Forensics

Wounds

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Introduction > **Definitions**

Injury: 3 components

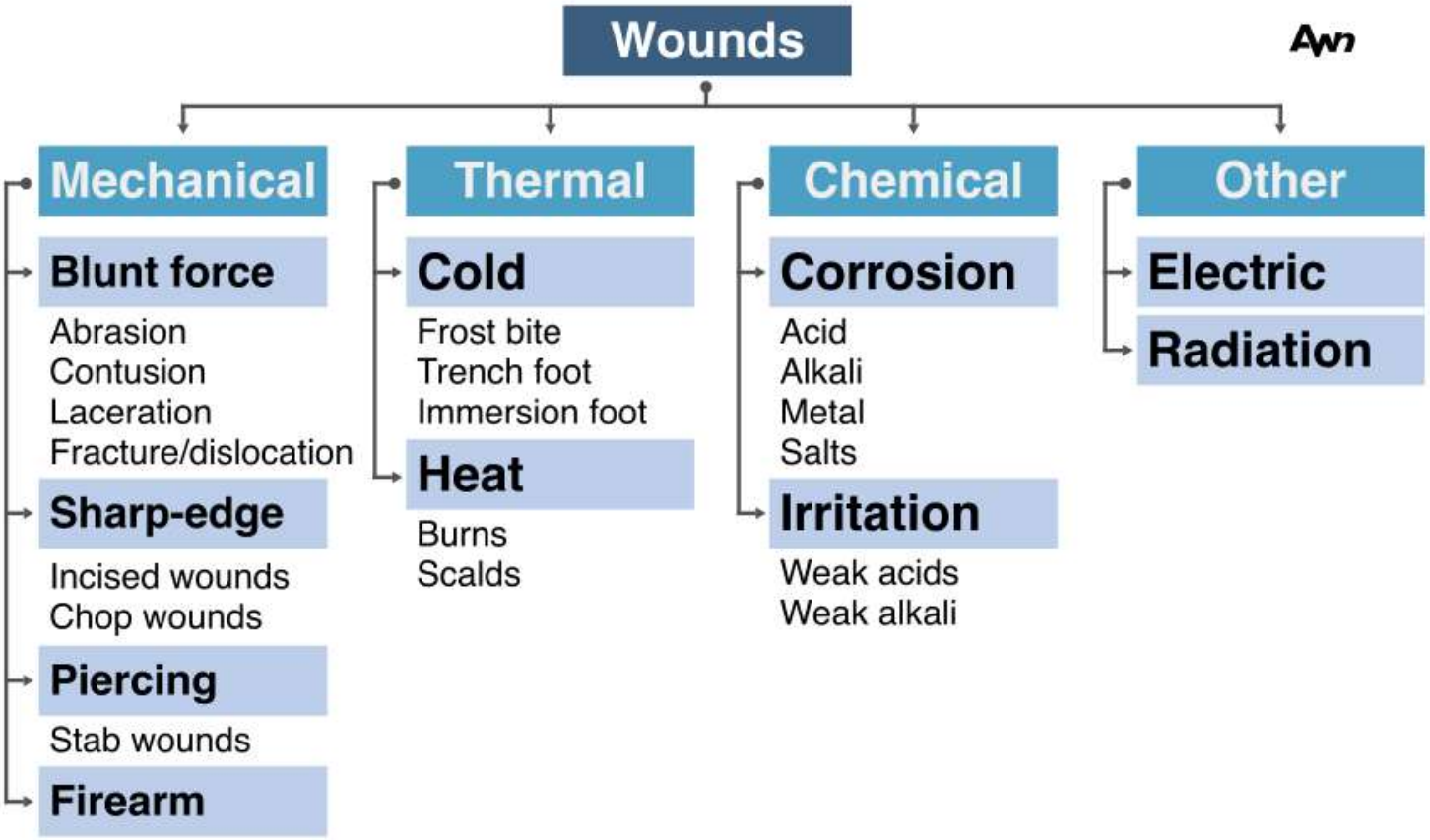
(i) **illegal** (ii) harm to a (iii) person (**body**, **mind**, reputation, or property).

Wound:

a **body injury** to skin/mucous membrane

Where there is disruption of the natural continuity of the tissues.

Introduction > **Classification (Causative Force)**

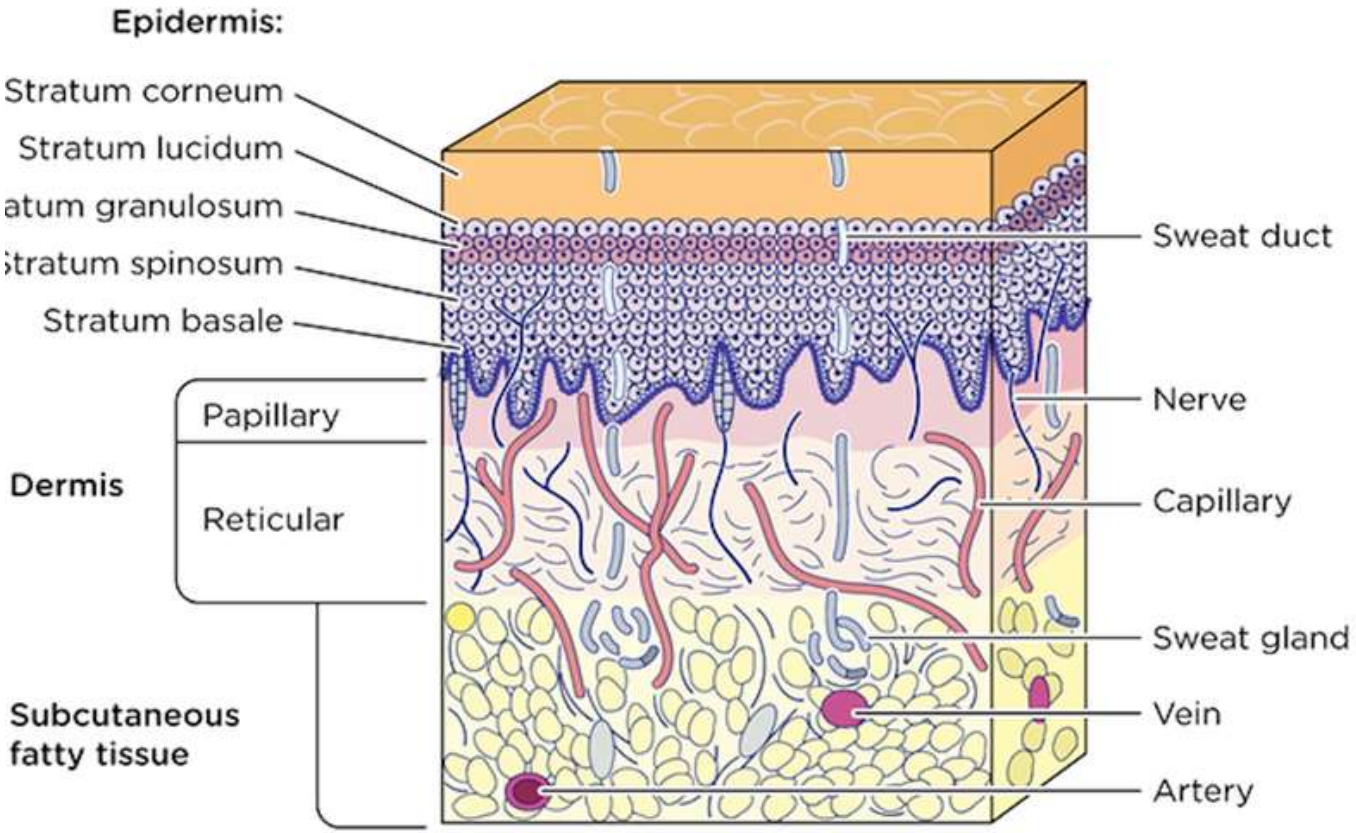


Introduction > **Classification (Legality)**

Medicolegal	**Intentional**	Suicidal injury Homicidal injury
	Non-intentional	Accidental injury Defence wounds
		Fabricated wounds
Legal	**Simple wounds**	heal in less than 20 days leaving no **permanent infirmity**
	Dangerous wounds	heal in more than 20 days or leave **permanent infirmity**
	Fatal wounds	leads to death

Permanent Infirmity: Loss of a functioning organ.

Skin Anatomy



Weight = 4 kg | Surface area = 2 m^2
Layers : (i) Epidermis (ii) Dermis (iii) Hypodermis
Stratum corneum varies greatly in thickness.
Thick on sole and palm, *thin* in scrotum and eyelids.

Biophysics of Wound

The human body absorbs mechanical forces by (i) **elasticity** of the soft tissues or (ii) rigidity of its skeletal framework.

Elasticity : tendency of stressed material to regain its unstressed condition

Injury (wound) occurs when energy applied exceeds the elastic limits of the tissue.

It's produced mechanically by physical contact between the object and the body either: a moving object strikes the body or the moving body strikes against a stationary object.
But usually a combination of both forces are involved.

The human body is made up of different complex tissues. Therefore, any force applied to the body will not effect all tissues in the same way.

Forces acting over body

1) **Tensile force -traction strain-**

Leads to pulling a body apart if sufficient, may cause separation of body into parts.

2) **Compressive force –compression strain-**

Pushes body together and if sufficient, the body may break into pieces.

3) **Shearing force -shear strain-**

Sliding of one part of body over an immediate adjacent part(tangential force).

There is a great variation in resistance of the different body tissues to the tensile force, rupture of tissues occurs when extensibility is exceeded.

For example, bone is a rigid tissue and resist deformation but when its limit of elasticity is exceeded then fracture results. The soft tissues are soft, plastic and pliable. They will rupture when they are stretched beyond the limits of their tensile strength..

Factors influencing for causation of wounds

1. Nature of Object/ Weapon
2. Energy Discharge Amount During Impact
3. Energy Discharge Conditions
4. Nature of Tissue Affected

1. Nature of Object/ Weapon

$$\text{Pressure(Pa)} = \text{Force(N)} \times \textbf{area}\ (\text{m}^2)$$

- If weapon used is sharp, the force is concentrated over the small area of strike resulting in deep penetration injury.
- The force acting from blow by broad/blunt surface of weapon will be dissipated over larger area of body with less damage.
- A **rigid** weapon will produce more damage than a plastic or flexible one.
- If the weapon breaks on striking the body, much of kinetic energy is lost, less damage.

