

# **Mechanical Injury**

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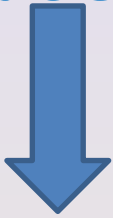
**M.D.(Ayu.)**

# Definition of Mechanical Injury

**Disintegrity of the natural continuity of any of the tissues of the living body.**

# Classification

## 1) Caused by Blunt Weapon/Force



**Abrasion**



**Contusion**



**Laceration**

**(Bruise)**

# Classification

## 2) Caused by Sharp Weapon/Force



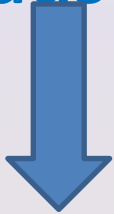
**Incision**



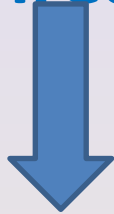
**Punctures**

# Classification

## 3) Caused by Firearm Weapon



**Rifled**



**Smooth-  
bored**



**Country-  
Made**

## Definition of Abrasion

**The injuries involving superficial layer of the skin e.i. the epidermis or mucus membrane, due to impact against some hard, blunt & rough object / Weapon where the depth is not more than covering epithelium.**

# Abrasion



# Abrasion





# Abrasion



# Abrasion



# Type of Abrasion

- 1)Scratches (Linear)-
- 2)Graze (Sliding, Grinding)-
- 3)Pressure-
- 4)Impact-

# Type of Abrasion

## **1)Scratches (Linear)-**

**They are produced by horizontal friction by the pointed end of some object like thorn, nail, needle or tip of any weapon.**

**Eg. Nail Abrasion in Strangulation.**

# Type of Abrasion

1) Scratches (Linear)-

**2) Graze (Sliding, Grinding)-**

**They are produced by horizontal friction between the broader area of the skin & the object / weapon or hard rough surface of the ground. Eg. Road Traffic Accident.**

# Type of Abrasion

- 1) Scratches (Linear)-
- 2) Graze (Sliding, Grinding)-

## 3) Pressure-

**They are produced by vertical impact by the impacting object to the skin surface or epidermis. Eg. Ligature mark.**

# Type of Abrasion

- 1) Scratches (Linear)-
- 2) Graze (Sliding, Grinding)-
- 3) Pressure-

## 4) Impact-

**It is produced when the force is applied at or around right angle to the surface of the skin.  
Eg. Motar Car imprint.**

# Type of Abrasion

1) Patterned- Impact &  
Pressure

2) Unpatterned- Scratches &  
Graze



# Age of Abrasion

Age	Appearance
<b>Fresh</b>	<b>Bright Red</b>
<b>12 – 24 hrs.</b>	<b>Bright Red Scab</b>
<b>2 – 3 days</b>	<b>Redish- Brown Scab</b>
<b>4 – 7 days</b>	<b>Dark-Brown Scab</b>
<b>&gt; 7 days</b>	<b>Scab Shrinks &amp; falls off</b>

## **MLA of Abrasion**

- 1) Site of impact & direction of force**
- 2) Patterned injury- Object/ Weapon**
- 3) Age of Injury – Time of Assault**
- 4) Dirt, Dust, Sand – Scene of Crime**
- 5) Characteristic & Manner of Injury-**
  - a) Throttling- Crescent Fingernail Abrasion-Neck**
  - b) Smothering- Nail Abrasion-Nose & Mouth**
  - c) Sexual Assault- Nail Abrasion- Breast, Genital**
  - d) Struggle- Nail Abrasion- Face**

# Contusion (Bruise)



# **Definition of Contusion (Bruise)**

- **It is characterized by infiltration of extravasated blood into the subcutaneous and/or sub epithelial tissues resulting from rupture of small blood vessels due to application of blunt force.**

