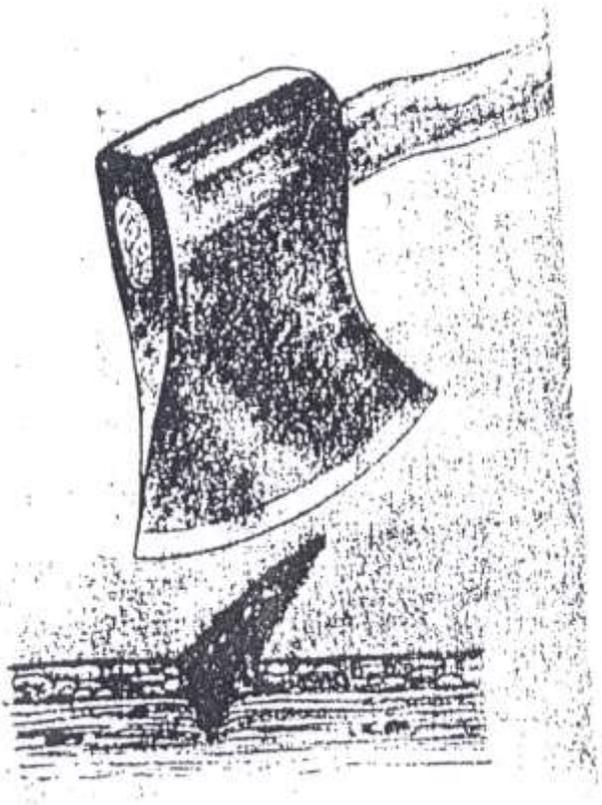
Chop Wounds: (cut lacerated wound)

- **Definition:** Deep gaping wounds caused by a blow with the moderately sharp cutting edge of a heavy weapon, applied with a significant degree of force.
- A chop wound is best considered a combination of blunt and sharp force injury.
- **Weapons used:** axe, and meat cleavers.
- Presence of an incised wound on the skin with an underlying comminuted fracture or deep groove in the bone indicates wounds caused by such weapons.
- Margins are sharp, and may show abrasion, bruising and some laceration with severe injury to the underlying organs.

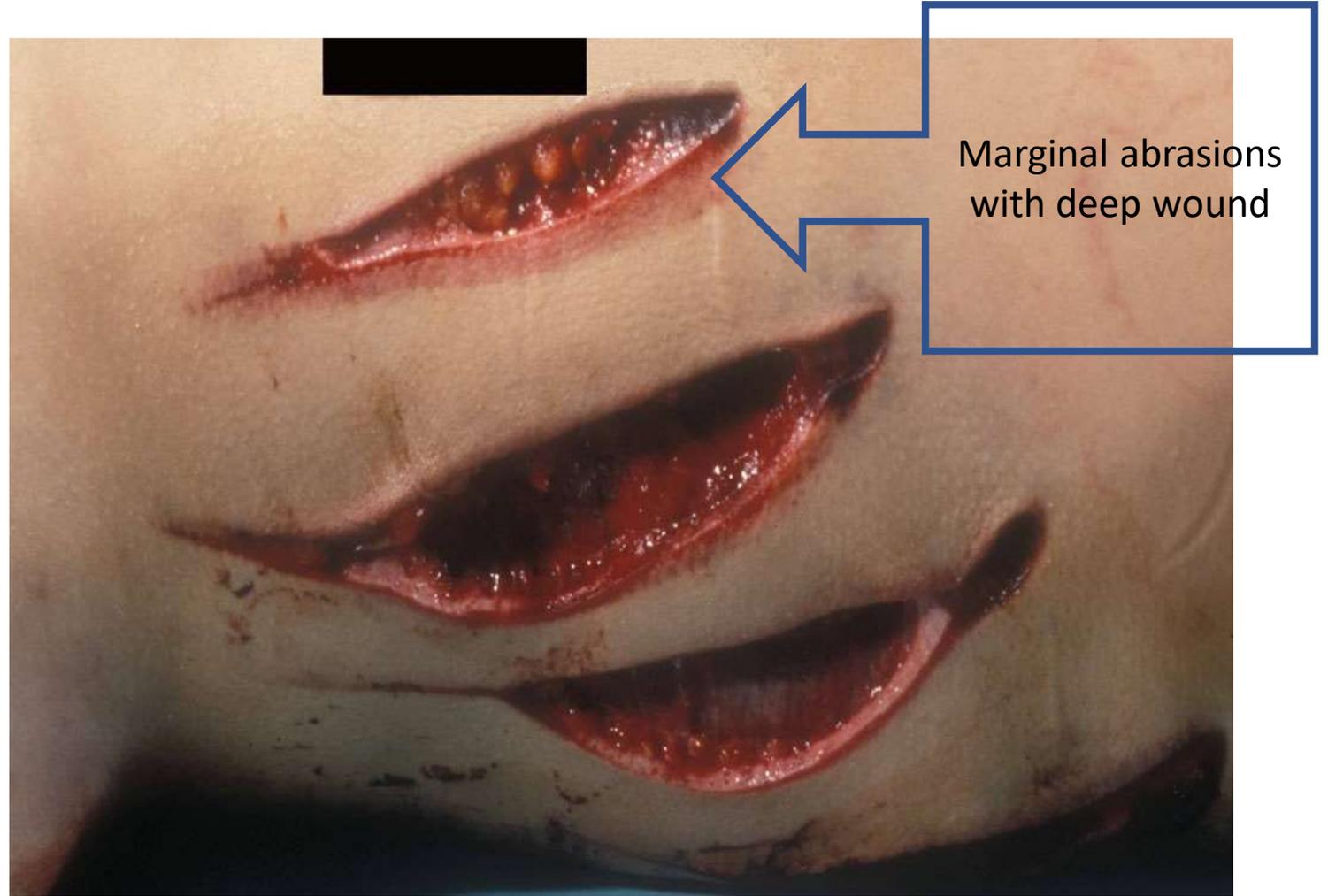
e. Cut laceration

Deep, fracture, can cause
some bruises because it is
heavy.