Factors influencing for causation of wounds

2. Energy Discharge Amount During Impact

$$\text{Kinetic Energy(J)} = \frac{1}{2}\,\textbf{mass}\text{(kg)} \times \textbf{velocity}^2\text{(m/s)}$$

3. Energy Discharge Conditions

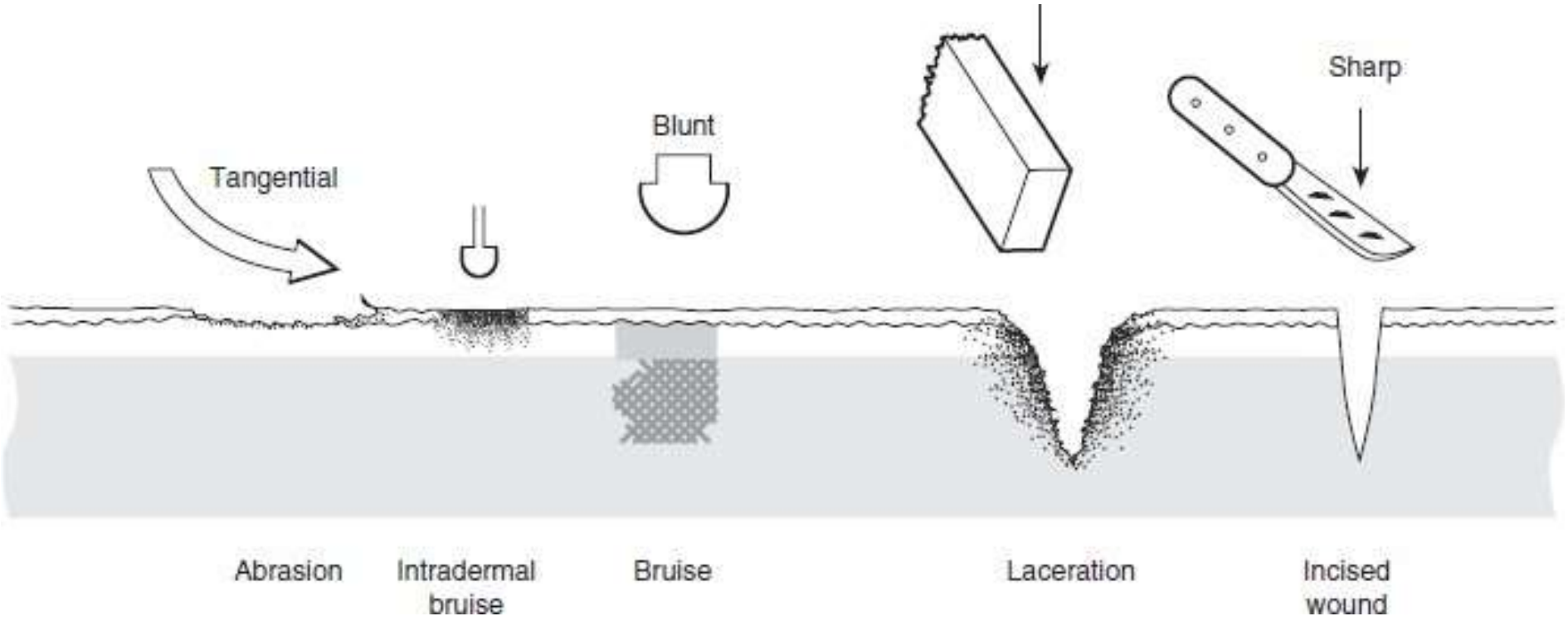
- Falling vs not?
- Similarly, if time period of discharge from impact is increased, the destructive effect on the target gets decreased.

Factors influencing for causation of wounds

4. Nature of Tissue Affected

Skin	Blunt weapon = flattened or elongated cells but not damaged. Crushed against bone = skin will readily split.
Subcutaneous Tissue	Is plastic and pliable.
Muscles	Elastic and plastic.
Body Fluids & Gases	Fluid can be easily displaced but cannot be compressed or reduced in size whereas gases can be compressed easily.
Bone	Rigid and elastic.

Mechanical Injury



Abrasion

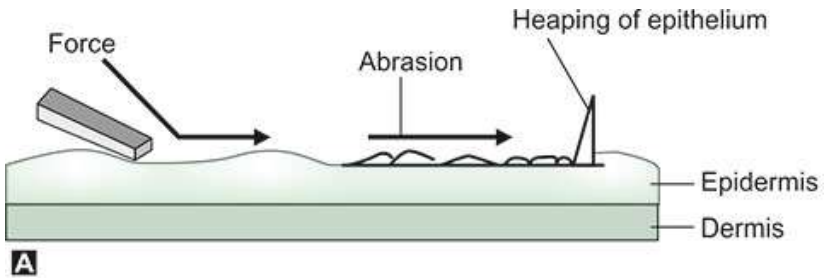
- Definition :

A type of mechanical injury characterized by removal of superficial skin layers (**Epidermis** +- Papillary dermis)

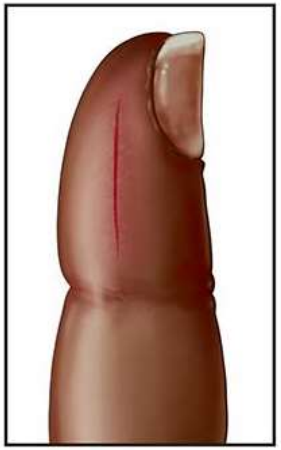
Abrasion > **Classification**

Abrasions

Tangential Force

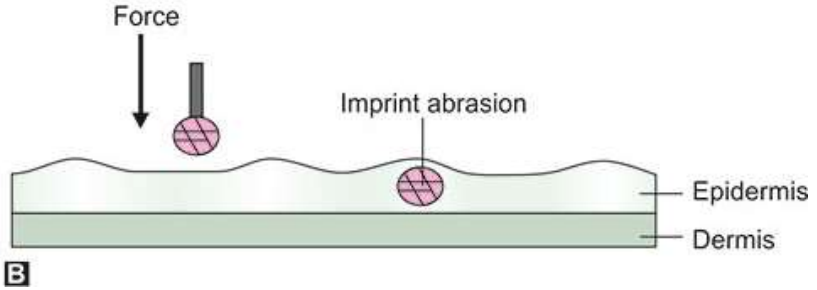


Linear



Graze

Compression Force



Imprint

Pressure

Abrasion > **Healing**

Image of a Scab

Age	Feature
Fresh	**Reddish**, no scab
12-24 hours	**Dark red scab**
1-2 days	**Reddish brown** scab
3-5 days	**Dark brown** scab
5-7 days	**Blackish** scab shrinks and falling begins from margin
7-10 days	Scab falls off, leaving **hypopigmented** area

Abrasion > **Differential Diagnosis**

Abrasions may be confused with :

1. Postmortem abrasions
2. Excoriation of skin by excreta
3. Pressure sore/bed sore
4. Ant bites

Abrasion > Differential Diagnosis > 1. **Postmortem**

Image of a parchment

Postmortem abrasion: These are the abrasions produced after death. These abrasions are pale white in color and dry.

	Antemortem abrasion	**Postmortem abrasion**
Site	Anywhere in body	Over bony prominences
Color	Bright red	Pale dry parchment like
Covering	scab composed of coagulated blood & lymph	No
Inflammation signs	Redness , vital reaction (healing & sepsis)	No
Microscopy	Congestion & vital reaction present	No

Abrasion > Differential Diagnosis > 2. **Other Abrasion Types**

- **Contused abrasion and abraded contusion :** High crushing force -> no pattern imprint -> will cause damage of capillaries in the dermis + extravasation of blood (contusion) surrounding the abrasion.
  Abraded contusion: contused area is more marked than abrasion.
  Contused abrasion: abraded area is more prominent than contusion.

- **Insect/Ant bite marks:** in post-mortem state may resemble abrasion. Ant bite marks are usually pale and are irregular in shape (map like). in moist regions of body.
- **Nappy abrasions:** These abrasions are seen in infants due to excoriation of skin at the nappy area
- **Fabricated abrasion:** These are the abrasions inflicted by a person by oneself or with the help of others, with a motive to implicate another person for false allegation of injuries.

Abrasion > **Medicolegal Importance**

1. **Site** of impact and **direction** of force
2. **Type** of weapon/object
3. **Time** of crime can be determined from the age of abrasion
4. Simple injuries unless over cornea -> corneal opacity and restrict vision.
5. Can give idea about some type of **offenses** committed.

7. Presence of foreign material along with abrasions, such as sand particles, mud, dirt, grease etc. may connect the injuries with **scene** of crime.

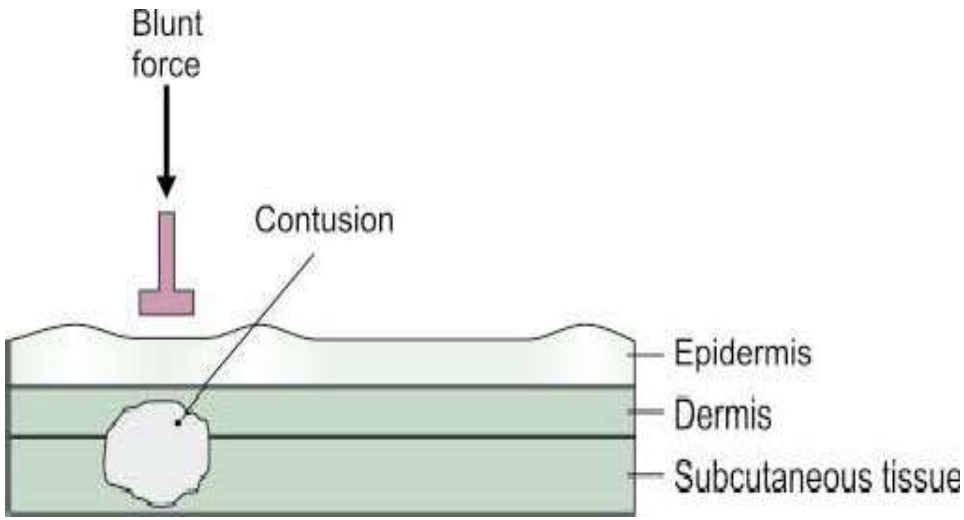
Contusion (Bruise)

Contusion: is an extravasation or collection of blood due to rupture of blood vessels caused by application of mechanical force of blunt nature without loss of continuity of tissue.

the word ‘bruise’ usually implies that the lesion is visible through the skin or present in the SC tissue,
while ‘contusion’ can be anywhere in the body such as spleen and muscles.

Contusion Mechanism

- Contusion is caused by blunt force impact causing crushing or tearing of subcutaneous tissue or dermis without breaking the overlying skin or mucous membrane.
- Due to rupture of blood vessels, there is extravasation of blood out of vessels and collected underneath the tissue.
- Collection of blood is accompanied by swelling and pain.

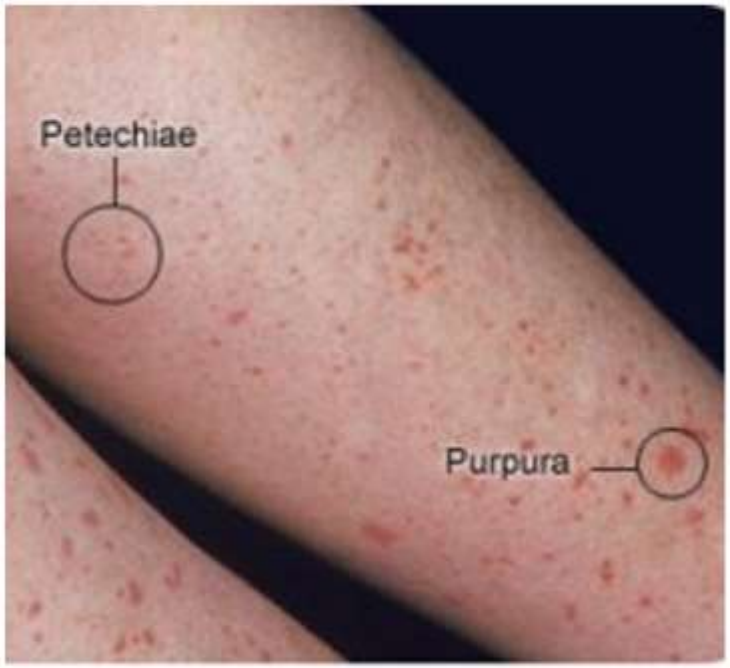


Contusions vs Petechiae vs Ecchymosis

What is ecchymosis and petechiae?

- In fact an extravasation of blood that is larger than few mm in diameter is usually termed bruise or contusion, this size overlaps the older and now little used the term ecchymosis which is really a small bruise.
- Even smaller is the petechial hemorrhage which is the size of pen-head or less, both ecchymosis and petechiae are not caused by mechanical trauma, they are caused by pathological disorder such as bleeding tendency.

Contusions vs Petechiae vs Ecchymosis



Purpura. https://www.physio-pedia.com/Purpura.
Image IQ: A 43-year-old man with a symmetrical palpable purpura rash on his legs. Dermatology Times. www.dermatologytimes.com. Published October 29, 2018.

Different Types of Bruises

- **According To Bruise Location:**
- Intradermal bruise
- Subcutaneous bruise
- Deep bruise
- Contusion over organs
- Gravitating or shifting contusion
- **According to Bruise Shape:**
- Patterned contusion
- Tram-line contusion
- Six-penny bruises
- Horse-shoe-shaped contusion
- Spectacle hematoma.