# Contusion (Bruise)



# Contusion (Bruise)



# Contusion (Bruise)

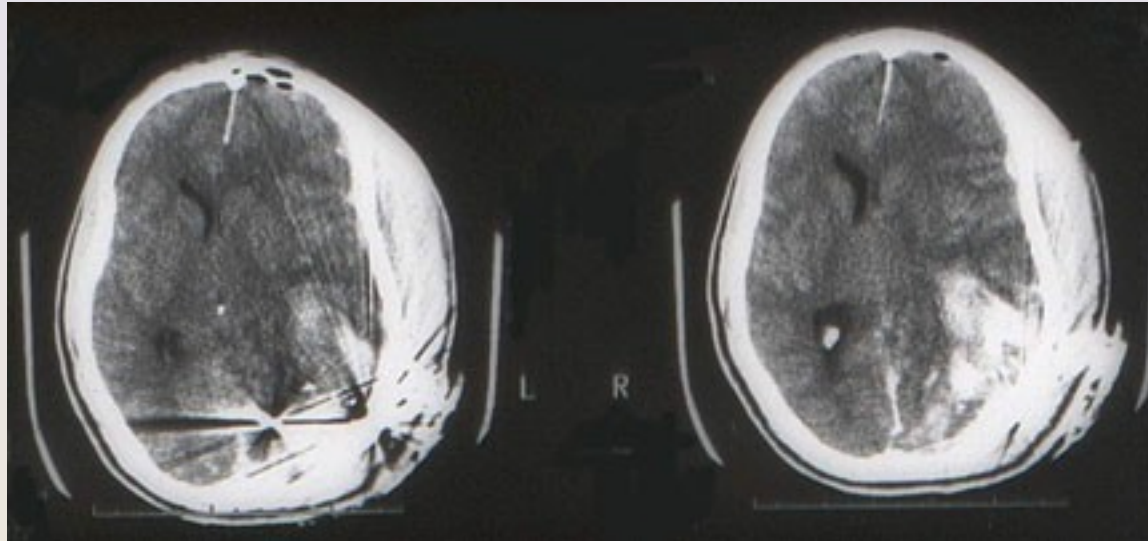


# Contusion (Bruise)

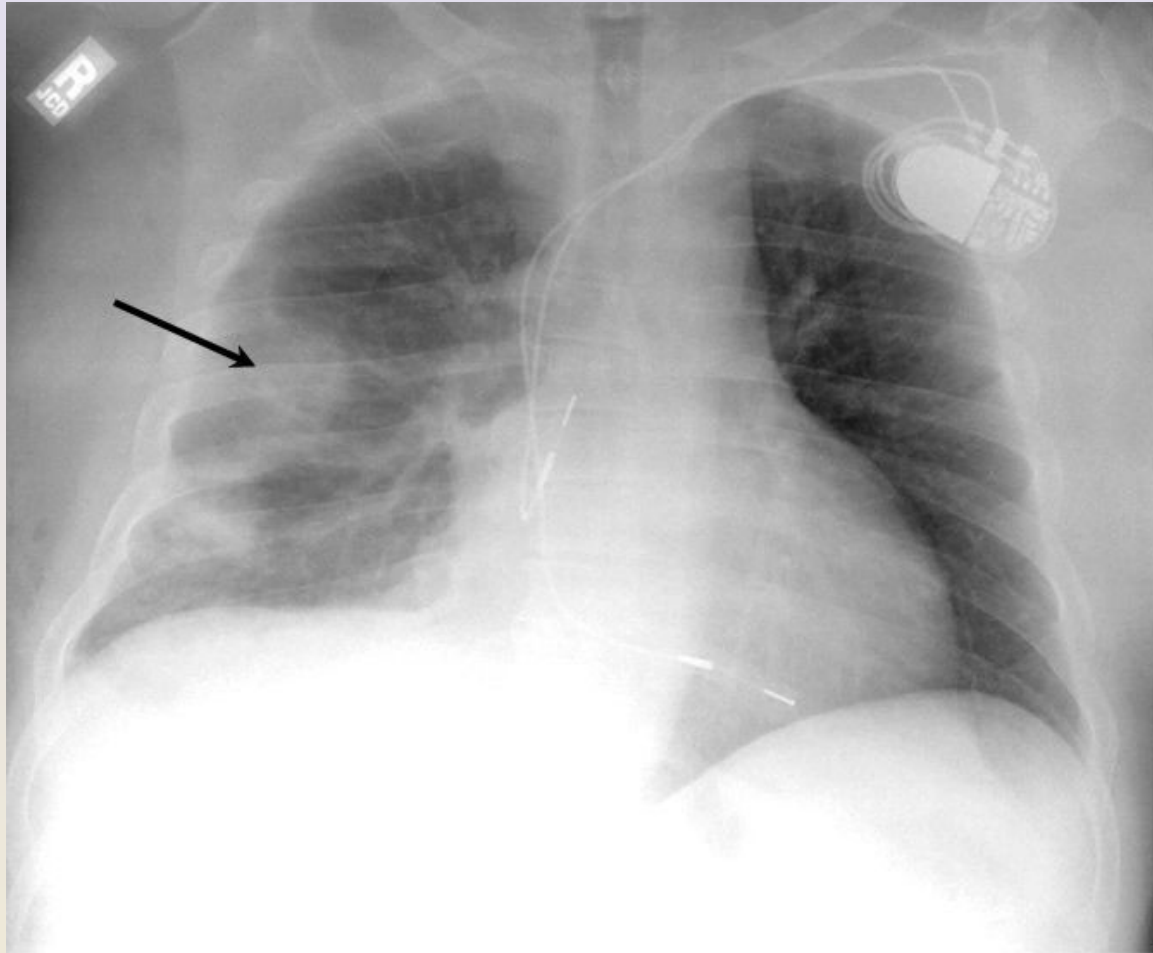




# Contusion (Bruise)



# Contusion (Bruise)



# Contusion (Bruise)



# Contusion (Bruise)



# Type of Contusion (Bruise)

1) Patterned

2) Non-Patterned

A) External

B) Internal

1) Delayed

2) Early

A) Superficial

B) Subcutaneus

C) Deep

# Age of Contusion (Bruise)

Age	Appearance
<b>Fresh</b>	<b>Red</b>
<b>Few – 3 days</b>	<b>Blue</b>
<b>4<sup>th</sup> days</b>	<b>Brown</b>
<b>5 – 6 days</b>	<b>Greenish</b>
<b>7 – 12 days</b>	<b>Yellowish</b>
<b>2 Week</b>	<b>Normal</b>

## Factor modifying Size & Shape

- 1) Condition & Type of tissue- Face > scalp**
- 2) Age- Old > Child > Adult**
- 3) Sex- Women > Men**
- 4) Colour of Skin- White > Black**
- 5) Coagulation disorder- Purpura, Haemophilia, Scarvy, Vit.K**
- 6) Gravity-**

# **MLA of Contusion (Bruise)**

- 1) Patterned Bruises-Victim-Object-Chain, Stick**
- 2) Age of Injury-Colour Changes-Time of assault**
- 3) Degree of Violence-Size & Shape Bruises**
- 4) Character & Manner-distribution**
  - a) Arm grasped-4+1 Finger Bruises**
  - b) manual strangulation-4+1 Finger Bruises**



# Difference bet. Bruise & Hypostasis

feature	Bruise	Hypostasis
Cause	Rupture vessel within SC tissue By Blunt Weopen.	Accumulation of blood within vessel in dependant by gravity.
Site	At site of trauma	Dependant part
Appearance	Elevation with Swelling	No elevation
Margin	Merge with surrounding area	Clearly defined
Colour	Varies as per Age	Uniform (Bluish-Purple)

# Difference bet. Bruise & Hypostasis

feature	Bruise	Hypostasis
<b>Incision</b>	<b>Extravasations of blood within SC tissue</b>	<b>Blood within blood vessel</b>
<b>Pressure Effect</b>	<b>Little Lighter</b>	<b>Absent</b>
<b>Epidermis</b>	<b>May be abraded</b>	<b>Not Abraded</b>