Heavy sharp tool



Cut laceration



Sharp force injury

Single blade or double blade



Sharp object could be drawing against the skin or thrusting inside.

Incised wound

جرح قطعي

Definition: These are caused by drawing the edge of sharp instrument along the surface of the skin



Easy 

<i>Item</i>	Incised (cut) wounds	Contused (lacerated wounds)
1- Definition	These are caused by drawing the edge of sharp instrument along the surface of the skin	These are due to blow with a heavy blunt object.e.g Stick, big Stone, fall From height
2- causal instrument	sharply edged	Heavy blunt instrument
3- Characters		
a) Edges	Regular Except if skin is corrugated or broken glass	Irregular
b) Bridges of tissues	No Bridges	Present
c) Gaping of edges	Wide	Less due to Bridging of tissues
d) Abrasions & Bruises at edges	Absent	Present
e) Tip of hair	Sharply cut	Crushed cut
*f) Bleeding 	Profuse <u>external</u> Bleeding (vessels are cut)	Less bleeding (vessels are crushed &sealed) (<i>internal</i>)
g) Sepsis	Less sepsis (minimal tissue destruction)	More sepsis (severe tissue destruction)
h) Healing	Rapid with a thin linear scar (1ry intention)	Delayed with thick scar (2ry intention)

Cut wound



Cut wound

• More bleeding

- regular
- 2 angles
- No abrasions or bruises
- Length $>$ depth

to differentiate
between cut & stab
wounds.



Cut throat



Cut throat



- resistance by --
- instrument may be irregular.
- Cut wound may appear irregular in sites with corrugated skin (neck, axilla...)



1- Stab wounds جروح طعنية :

These are caused by forcing sharp pointed instruments into the body in **stabbing manner** e.g a knife or a dagger.

Depth > length

↳ internal bleeding

**Instruments
used
in
puncture wound**

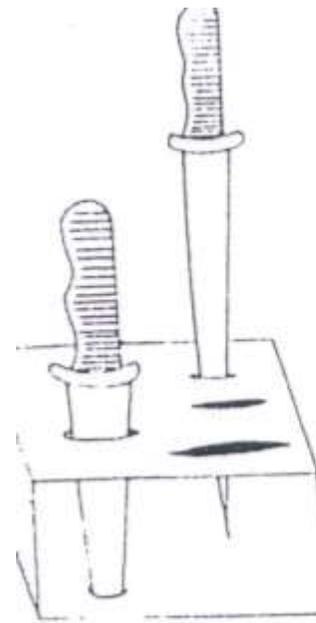


Characters of Stab Wound:

1. Is usually deeper than long.
2. Its depth being usually relative to the length of the blade.
3. The width is also relative to the breadth of the blade, sometimes the wound may be enlarged on withdrawing the instrument.
4. The edges are cleanly cut without surrounding abrasions or contusions except in punctured wounds and those produced by the handle of the knife.

5. The shape of the wound is related to the shape of the causal instrument.

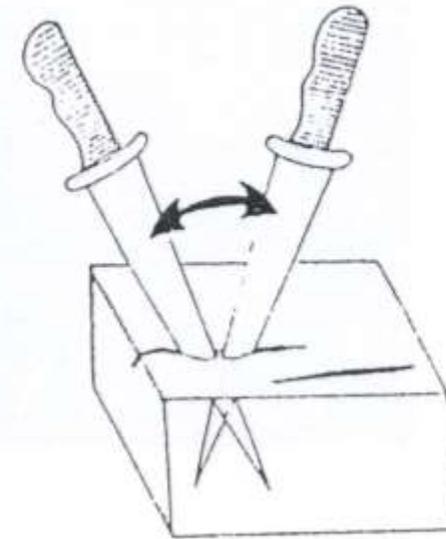
- Bipladed knife → Two-pointed sharp angle
- Monobladed knife → One end is sharp pointed, the other is transverse.