Intradermal Bruise

- In this type, the bruise is situated in the sub- epidermal
- layer of skin. Patterned bruises are often associated with intradermal bruise. Due to superficial position of these bruises and translucency of the skin that overlies these bruises, the patterned contusion becomes more prominent. The bruises are usually occurred at the point of application of force. The margins in intradermal bruises are well-defined.
- Examples – motor tyre marks, impacts from whip, impact from rubber soles of shoes.

Patterned Contusion

In these contusions the imprint or design of the Offending weapon or object is imprinted over the skin.

- If such patterned contusions are present, they provide vital information regarding the nature of the offending object or weapon.

Examples – impression of motor tire, impression of rubber sole of shoe, etc.

Subcutaneous Bruise

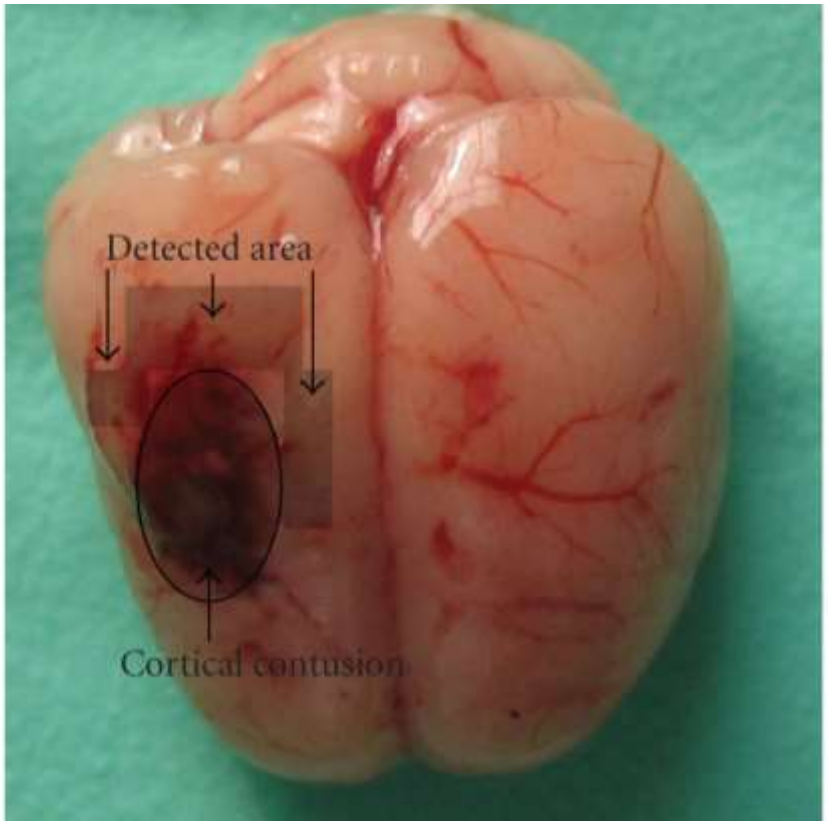
- These bruises are the commonest types and are located in the subcutaneous tissue often in the fat layer above the deep fascia and therefore are fairly visible through the skin. Such bruise is called as **superficial bruise**

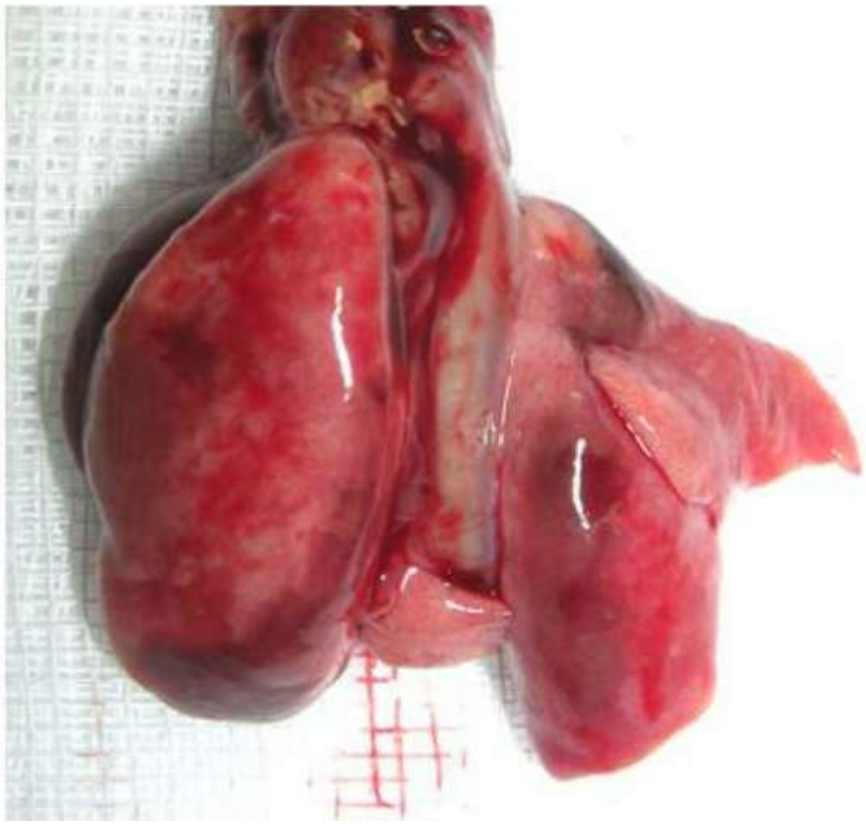
- If such bruises are located below the deep fascia, such bruises are called as **deep contusions** and these bruise take time to appear over surface. The features of these bruises are that the margins appear blurred(ill-defined) especially at the edges.

Tissue and Organ Contusion

- All organs can be contused. A contusion of the brain with bleeding into the substance of the brain, may initiate swelling with generalized accumulation of acid byproducts of metabolism that causes further swelling and impairment of brain functions. Contusion over brainstem often fatal.
- Heart is also vulnerable to contusion. A small contusion on the heart may cause serious disruption of the normal rhythm or cessation of cardiac actions by interfering with initiation and conduction of impulse responsible for heart beating. Similarly, large contusion, due to swelling and interference with muscle action, often prevent adequate cardiac emptying and lead to cardiac failure.
- Contusion of other organs may cause rupture of that organ's cellular covering with resulting bleeding, either slow or brisk into the body cavity containing that organ.

Organ Contusions





Shifting Bruise

- Bruises that appear at different site from the actual site of application of mechanical force. This sort of feature is frequently associated with deep-seated contusions.
- When the bruise is located in deep tissue then it takes time to appear at skin surface. The movement of bruise from deep-seated tissue to surface is affected by number of factors such as fascial planes, anatomical structure of that particular location and gravitational force acting.
- An example of contusion in forehead. If the victim survives for some period after sustaining bruise then the contusion in forehead can slide downwards over the eyebrow and appear as ***black eye***.

Similarly bruises situated at arm or thigh may gravitate downward to appear at lower surface at elbow or knee.

Shifting Bruise

Such shifting of bruises from the point of impact to newer area are also called as **migratory contusions** and if they appear at newer areas then such contusions are called as **ectopic contusions** or **percolated contusions**. Similarly the occurrence of bruises to come out from deep site to surface is also called as **come-out-bruise**. This phenomenon is due to hemolysis of blood. The freed hemoglobin stains the tissue more and more densely with time.

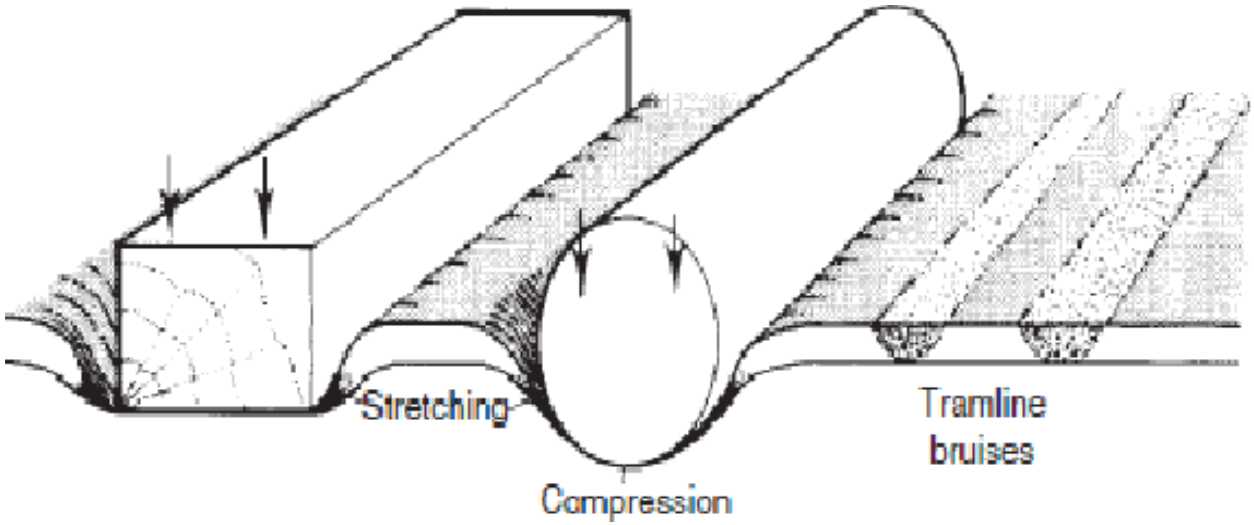
Wine Bottle and Whip Bruises

Tram-Line Contusion

Also called as rail-way contusion or tram-track contusion

- These contusions are caused by blow with rod, stick, whip or belt etc.
- The contusion is characterized by two-parallel tram-track like lines of hemorrhages with intermediary area of skin remains intact.
- Mechanism – blow with object like stick or rod over skin

causes the skin under the part of contact of weapon to get compressed. Due to compression of skin by the offending object or weapon, the blood in that part is displaced sideways causing tram-track like hemorrhages on the side of the skin.



Six-Penny Bruise

- Indicates?

Six-Penny Bruises

- These are the discoid shaped bruises of about a centimeter in diameter and resulted from fingertip pressure. These bruises are called as six-penny bruises because of the apparent resemblance with six penny.
- These bruises are usually found in neck region in case of manual strangulation. They may also be noted over the arms, forearms or wrist of children in ***child abuse*** cases caused by holding a child.

Horse-Shoe Shaped Contusion

Spectacle Hematoma

- Spectacle Hematomas can be caused by eye trauma, basal skull fractures, or systemic disorders like amyloidosis and neuroblastoma.

In what conditions are bruises more likely to develop?

- Ideas?

Factors Affecting Contusions

1. Condition of tissue – contusion results from extravasation of blood in the surrounding tissue. To accommodate this extravasated blood, space should be present in the tissue. In lax tissue, comparatively more space is available and therefore bruising occurs with ease in lax tissue such as eye socket or scrotum, whereas it is rare in dense tissue such as sole of foot or palm of hand. Similarly, in fat people, there is greater volume of fat and therefore they are more susceptible for easy bruising than the thin people.

2. Body part – apperance of contusion depends on the body part affected by the impact. yielding areas such as abdominal wall or buttock will bruise lesser than rigid surface such as head, chest or shin.

3. Situation of bruise – contusions located in dermis or in subcutaneous tissue above deep fascia are fairly visible whereas bruises situated in deeper tissues are non visible and we should dissect to view them.

Factors Affecting Contusions

4. **Condition of blood vessels** – the amount of blood extravasated in the surrounding area depends upon the state of blood vessels and coagulability of blood. In older individuals, the vessels being more fragile bruises easily and heavily even with minimal trauma.

5. **Presence of disease** – concomitant presence of any disease such as bleeding diathesis, scurvy, liver disorder, arteriosclerosis, purpura, leukemia, hemophilia, vitamin C and K deficiency, chronic alcoholic or certain medications such as aspirin will lead to bruising easily in comparison with normal people.