## Difference bet.True & Artificial Bruise

Feature	True Bruises	Artificial Bruises
Cause	Trauma	Juice of Bhalatak, Calotropis
Site	Exposed accessible part	Anywhere
Colour	Dark-Brown	Varies
Shape	Usually round	Irregular
Margin	Merge with surrounding	Well defined & Regular

# Difference bet.True & Artificial Bruise

Feature	True Bruises	Artificial Bruises
Redness & Inflammation	At site	Surrounding
Contents	Extravasated blood	Acrid Serum
Itching	Absent	Present
Vesicle	Absent	Present
Chemical Test	Negative	Positive for Chemical

## **Definition of Laceration**

**It is a rupture or tear or a split in the skin, mucus membrane, muscle or any internal organ, involving depth more than the covering epithelium of the skin or that of an organ & produced by application of blunt force.**

# Laceration



# Laceration



# Laceration





# Laceration



## Type of Laceration

- 1) **Split** – betn. Two hard surface  
(scalp+hard object)
- 2) **Stretch** – overstretching of skin by  
pressure
- 3) **Avulsion/Shearing/Flaying** – grinding  
force
- 4) **Tears** – Impact by irregular/semisharp  
object
- 5) **Cut** – by heavy sharp-edged object

## Type of Laceration

**1) Split** – betn. Two hard surface  
(scalp+hard object)

It occur when the soft tissues are  
'sandwiched' between a hard  
unyielding deeper structure & agent  
applying the force.

Eg. Laceration on Scalp, Face, Eyebrow  
etc.

## Type of Laceration

1) Split –

**2) Stretch –**

**It result due to heavy forceful  
overstretching of skin by pressure**

## Type of Laceration

- 1) Split –
- 2) Stretch –
- 3) **Avulsion/Shearing/Flaying** – grinding force or compression by a weight such a wheel of a heavy vehicle or some heavy part of machinery passing over the limb.

## Type of Laceration

- 1) Split –
- 2) Stretch –
- 3) Avulsion/Shearing/Flaying –
- 4) **Tears** – Tearing of the skin & subcutaneous tissue can occur from localized Impact by irregular/semisharp object

## Type of Laceration

- 1) Split –
- 2) Stretch –
- 3) Avulsion/Shearing/Flaying –
- 4) Tears –
- 5) Cut – it is due by heavy sharp-edged object**

## Feature of Laceration

Sr. No.	Trait	Feature
1	Margins	Irregular & often undermined
2	Shape	Varies, usually irregular
3	Dimension	Usually longer than deep
4	Depth	Small strands of tissue at the bottom bridge across margin
5	Hemorrhage	Slight except Scalp & Internal



## Feature of Laceration

Sr. No.	Trait	Feature
1	Abrasion on edges	Usually present
2	Bruising	At surrounding & underlying tissue
3	Hair Bulb	Crushed or torn
4	Bone	May be Fracture
5	Foreign bodies	Usually present

## Age of Laceration

Age	Appearance
<b>Fresh</b>	<b>Bright Red Clot with bleed</b>
<b>12 – 24 hrs.</b>	<b>Margin swollen &amp; Red. Neutrophils</b>
<b>24 – 48 days</b>	<b>Epithelial cells from both edges migrate &amp; proliferate along the dermis, meeting in the midline beneath the surface Scab. Monocyte</b>
<b>2 – 3 days</b>	<b>Macrophages &amp; granulation tissue invade the incisional space.</b>
<b>4 - 5 days</b>	<b>Neovascularization with granulation tissue &amp; collagen fiber, reaches it's peak.</b>
<b>&gt; 7 days</b>	<b>A soft, reddish scar is left</b>