Wound size depends on penetration



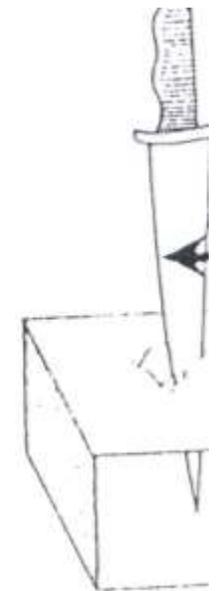
Double-edged knife wound



Rocked long wound



Single edge
(sharp from one side)



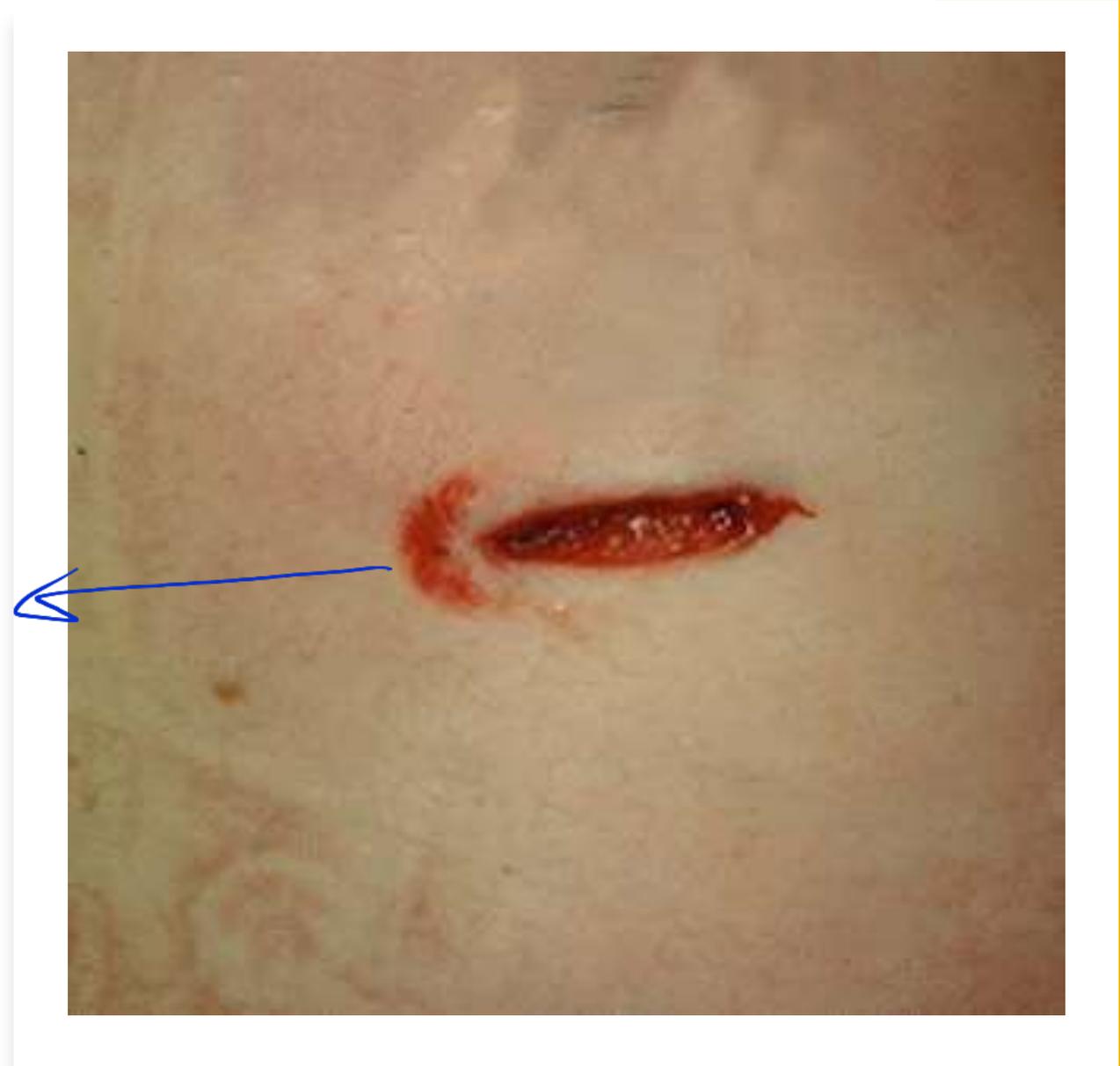
Twisted



Torn skin at blunt edge

Stab with
abrasion
And contusion
Around ?