Factors Affecting Contusions

6. **Sex** – women will bruise easily in comparison with male because of presence of abundant subcutaneous fat and delicate tissues.

7. **Age** – older individuals' bruises easily – *vide supra*. Children tend to bruise more easily than adult because of softer tissue composition and less volume of protecting tissue.

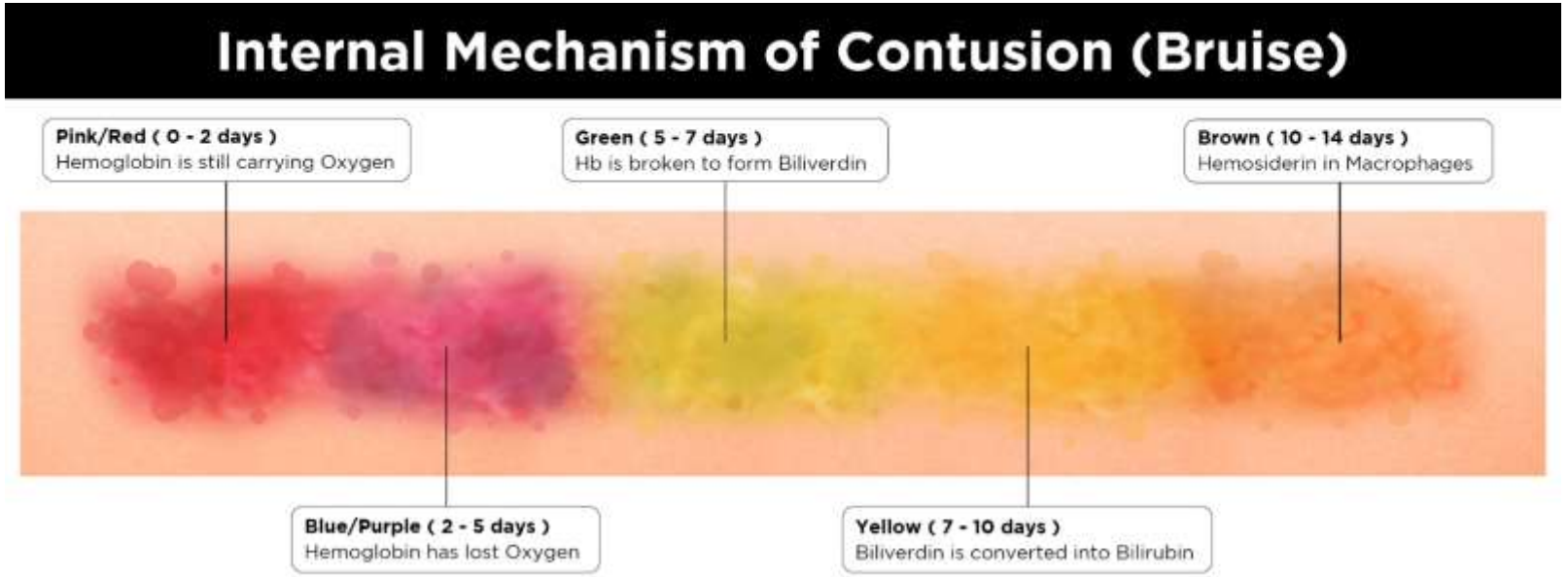
8. **Color of skin** – bruising is more apparent and easily visible in fair skin person than dark complexion persons.

Factors Affecting Contusions

9. **Optical character of skin** – bruises localized near the surface have more reddish appearance while bruises in deeper layer (subcutaneous) give a more bluish color impression. This is because of optical characteristics of skin. Blood localized in the subcutaneous tissue appears blue on the surface due to scattering processes in the dermis (**Rayleigh scattering**) as the blue wavelengths of

light are scattered (and thus reflected) to a greater extent than the red wavelengths.

Aging of a Bruise



Large Bruises?

Repair and Healing

- With advancement in the age of bruise, the blood collected in contusion will begin to disintegrate causing hemolysis.
- The process of hemolysis liberates hemoglobin.
  The freed hemoglobin is broken down into hemosiderin → biliverdin → bilirubin or hematoidin by tissue enzymes and histiocytes.
- With breakdown of hemoglobin and formation of these pigments, certain colours changes can be visualized by naked eye examination.
- These colour changes are utilized to estimate the age of bruises.
- The time taken for a bruise to disappear will depend on its size.

  In larger extravasation – the changes usually begin at the margin and

  takes longer time to be absorbed than smaller contusions.

Age of Contusion

- There is temporal series of changes occurring in contusion in living person.

Age	Changes	Caused by
Fresh	Red	Fresh exravasation of blood
1-3 days	Bluish	Deoxyhemoglobin
4 days	Bluish black to brown	Hemosiderin pigment
5-6 days	Greenish	Hematoidin pigments
7-12 days	Yellow	Billirubin pigments
2 week	Complete disappearance of contusion	

Pay Attention

It is not practical to construct an accurate time according to colour changes, as was done before, as there are too many variables for this to be reliable.

These include:

- The size of the extravasation – changes begin at the margin and a larger bruise will take a longer time to be absorbed. A large old bruise may contain all the colours possible – from purple in the center to yellow at the edges.
- The age and constitution of the victim. Aged persons may not heal their bruises at all and carry them for the remainder of their lives.
- A personal idiosyncrasy in the rapidity with which such changes occur in any one person, including coagulation defects.

Ante- vs Post-mortem contusion

- It is stated that with greater degree of application of mechanical force in immediate postmortem period results in contusion.
  - In such cases, the hemorrhage is little and scarce and these contusions are easily differentiated from antemortem bruises.

	Ante-mortem Contusion	**Post-mortem Contusion**
Swelling	Present	Absent
Blood Extravasation	Present	Minimal
Inflammation Signs	Present	Absent
Hemorrhage	Considerable	Insignificant

Bruise Value

Bruises have less value than abrasion because:

- The size may not correspond with the size of offending weapon.
- The bruise may visible immediately or may be delayed in appearance.
- The bruise may shift from the actual site of assault to other site as ectopic contusion.
- The contusions do not indicate the direction of the force applied.

Complications

1. If inflicted on vital parts (e.g. neck, heart), the contusions may cause death
2. Multiple contusions may cause death by shock and hemorrhage
3. The contusions are painful lesions
4. Multiple contusions of intestine may cause ischemia or gangrene
5. The collected blood in contusion may act as a suitable media for proliferation and multiplication of bacteria
6. Pulmonary fat embolism – due to fat expressed from fat cells and then liquid fat entering the injured and torn blood vessel may lead to pulmonary fat embolism.

Differential Diagnosis

The bruise may be confused with

1. Postmortem lividity
2. Congestion
3. Artificial bruise
4. Purpura – bruising need to be differentiated from purpura. Purpura develops spontaneously in those persons with a hemorrhagic tendency.

Artificial Bruises

- Artificial bruises are produced due to application of some irritant substance or juice to the skin. Such irritant substance produces inflammation and vesication simulating bruises.
- These contusions are produced with intention to make false allegations against somebody or to implicate someone else.

Causes of artificial bruises:

- Marking nut
- Calatropis
- Plumbago rosea
- Plumbago zeylanica

Contusions vs Postmortem Lividity, Which Mortis?

	Contusion	Postmortem lividity
Cause	Rupture of vessels with extravasation of blood due to application of mechanical force	Due to stasis of blood in vessels
Site	Any site	Only on dependent part
Surface	Elevated due to swelling	Not elevated
Swelling	Present	Absent
Color	Variable, depends on the age of contusion	Usually purplish blue
Edges	Ill defined	Well defined
Incision	Show extravasation of blood in the surrounding tissue & can't be washed off	Shows blood in vessels & can be washed off
Microscopy	Signs of inflammation	No signs of Inflammation

Contusion vs Congestion

	Contusion	Congestion
Cause	Blunt mechanical force	Pathological
Color	Variable, depends on the age of contusion	No change of color
Margins	Diffuse and ill defined	Well defined
On Dissection	Extravasation of blood	Engorged vessels with blood

Medicolegal Importance: Contusions

- Offending weapon might be known.
- Character and manner of injury might be known.
- Application of degree of violence can be estimated.
- A bruise is usually simple injury but if present on vital parts or organs may cause death.
- The age of injury might be determined

Lacerated Wounds

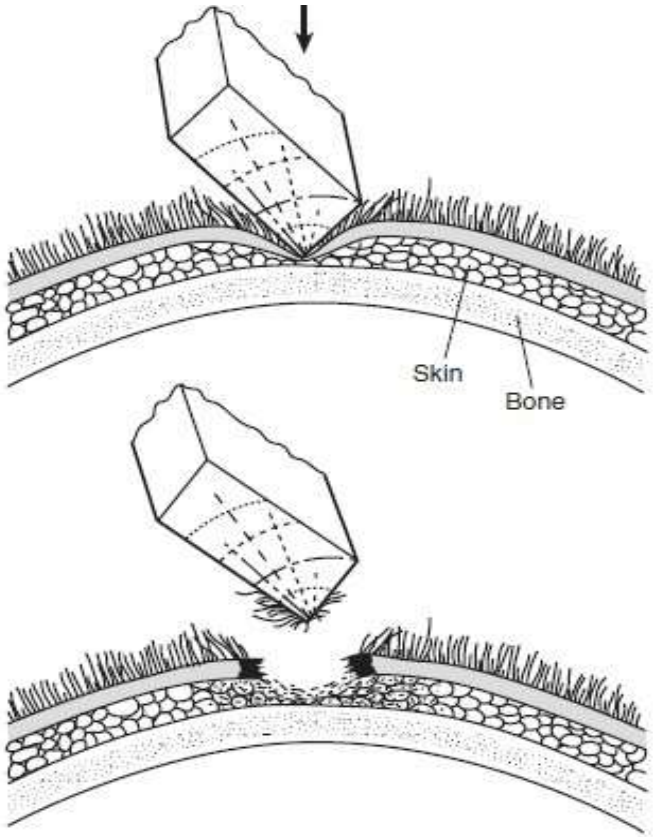
- **Laceration wound** is form of mechanical injury caused by hard and blunt force impact which is characterized by splitting or tearing of tissues.
  It's characterized by the affection of the whole thickness of the skin.

- **Mechanism**
  When the skin or other structures are subjected to blunt forces, the tissue gets crushed or stretched beyond the limits of their elasticity leading to tearing of the skin or other tissue thus producing laceration. Laceration differs from the incised wounds because in laceration, the continuity of the tissues is disrupted by tearing rather than clean slicing.

Laceration Types

Following are the types of lacerated wounds

1. **Split** تمزق انشطاري
2. **Stretch** تمزق بالتمدد
3. **Tear** تمزق ناتج عن التمزق
4. **Avulsion** تمزق اقتلاعي / نازع
5. **Crush** تمزق ساحق
6. **Patterned** تمزق نمطي



Crushing impact of a blunt object on skin supported by bone, such as scalp on skull. The skin is sandwiched between weapon and bone and this causes a lacerated split that has bruised margins and bridges of hair and tissue in the wound.

Split Laceration انشطاري

- Also called as incised looking laceration
- Split lacerations are caused by blunt force(heavy edged object) splitting the thickness of the skin most frequently when the skin and soft tissues are crushed between impacting force and underlying bone(sandwich like).
- These types of lacerations are usually found in body parts with underlying bones without much tissue in between.
- Common sites includes – scalp, face, shin etc.
- Due to splitting of skin these lacerations appear like incised wounds.

Stretch Laceration بالتمدد

- Stretch laceration results due to over-stretching of the fixed skin till it ruptures. In such type of lacerated wound, there is localized pressure with pull that causes tearing of the skin. Thus a pulling force causes stretch laceration
- **Example** – if pressure is applied over the thigh stretching the skin towards knee, then such force can cause laceration along the inguinal line.
- *Striae -like lacerations or stretch mark-like lacerations* are also considered as a variety of stretch laceration. These lacerations are superficial and multiple and mostly located

at groin. They are usually present in traffic accidents when the body is run over. The crushing weight of car wheel causes stretching of the skin .