*bruising caused
by handle*

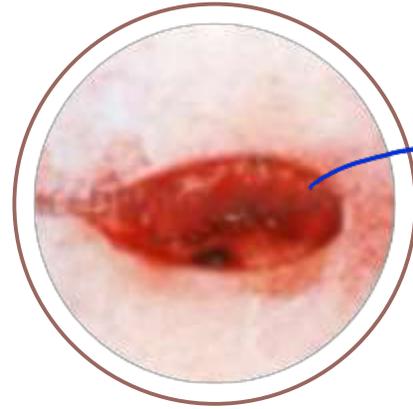




Multiple stab wound



**Multiple stab
wound**



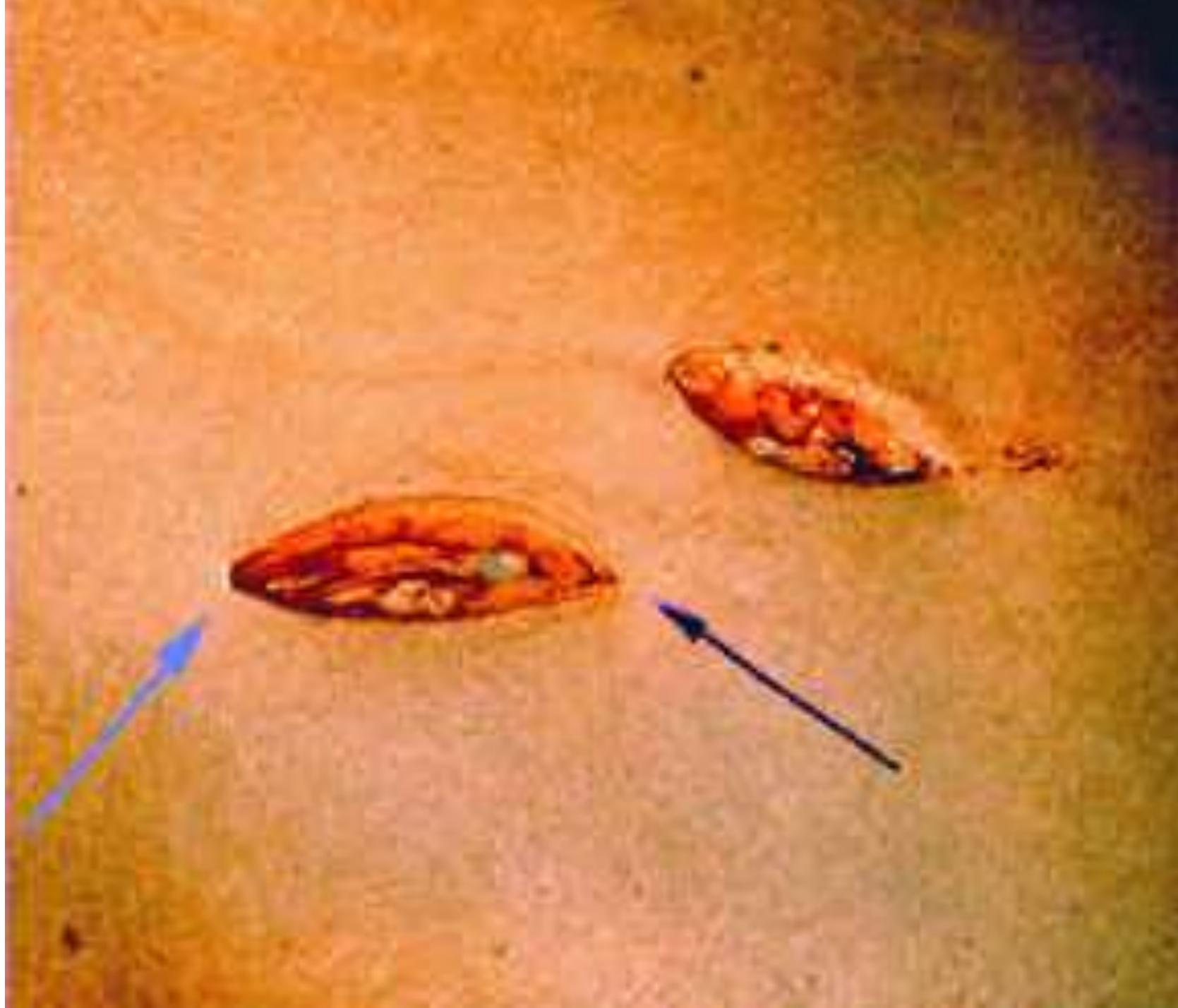
single sided blade

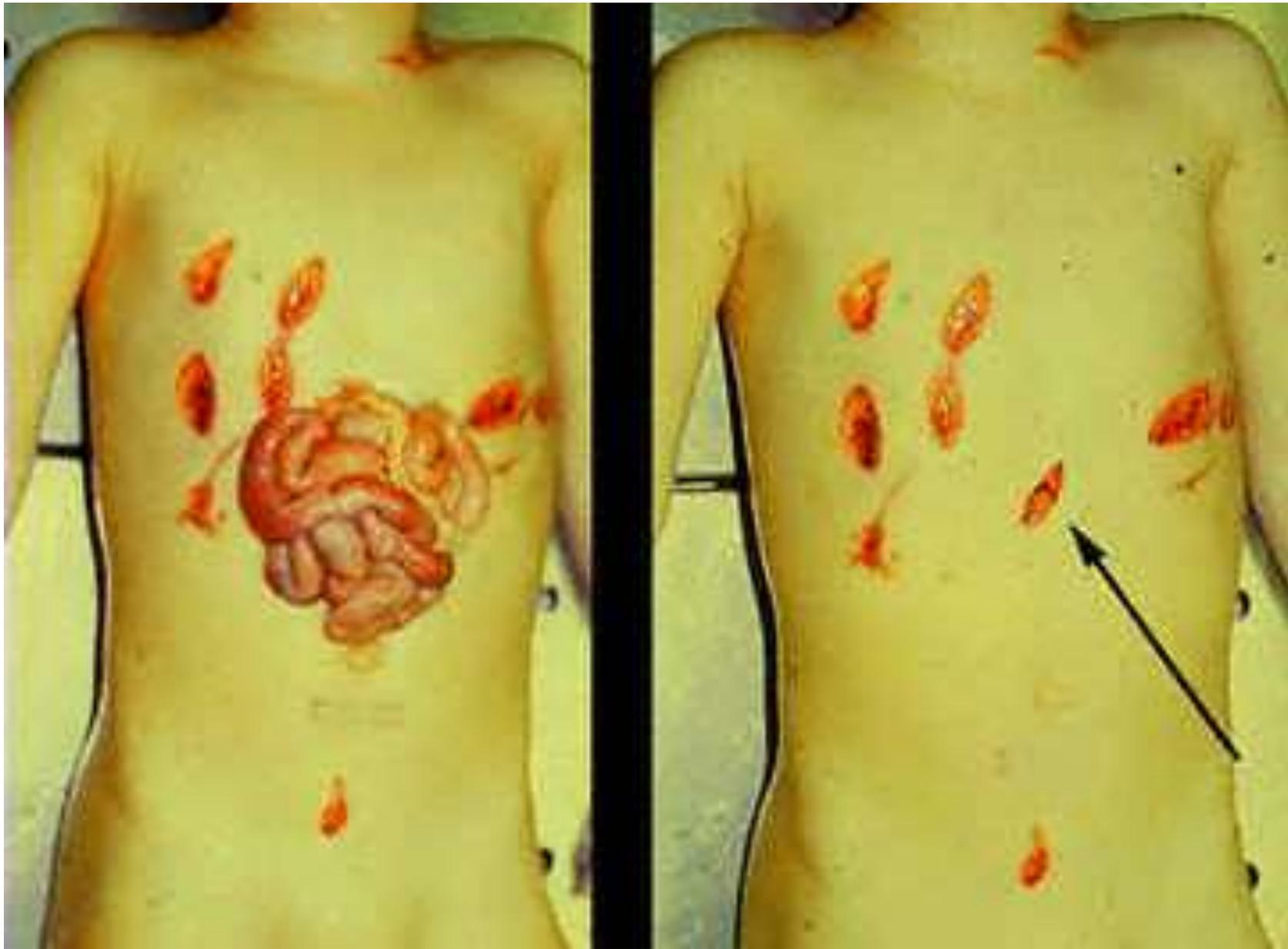
Stab wound

Stab wound

should be distinguished from cut







Stab wound



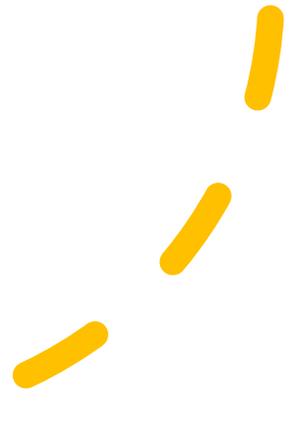
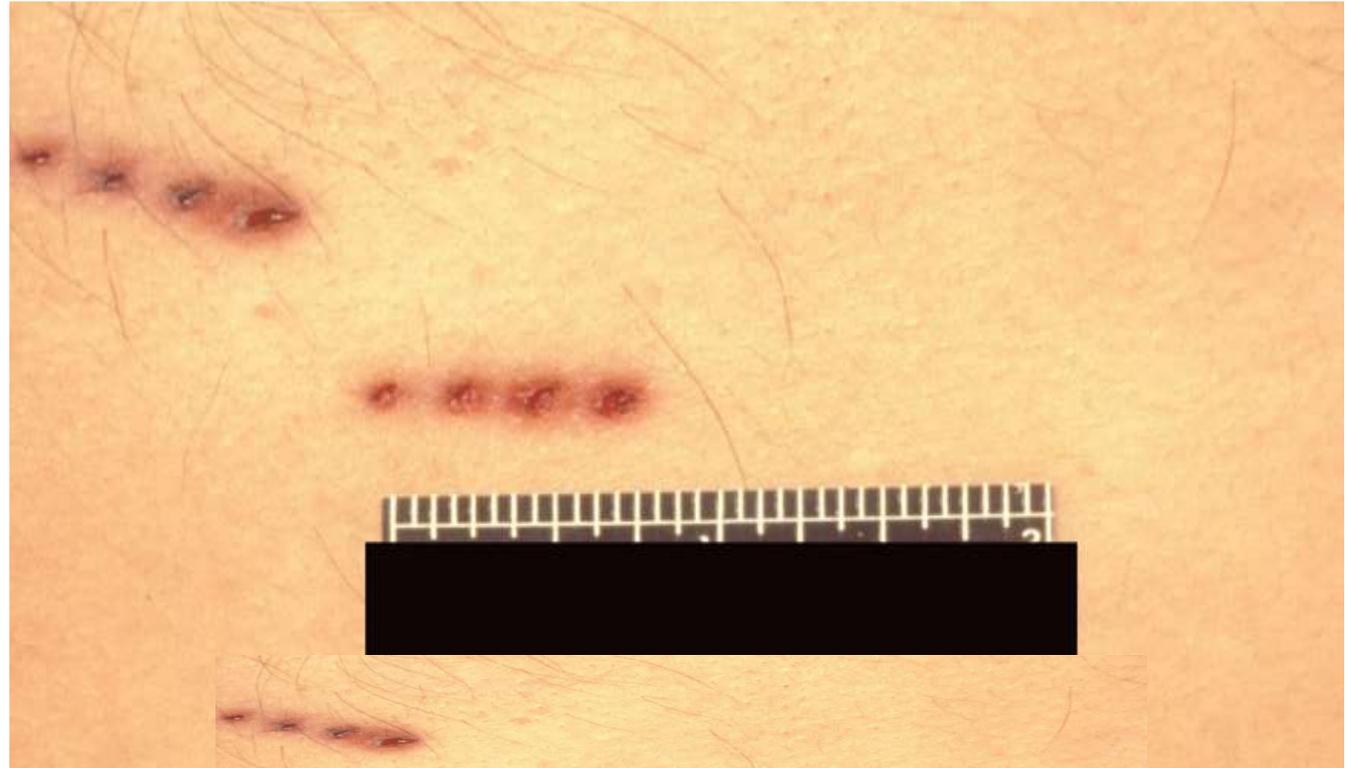
Stab wound subtypes