Tear Laceration ناتج عن التمزق

- It is common form of laceration
- In this type, tearing of the skin and subcutaneous tissue occurs from localized impact by hard and blunt force

- The acting force from object or weapon rips the skin or tissues producing the laceration.

Avulsion Laceration اقتلاعي / نازع

- Also called as **flaying injury** or **grind laceration**
- Avulsion laceration occurs due to grinding compression of the tissues to such an extent that the skin gets detached from the deeper tissues thus resulting in the degloving of the skin.
- Here, large area of the skin and subcutaneous tissue is rolled off from body part, almost always by the rotary action of the causative object such as rotating motor wheel or tire.

Crush Laceration ساحق

- Here compression force causes crushing of tissues below. This form of injury may cause total or partial amputation of the affected body part, for example limb.
- It may also be associated with avulsion(if there is a rotary action) and/or stretch laceration.

Patterned Laceration نمطي

- Up to some extent, some weapons may produce patterned laceration but the patterns are not prominent like patterned abrasion or bruises. From some injury pattern, some weapons shape may be recognizable.

The examples are given below:

- Blow with hammer head with circular face may produce

a circular or an arc of circle (crescentic) shaped laceration

- Long and thin objects may produce linear laceration
- Heavy focal blow may cause a stellate shaped Laceration(in which the center is the site of impaction).

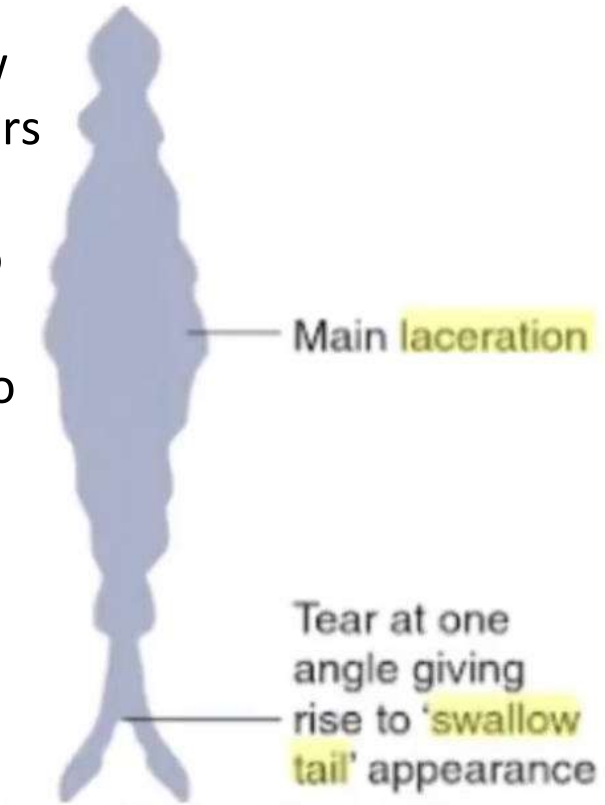
Laceration Features

- In laceration wounds, continuity of the tissues or skin is disrupted by tearing or splitting rather than by clean slicing as observed in incised wound.
- Margins – the margins are irregular and may be slightly inverted.
- In Lacerated wounds there is gapping of the edges.
- There may be bruising and crushing of the edges often placed in a narrow zone and requires lens for viewing
- The underlying blood vessels, nerves and delicate tissue bridges may be observed in the depth of wound.
- Hair follicles are crushed.
- There is absence of sharply linear injury in the underlying bone.

Laceration Features

- The ends of the lacerations at angles may show shallow tears, diverging from main laceration itself. Such small tears are known as **shallow tails**.
- Bleeding from lacerated wound is less in comparison to incised wound because the vessels are torn and crushed. The crushed vessels are capable of retracting and undergo thrombosis thus causing less hemorrhage.
- Foreign body or matter may be driven in the lacerated wound or may be soiled by grit, paints, fragments or glass etc.
- The shape and size of lacerated wound may not correspond

to the causative weapon or object. However, sometimes some weapons may leave patterned lacerated wound such as hammer.



Swallow tail - Lacerated wound

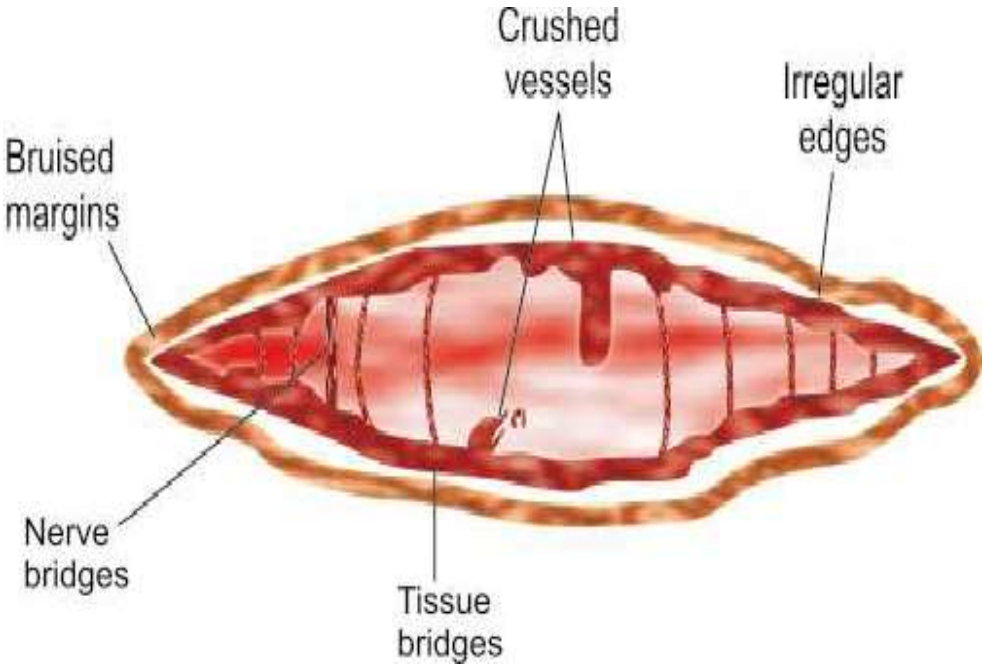
Laceration Features

- Examination of lacerated wound will reveal the direction of the application of the force or how the blow was applied to effect the laceration.

The more undermined edge of the laceration is the side toward which the force of striking object was directed;

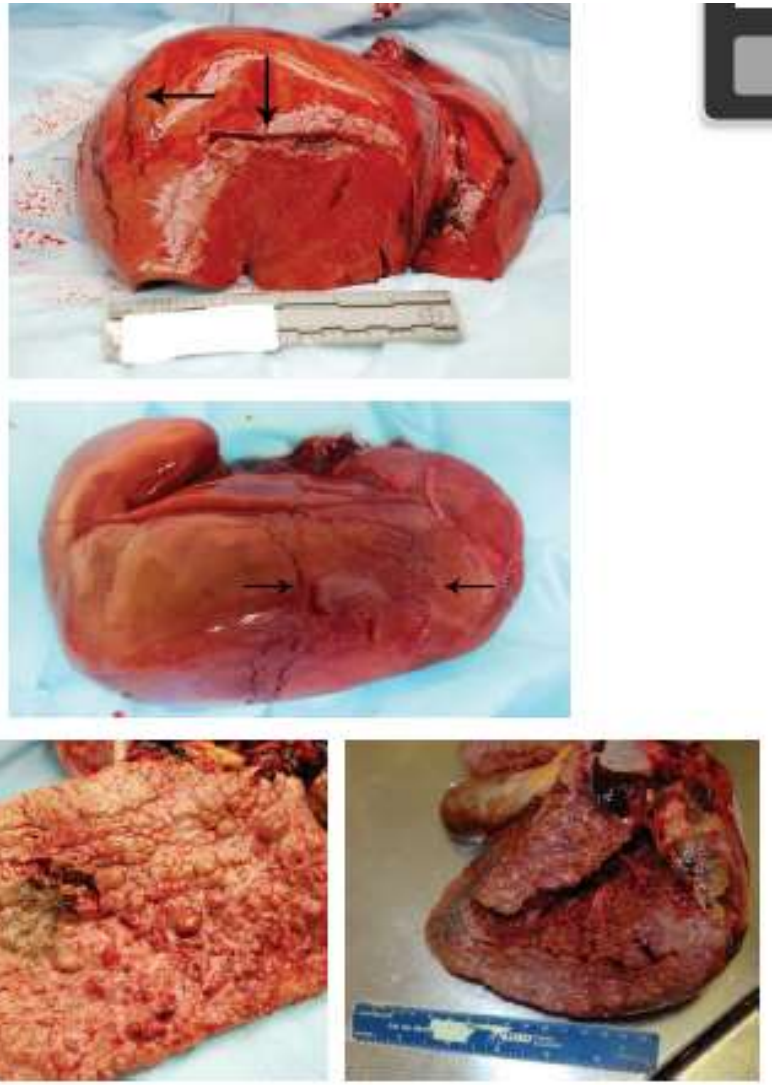
the slopped side of the laceration is that side from which the blow was directed.

Similarly the side of laceration with adjacent contusion is often the side from which the force was directed.



Organ Laceration

- Laceration of the internal organs are caused due to application of **blunt** mechanical trauma.
- It may possible that <u>externally no injury</u> may be evident but internal organs may suffer damage.
- **For example**, if kick is applied over yielding surface such as abdomen, externally there may be no evidence of injury but internally may cause injury to **pancreas, liver and spleen**.



Figures 6.215–6.218 Laceration of liver and kidneys due to blunt force trauma. Note the last two livers have hepatic cirrhosis. Hepatic cirrhosis is less commonly associated with laceration due to the increased fibrosis. A normal liver is the most common organ in the peritoneal cavity to lacerate in association with blunt force trauma.

Ante- vs Post-mortem Laceration

	Antemortem	Postmortem
Extravasation of blood	Present	Absent
Coagulation of blood	Present	Absent
Increase enzyme activity	Present	Absent
Signs of healing	Present	Absent
Pus/infection	Present	Absent

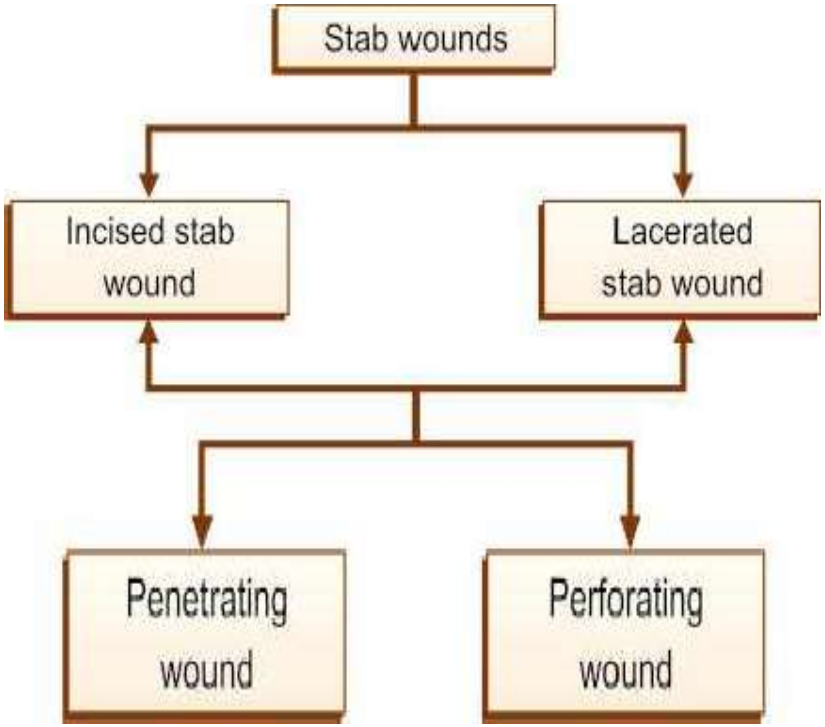
Medicolegal Importance: Lacerated Wounds

- Cause of injury can be known.
- Nature of injury can be determined– whether simple or dangerous.
- Foreign bodies present in wound may help in identification of the offending weapon/place of incident etc.
- Age of injury can be estimated.
- It can be known whether the injury is accidental or suicidal or homicidal.
- Direction of application of force can be known.
- It may be confused with incised wound.
- Differences between antemortem and postmortem laceration.