- **Punctured Wound:** (Pointed object with a blunt edge)
Caused by thrusting an instrument with a blunt edge and pointed end e.g. nail, *pen*
-
- **Penetrating Wound:** These are stab or punctured wounds reaching a body cavity e.g. chest (pleura, pericardium), abdomen (peritoneum), joint cavity.
- **Transfixing Wound = Perforating Wound:** These are stab or punctured wounds transfixing a limb or even the whole body.
→ when tool penetrate one side & exit from the other one.

Puncture
wound caused
by screwdrivers



Puncture
wound
caused by
fork



Parallel hesitation
(tentative) wounds on
the
wrists of an individual
who eventually
stabbed herself in the
heart

→ cut wounds

Hesitation can cause multiple cut wounds



Multiple self-inflicted incised wounds of the wrist with superficial hesitation wounds



patterned wounds

- A patterned abrasion produced when the decedent sustained a blunt impact. Note that the pattern on the skin mimics that of the weave pattern of the clothing



- Numerous patterned injuries produced by an electrical cord “loop” that was used as a “whip.” Notice that some of the marks have a “tram-track” appearance



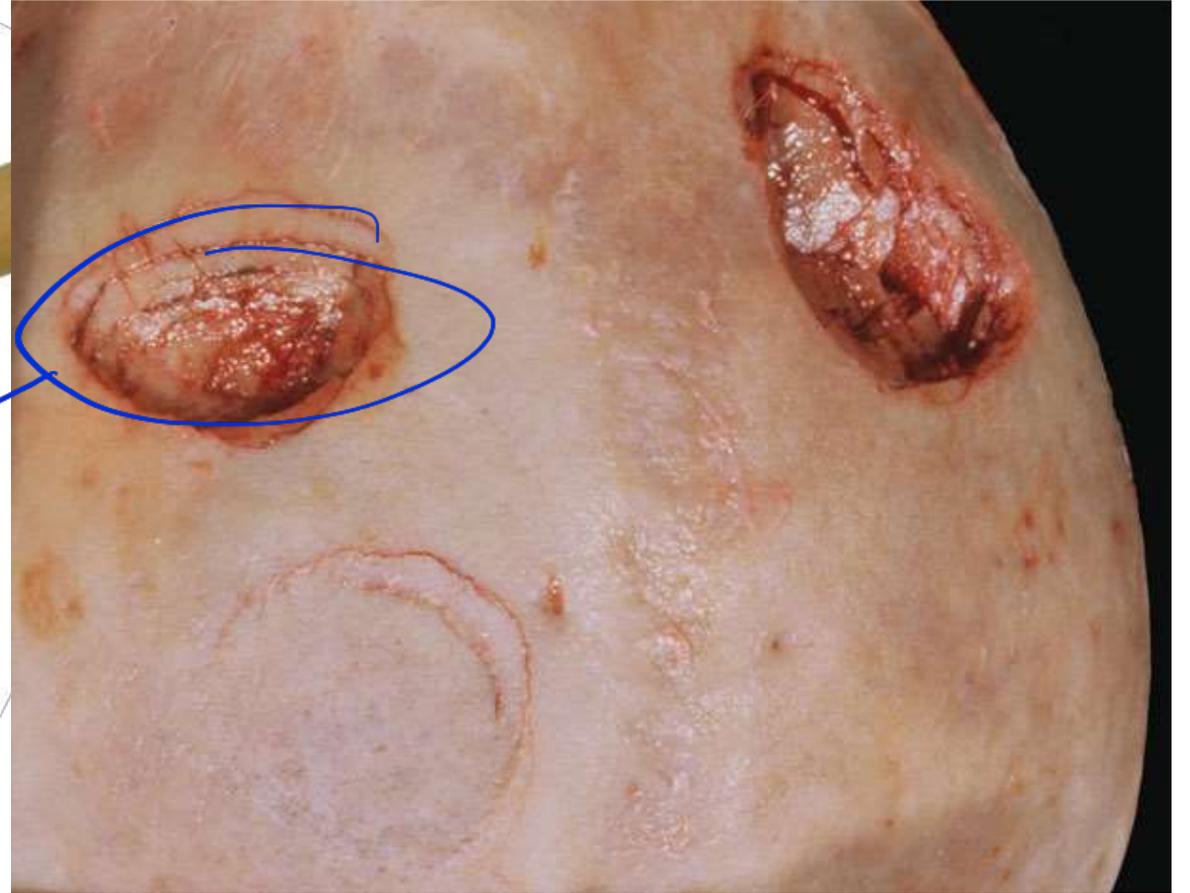
- Another case with multiple hammer strikes. The two injuries shown were produced by the round end of a hammer, the dimensions of which matched the circular abrasion around the lacerations



Patterned depressed skull fractures produced by hammer blows



depressed ←



- A **patterned abrasion** produced by the zipper of a jacket. The decedent was forcibly struck in the chest by a tool that was flying as a result of an industrial site explosion