STAB WOUNDS (PUNCTURE WOUNDS)

Stab wound: Wound caused by force along the narrow, pointed object's long axis

Classification: Based on Depth of wound & Based on the causative weapon



Penetrating vs Perforating Wounds

- terminate in the tissue/organ/cavity
- only one surface wound is present on body due to entry of blade and no exit wound

- passing the body through-and-through
- two separate surface wounds will be observed over body(entry wound, exit wound)
- Entry wound larger (weapon tapers at tip)/Entry edges inverted; exit edges everted
- Foreign bodies (cloth, hair) near entry/tract

Lacerated stab wound

- Not so sharp weapon, relatively blunt object

Incised stab wound

- Sharp edged, pointed weapon

STAB WOUNDS

1. Type of weapon used and the shape of wound :

Single-Edged Weapons:

- One sharp edge; the other blunt or modified.
- Common in knives used for stabbing.
- Wound has a **"V"-shaped** sharp angle (from the cutting edge) and a **blunt angle** (from the dull edge).
- Sometimes, the blunt edge is sharpened near the tip, causing the wound to look symmetrical as the blade advances

Double-Edged Weapons:

- Both edges are sharp.
- Typically produce **symmetrical, spindle-shaped** stab wounds.

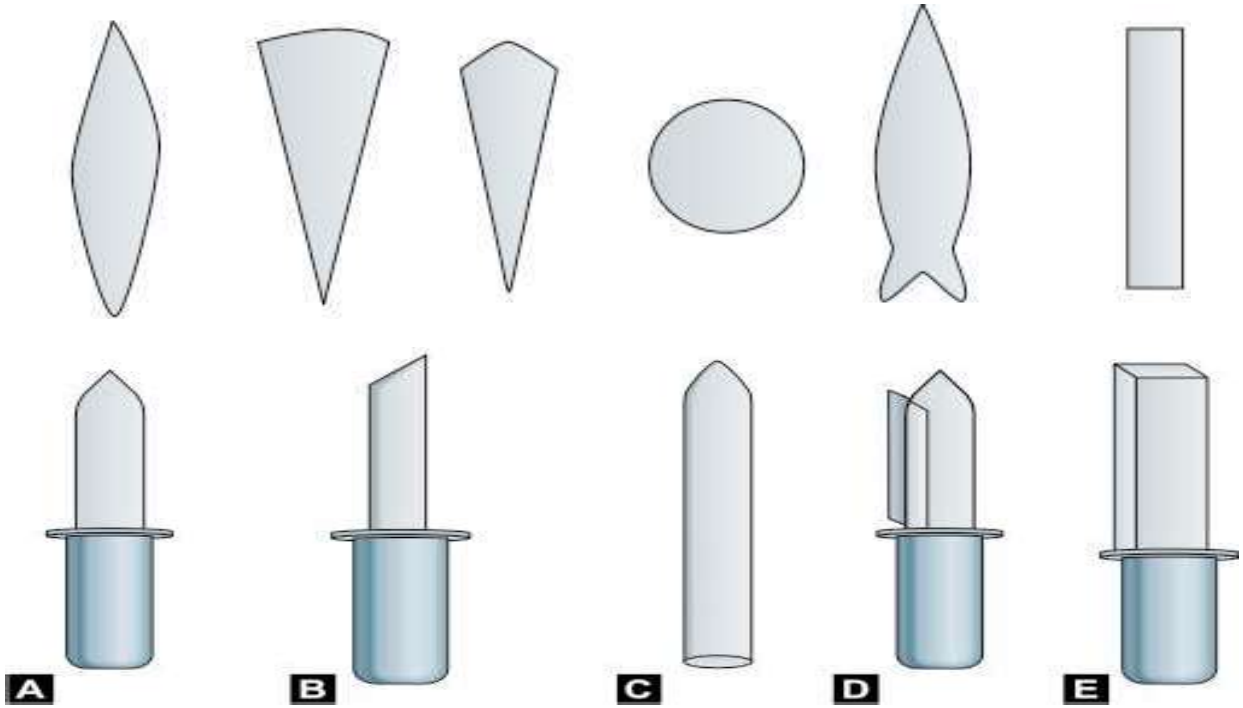
STAB WOUNDS

- In some weapons, one edge is sharp along the entire blade, while the other is sharp only near the tip. When used, the sharp tip pierces the skin, and as the blade goes deeper, the skin splits along the blunt edge, creating a wound that looks symmetrical.

- If one edge of a weapon is sharp and other edge is serrated, the angle produced by serrated edge may be torn in appearance and, when weapon is thrust obliquely, may leave serrated abrasions on the skin adjacent to the end of wound

STAB WOUNDS

Stab wound. A: Stab wound caused by blade with both edges sharp resulting in spindle shaped. **B:** Wedge shaped wound or tear drop wound if one edge of blade is sharp and other is blunt. **C:** Round shape wound resulting from round object.**D:** fishtail appearance of wound resulting from weapon with one edge sharp and other edge square-off. **E:** Rectangular shape or slit like wound that is caused due to rectangular object.



STAB WOUNDS

Wedge shaped stab wound

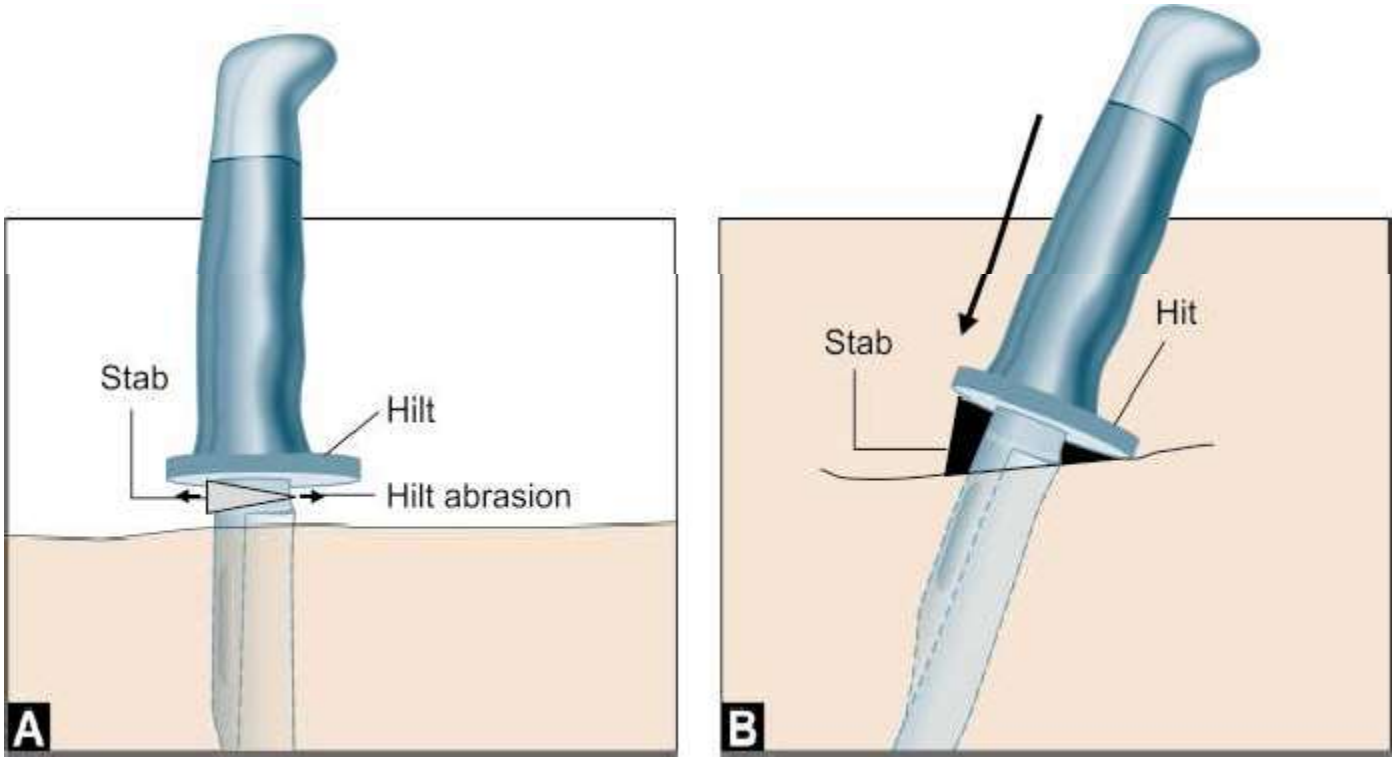
STAB WOUNDS

Types of Scissor Injuries

- 1. Laceration
- 2. Puncture Wound
- 3. Avulsion
- 4. Contusion (Bruising)
- 5. Incision

STAB WOUNDS

Stab wound with hilt abrasion. **A:** Weapon is penetrating skin perpendicularly and completely thus producing hilt abrasion around wound. **B:** Weapon is being thrust obliquely thus producing hilt impression on one side where hilt comes in contact



STAB WOUNDS

2. Depth and thrust

If, for example knife is used for stabbing and the knife is withdrawn along the same track then it will form a track inside the body and the measurements of wound will indicate the dimensions of weapon.

length of blade=depth of wound

Thus the depth of stab wound is important parameter to assess the length of weapon used.

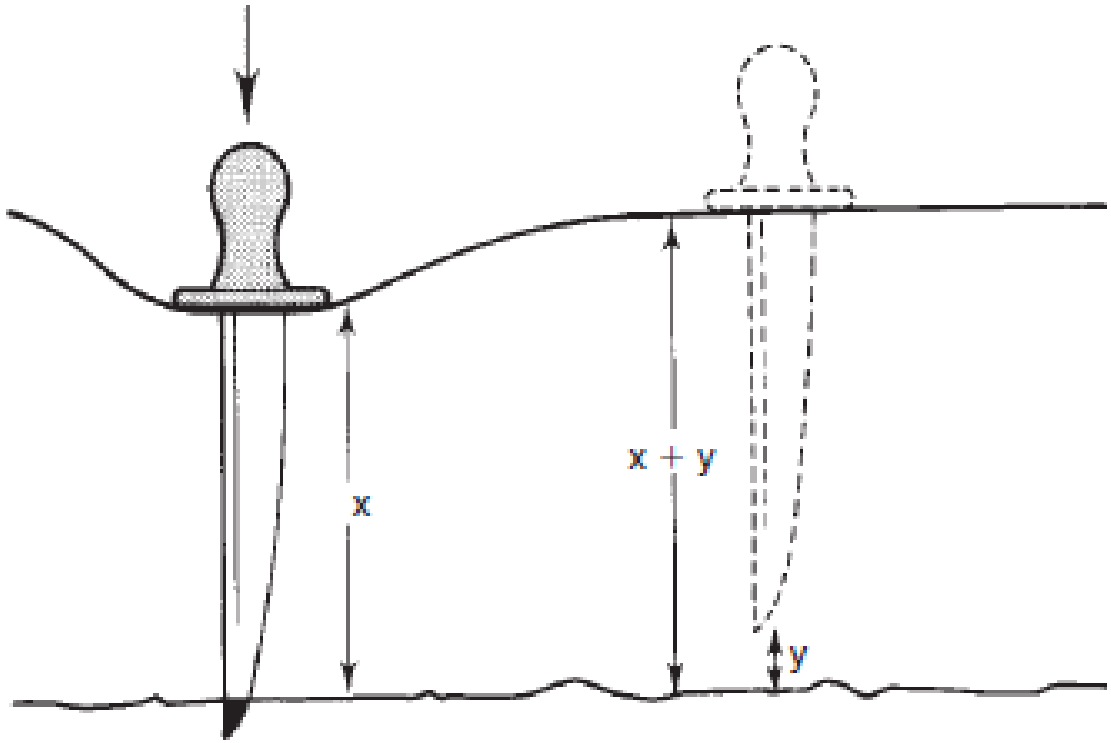
When depth of wound > length of weapon ??

The depth measured at autopsy may be actually more than the length of blade of a weapon and this phenomenon is commonly encountered over body parts that are yielding or compressible such as abdomen, chest. Due to compression of body part, the tip of blade will penetrate more in depth. Now if same weapon is used to inflict on non-yielding part, for example head then blade would not penetrate deeper than its length.

STAB WOUNDS

Forcible stabbing can indent the body surface so that

deep structures can be injured that appear to be beyond the reach of the knife.



STAB WOUNDS

3. Movement of weapon in the wound

- If, for example, knife is used for stabbing a person and the knife is withdrawn along the same track after inflicting the stab then the knife will form injury inside the body called as tract of stab wound.

Measurement of such track would indicate the dimension of the knife used to cause stab.

- if a person causes stab to another person with knife and he do not withdraw the knife along the same track but rotate the knife (rocking of weapon), then there will be greater wound defect.

The term **"rocking"** is used when the weapon is moved inside the wound with leverage or angulation in the plane of wound. Due to rocking, the cutting edge of weapon extends the wound. The rocking can be done by the assailant with active movement of weapon inside the wound or may be done by the victim due to body movement in relation to knife (weapon). In some cases, both mechanisms may act.

STAB WOUNDS

4. Direction of stab wound

– **Direction depends upon the entry wound, the track and the exit wound if present**. Careful dissection of the body in layers would reveal the track of the wound.

With advancement in imaging techniques, attempts had been made to view the direction of wound by **filling the wound defect with radio-opaque dye and X-ray films taken**. However, these radio-opaque substances often exhibit leaks making more difficult to access the track. In similar manner, **magnetic resonance imaging (MRI Scan) has been attempted.**

5. Pattern of stab injuries

– If the weapon used for stabbing, enters the skin obliquely, the edge of the wound that first cut the skin becomes ***beveled*** while the other edge ***overhangs*** the wound.

STAB WOUNDS

6. Dimension of wound

– Length of stab wound is usually corresponds with that of breadth of blade, but when the length of Wound is shorter in measurement than actual breadth of blade ,this shortening of wound is due to elasticity of skin, gaping of wound and contraction or postmortem shortening of underlying muscles, **especially when the muscle fibers are cut across**.

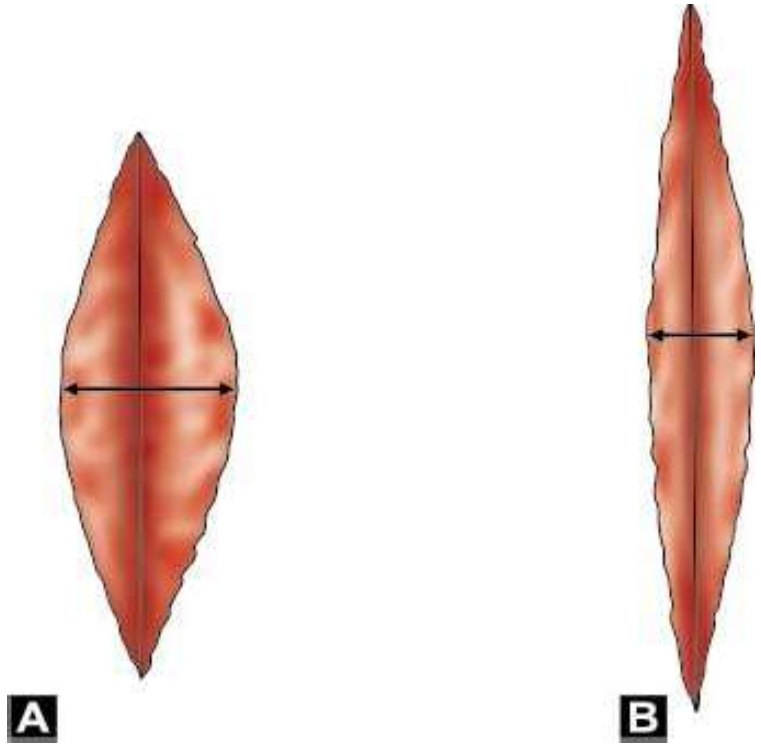
– Depth of stab wound is more than length and width.

STAB WOUNDS

- Important point for length and width depends on wheather the axis passing through a muscle/elastic tissue or not :

A: Stab wound appears short and wide because the long axis of wound is at across to muscle fibers or elastic tissue of skin.

B: The wound is parallel to muscle or skin plane and thus it appears narrow and long



STAB WOUNDS

A stab wound and the inflicting knife. The wound is slightly shorter than the width of the blade at the depth of penetration because of sideways gaping and the contractile elasticity of the skin…

Medicolegal Importance: Stab Wounds

- Type of weapon used can be known.
- Dimensions of weapon can be known.
- Movement of knife in the wound can be known.
- Depth of thrust can be known.
- Direction of thrust can be known.
- Amount of force used can be known.
- Age of wounds can be known.
- Manner of infliction – suicidal/homicidal/accidental can be known

Incised Wound

INCISED WOUND(Slash, cut)

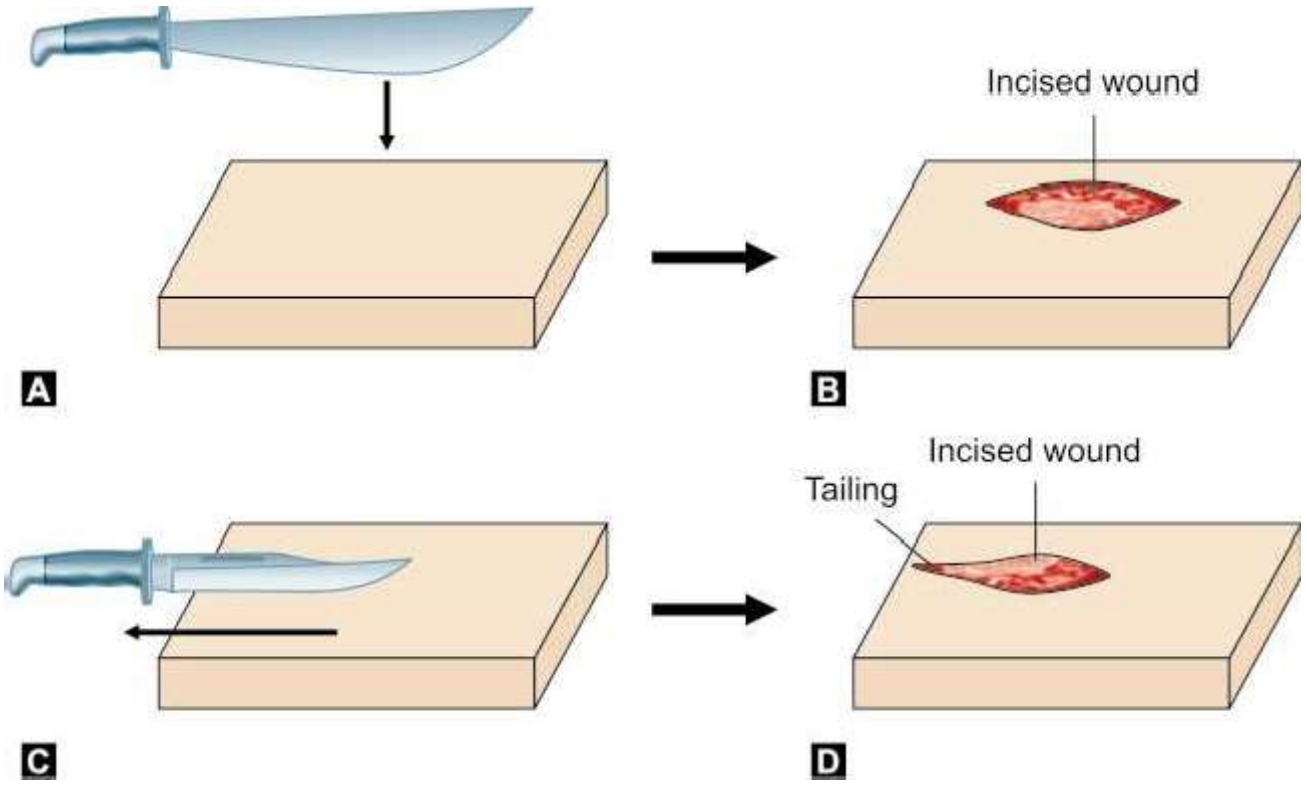
An incised wound is the wound caused by drawing or striking the edge of sharp object on the skin and underlying tissues.

	Lacerated wound	Incised wound
Edges	Lacerated, irregular, ragged	Clean cut
Bruising of margins	Present	No bruising
Injury to blood vessels, nerves	crushed	Clean cut
Hair bulbs	Crushed	Clean cut
Bleeding	Less	More
Underlying bone	No sharp injury	Sharp linear injury

Incised Wound

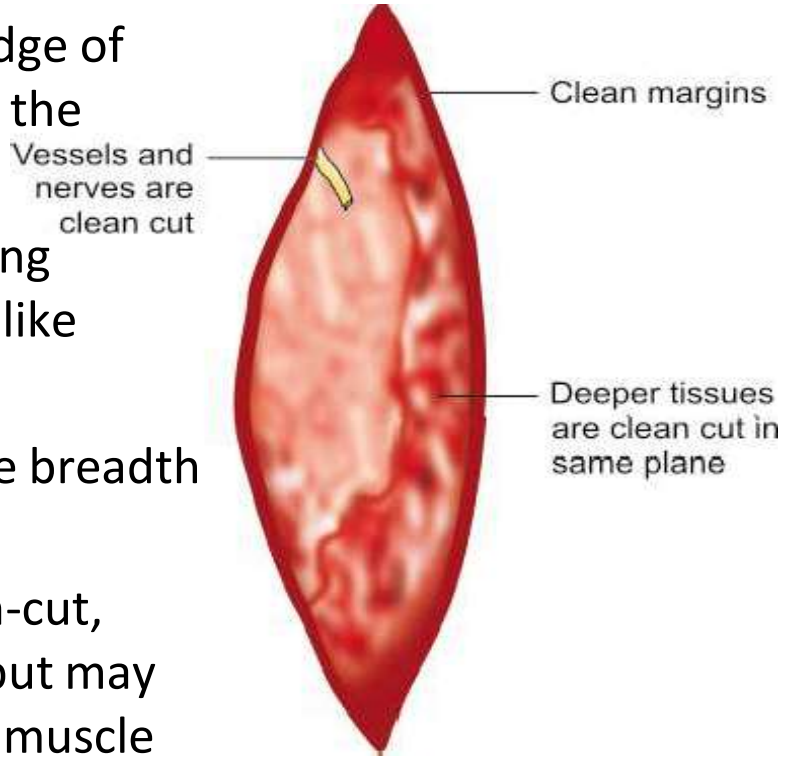
Incised Wound

Mechanism of incised wound production. **A and B :** Incised wound produced by striking force **C and D:** Incised wound produced by drawing the weapon



Incised Wound Features

- Incised wounds are always broader than the edge of the weapon causing it because of retraction of the divided tissues.
- Often, it is somewhat spindle-shaped and gaping but may be **zigzag** if the skin is lax(corrugated) like skin of scrotum or axilla.
- The length of incised wound is greater than the breadth or depth of wound (Opposite to stab wounds).
- Margins – margins of incised wounds are clean-cut, well defined. Mostly the margins are everted but may be inverted in some, especially if thin layers of muscle fibers are closely attached to the skin as in scrotum.
- Deeper tissues are all cut cleanly in the same plane.
- The length of incised wound has no relation to the length of the cutting edge of the weapon.