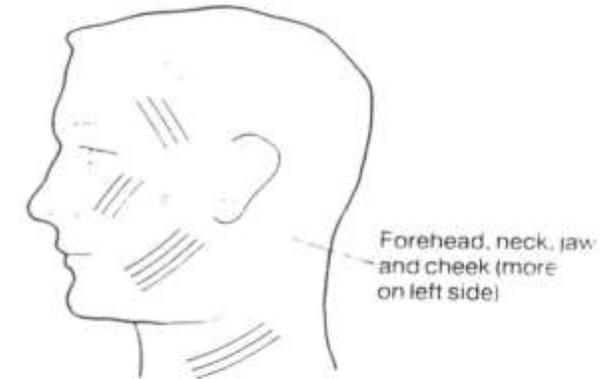
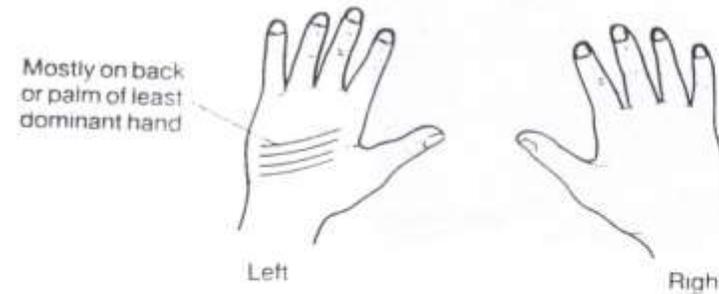
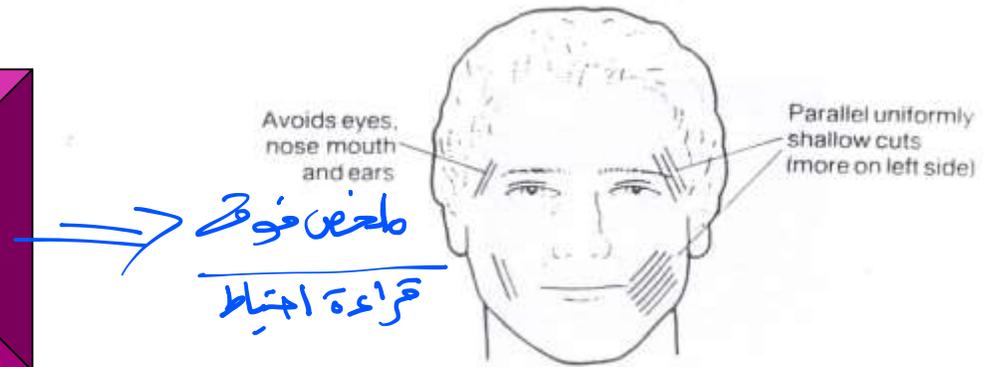


- A **patterned injury** produced by a driver-side **seat-belt** shoulder strap (in a left hand-drive vehicle)



Fabricated wounds

Definition: fabricated wounds are self-inflicted wounds made to establish a false charge of attempted murder or unlawful wounding



Characteristics of non-fatal self-inflicted injuries

Characters of fabricated wounds:

- Usually in the form superficial incisions or linear abrasions.
- Trivial nature, superficial, parallel, and within the reach of fabricator hand e.g. on the face on the front of the trunk, on the arm, on the fronts of the legs but if the wound is done by the help of another person, it may be in an unexpected parts of the body e.g. in the back. *→ at the reach of dominant hand.*
- They are usually present in safe part of the body. *→ away from vital organs.*
- The wounds usually have the same depth through out its length
- The skin is usually bared, so that no corresponding tear or bloodstains are found in the clothes.

Abrasion

Self-inflicted incised wounds are often multiple and superficial in accessible sites such as the arms, wrists, thighs, and ankles. Sensitive areas such as the nipples, ear lobes, genitals, and eyelids tend to be avoided. The lesions are often of uniform depth, parallel or at right angles to each other in a “chessboard” pattern. They also tend to be symmetrical in contrast to the irregular asymmetric incised wounds that typify a knife attack. Clothing has often been lifted and typical defense wounds are lacking.