Incised Wound Features

- If incised wounds are inflicted on body areas with loose skin, as in axilla, the wound appears irregular due to puckering of skin occurring at the time of cutting the tissue.
- Usually, the starting end of incised wound is deeper than end part because the wound gradually becomes shallower and may ends in a "**tailing**" or scratch tailing. The tailing off of an incised wound indicates the direction in which the weapon was drawn off.
- Hemorrhage in case of incised wound is more in comparison with lacerated wound because the blood vessels are cleanly cut. The clean-cut ends are not effectively retracted and bleed considerably.

Medicolegal Importance: Incised Wounds

- Cause of injury can be known.
- Nature of injury– whether simple or dangerous .
- Age of injury can be estimated.
- It can be known whether the injury is accidental/ suicidal/ homicidal.
- Direction of application of force can be known.
- It may be confused with:
  -lacerated wound
  -Self-inflicted injuries
  -Defense injury

Self-Inflicted Wounds

“fabricated wounds or sympathy wounds"

- Located on the accessible part of the body.
- Usually superficial or minor.
- Regular.
- Similar in style or shape.
- Multiple.
- Parallel or grouped together.
- Handedness – in right-handed person, injuries are predominantly
  on the left side and for left handed person;
  the injuries are inflicted on right part of body.
- Old scars of previous attempt of self-infliction may be noted.
- Underlying psychiatric disorder could exist.

Defense Wounds

Defence wounds: are the injuries inflicted to a person when he tries to defend himself against an attack.

Active Defence Wounds

These occur when the victim tries to grab, catch, or push away the weapon:

- Palm of the hand – often cut while grabbing a sharp weapon
- Ulnar aspect of the forearm or hand – the side of the arm facing outward when trying to block blows

Passive Defence Wounds

These happen when the victim raises their limbs or curls their body to shield themselves:

- Extensor surface of the forearms – especially the ulnar side
- Lateral or posterior aspect of the upper arms
- Back of the hands (dorsum)
- Front and back of the legs, if used to shield the body
- Back, when the person curls into a fetal position, flexing the spine, hips, and knees to protect the front of the body

Chop Wounds

Chop wounds: Chop wounds are a type of incised wound caused by a heavy, sharp-edged weapon used with a hacking or chopping motion. Such as axe, chopper, and sword.

Characteristics of Chop Wounds

- Caused by a **relatively sharp and heavy weapon**
- Wound is **wider and deeper** than a typical incised wound
- **Margins may be bruised or abraded** due to the forceful impact
- **Edges are less sharp** than clean incised wounds
- May involve **underlying bone fractures** or **deep tissue damage**

Bevelling

If the wound is inflicted **obliquely**, the margins may show **bevelling**:

Bevelled edge: Sloped or angled appearance of one margin, often indicating direction of force

Heel and Toe Concept

Chop wounds often show variation in depth along the wound track:

Heel end:

Closer to the assailant

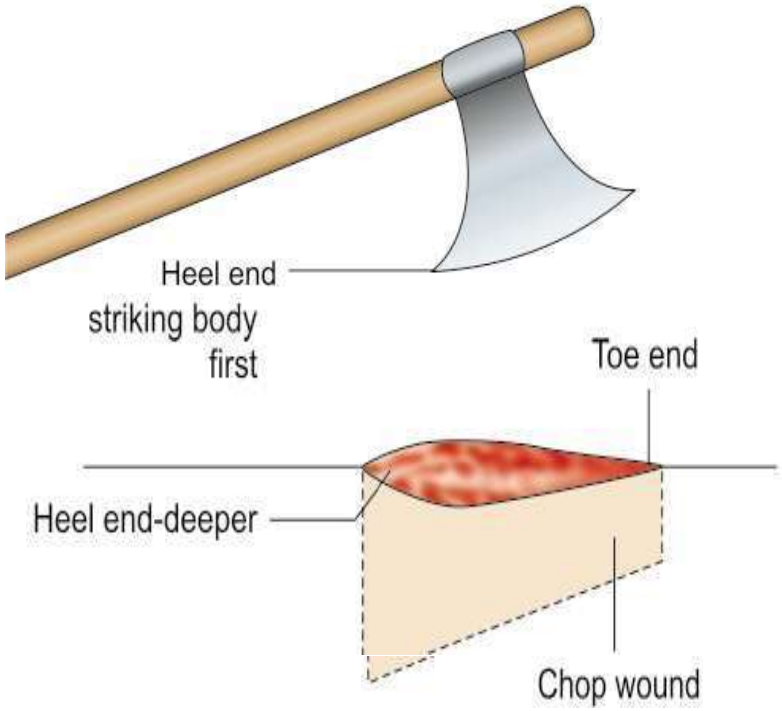
Deeper part of the wound (initial impact)

Toe end:

Farther from the assailant

Shallower part (as the weapon exits)

Chop Wounds


Heel end
striking body
first
Toe end
Heel end-deeper
Chop wound

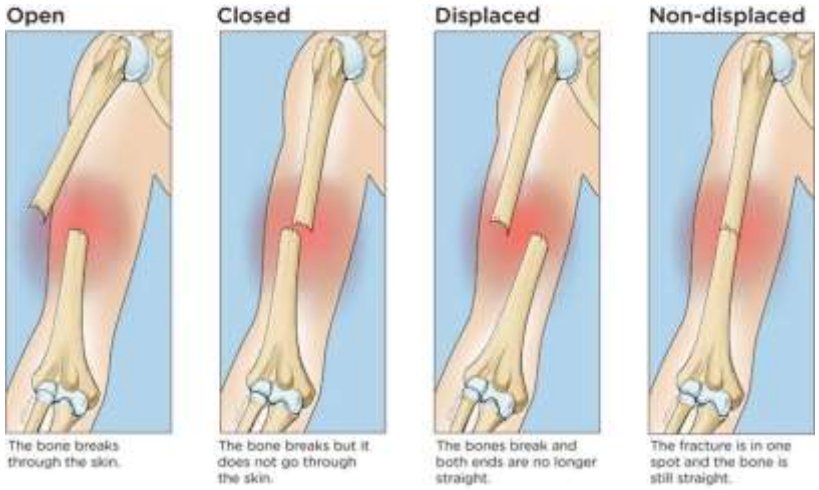
Medicolegal Importance: Chop Wounds

- Chop wounds are usually homicidal in nature. however, accidental injuries may be sustained by a person working in factories etc.
- From the heel or toe end, the relative position of the assailant and the victim can be known.
- The type of weapon used can be known.
- Age of injury can be known.

Fractures

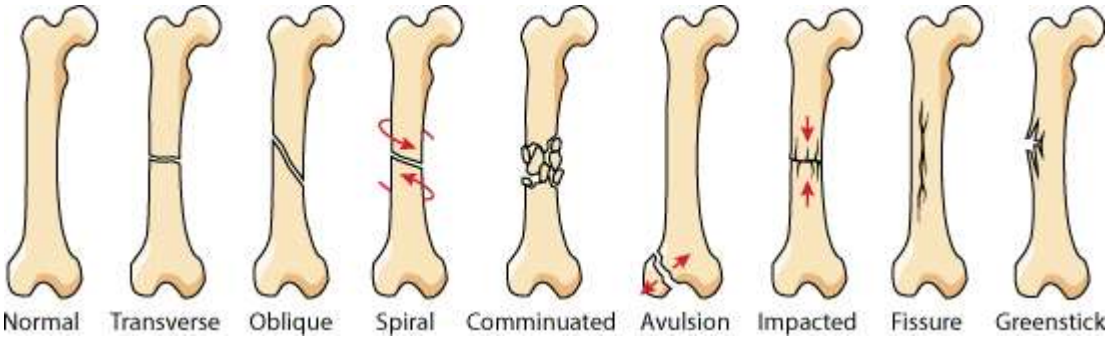
Breach in the continuity of bone due to application of mechanical force or other traumatic agent.
The force applied to bone may be direct or may be indirect.

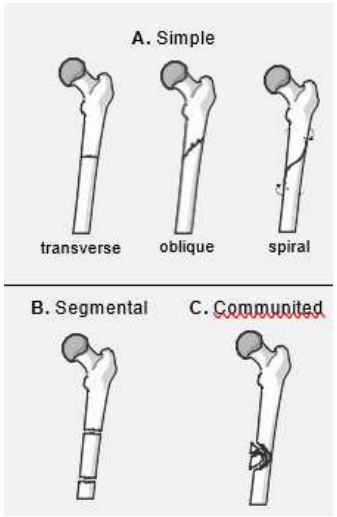
Displacements	Non-displaced	
	Displaced	
Relation to skin and external environment	Simple	the overlying skin and tissues are intact.
	Compound/ open	the overlying skin and tissues are torn and communicating with the exterior.



Fractures

Etiology	Traumatic	fracture resulting from application of mechanical force.			
	Pathological	due to some pathology or disease, the bone is weak.			
Pattern	Transverse	Spiral	Oblique	Segmental	Comminuted
Direct	Focal	Crush	Penetrating		
Indirect	Traction	Angulation	Rotational	Vertical compression	Angulation-compression





Fractures Complications

Early complications

- Shock
- Injury to vessels, muscles, tendons
- Injury to joints
- ARDS
- Fat embolism
- Deep vein thrombosis
- Pulmonary embolism
- Compartment syndrome
- Crush syndrome
- Aseptic traumatic fever

Delayed complications

- Septicemia
- Delayed union
- Non-union
- Mal-union
- Avascular necrosis
- Joint stiffness
- Sudeck's dystrophy
- Osteomyelitis
- Ischemic contracture
- Myositis ossificans

Medicolegal Importance: Fractures

- Fracture of bone constitute great hurt.
- Fracture accompanied with vessel injury may endanger life.
- Fracture associated with injury to nerve may cause deformity or loss of function.
- Multiple fracture with hemorrhage may cause death of a person.
- Age of injury can be known.

Conclusion

- Wounds are classified by mechanism, anatomy, and underlying biophysical properties.
- Accurate assessment of wounds is critical in forensic medicine to distinguish between types.
- Understanding wound characteristics guides both clinical care and legal investigation.
- Injury mechanism, wound pattern, and distribution help determine the manner, timing, and potential cause (accidental, self-inflicted, homicidal).
- Proper documentation and interpretation of wounds are essential in forensic practice.

Take Home Messages

- Always assess the wound type, depth, and associated injury patterns.
- Differentiate between accidental and non-accidental injuries using wound features and context.
- Don’t overlook rare or subtle findings (e.g., defense wounds, self-inflicted injuries).
- Correlate clinical findings with forensic principles for accurate reporting.
- Comprehensive evaluation contributes to justice and appropriate medical care.

Assessment

Q1. What is a lacerated wound? How is it different from an incised wound?
Lacerated wound = torn edges with tissue bridging (blunt trauma).
Incised wound = clean, sharp edges with no tissue bridging.

Q2. How do defense wounds differ from self-inflicted wounds?
Defense wounds: on forearms/hands, from blocking attacks.
Self-inflicted: superficial, accessible sites, often multiple, uniform.

Q3. Name four signs a wound may be non-accidental.
Unusual location, multiple wounds at different healing stages, presence of defense wounds, and inconsistent history.

Q4. What are the main forensic wound types?
Abrasion, contusion, laceration, stab wound, incised wound, chop wound, fracture.

Q5. What key steps are essential in forensic wound evaluation?
Detailed description, photographs, measurements, identification of wound patterns.

الحمد لله

Thank you for your attention