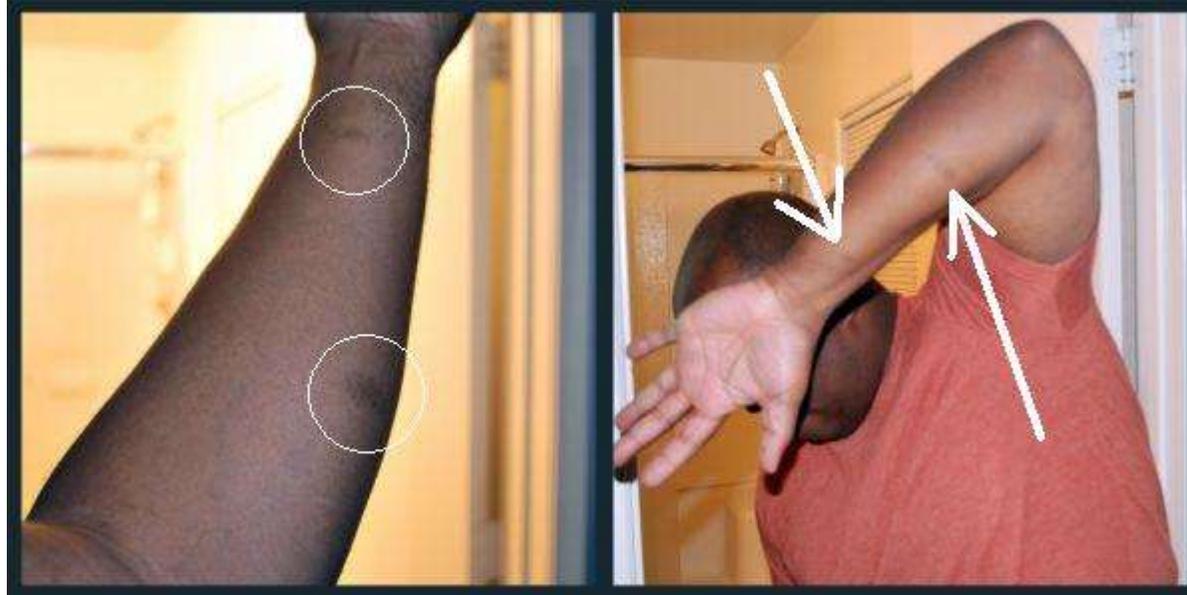


Defense wounds

- - The victim does it as a result of immediate and intensive reaction to save himself.
- A victim lying on the ground curls up to protect the face and the front of the trunk so that other surfaces of the limbs are liable to defensive bruising.



DEFENSIVE WOUND







Defense wound

Cuts

Cuts



Danger, complications, causes of death in wounds

I. TRAUMATIC SHOCK

A. Primary or neurogenic shock: This includes

i. Death from reflex vagal inhibition of the heart i.e. parasympathetic stimulation → slowing of the heart → instantaneous death.

ii. Death from sympathetic stimulation of the cardiovascular system (sympathetic shock) → associated with preexisting pathology in the heart.
 → Common than parasymp

B. Secondary or hematogenic shock = Surgical shock

It is of gradual onset, there is reduction of the total circulating blood volume due to local loss of fluids (blood, plasma) at the site of injury with capillary dilatation due to absorption of histamine like substance liberated from the injured tissues.

- (increased capillary permeability due to profuse vasodilation)

II. HEMORRHAGE

• Insidious internal bleeding is more dangerous than external bleed which can be noticed easily.

Loss of blood is the commonest cause of death in wounds e.g. stab or incised wounds and especially if it results from injury of an artery. Symptoms from hemorrhage start to appear if the person loses one liter of blood and grave danger occur if he loses 2 liters or one third of the total blood volume, this is termed external hemorrhage.

Types of hemorrhage

1. **Primary hemorrhage**: follow immediately after injury.
2. **Reactionary hemorrhage** is usually delayed for several hours up to 24 hours after injury.
3. **Secondary hemorrhage** is due to infection of a wound; it occurs between 10-16 days after injury.

→ 2nd skip

Postmortem picture of death from hemorrhage

- Pale
- Ill-defined or absent hypostasis.

Externally:

→ can be fatal when a person loses 1/3 of their whole blood volume.

- Large amount of blood at the scene and on the clothes (may be inside a body cavity), also a wound is present.
- The body looks pale.
- Post mortem hypostasis is ill defined or even absent.

Internally:

→ variable amounts is need to cause a dangerous states but much less than external bleeding.

- Pallor of organs (heart, lungs, brain).
- Heart and big vessels are empty of blood.
- Petechial hemorrhages under serous coats especially the endocardium (subendocardial petechial hemorrhages).
- Spleen is contracted.

- Wound infection may be caused by organisms which are normally present on the body surfaces or by organisms which invade the tissues from the environment.

Infection of the wounds may be:

1. **Primary** is caused by organisms which are carried into the wound **at the time of the injury** e.g. from the skin, clothing or street dirt (tetanus). Primary infection often **cannot be avoided**.
2. **Secondary** is caused by organisms which invade the wound **after the injury** e.g. by air droplet infection, contaminated dressing . It can be **prevented** by adequate aseptic surgical measures.

III. INFECTION OF THE WOUND

*(more in contused
wounds)*



IV. EMBOLISM

	Venous air embolism	Arterial air embolism
Incidence	Common	Less common
causes	<ul style="list-style-type: none"> * Open injuries (neck, chest) * During blood transfusion * Others: criminal abortion, insufflation. 	Stab in chest communicating a bronchus with pulmonary vein
P.M. picture	Puncture of <u>right ventricle</u> under water → air comes out	Puncture of <u>Lt. ventricle</u> under water → air comes out. beaded coronary & cerebral arteries.

A. Air embolism

- The minimum amount of air to cause air embolism is 60 ml.

more common in venous side

B. Pulmonary embolism due to deep vein thrombosis:

Injury to the veins of a limb leads to deep vein thrombosis, the effects of pulmonary embolism depend upon the size of the emboli released from the venous thrombus. When a large branch of one of the pulmonary arteries is obstructed, an infarct may develop in the lung.



C. Fat embolism

It is due to obstruction to the flow of blood through the capillaries by fat globules. It usually occurs after

1. fractures involving long bones i.e. bones containing marrow fat, but it may follow severe injury.
2. burn to fatty tissues in any part of the body.