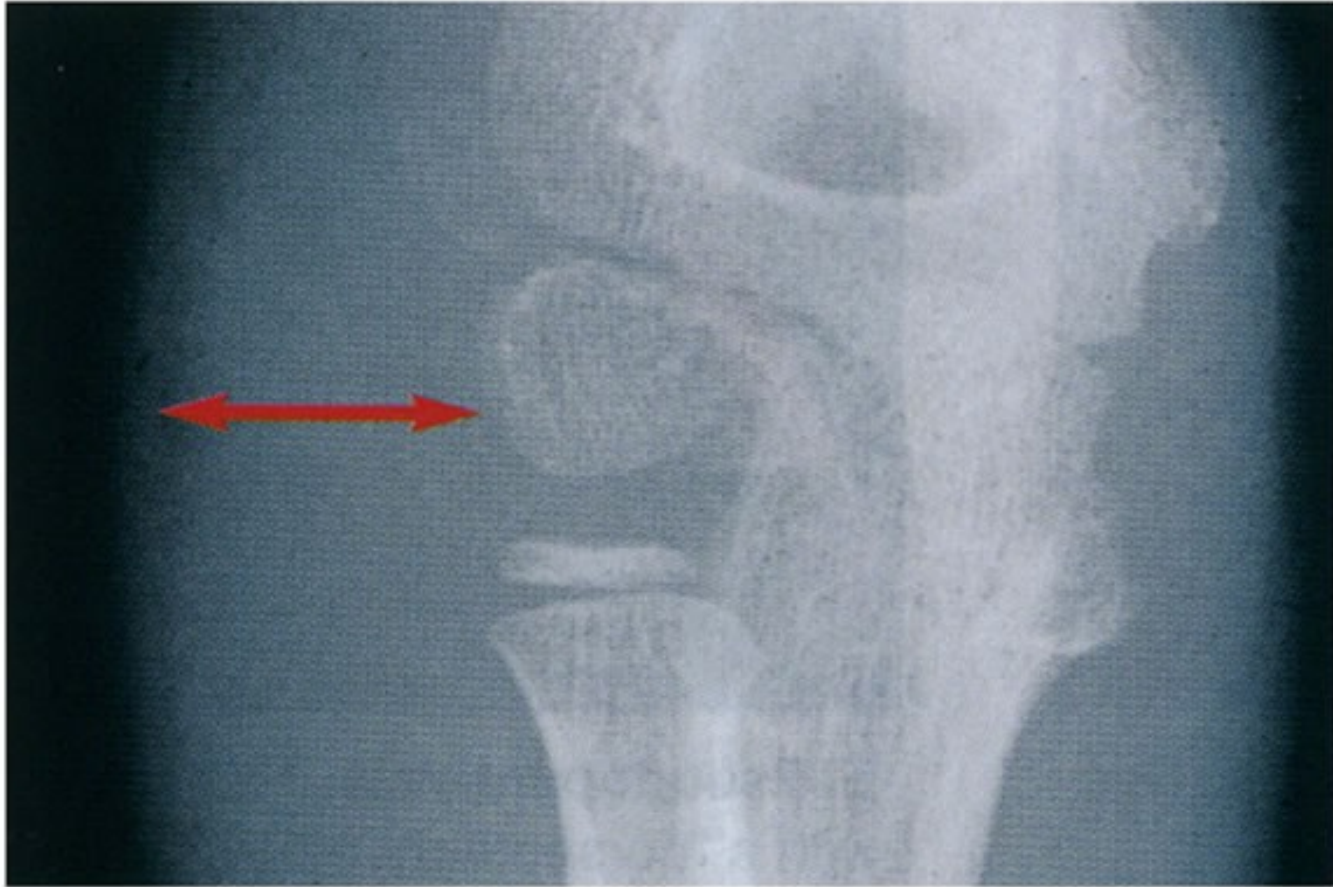
## **MLC of Laceration**

- 1) Usually Accidental or Homicidal**
- 2) Rarely Suicidal**
- 3) Internal organ suffer extensive parenchymal damage beneath intact surface**
- 4) Blunt trauma can be fatal with neither external nor internal evidence of injury.**
- 5) Unusual & unexpected result which may be seen in Laceration is delayed rupture of internal organ.**

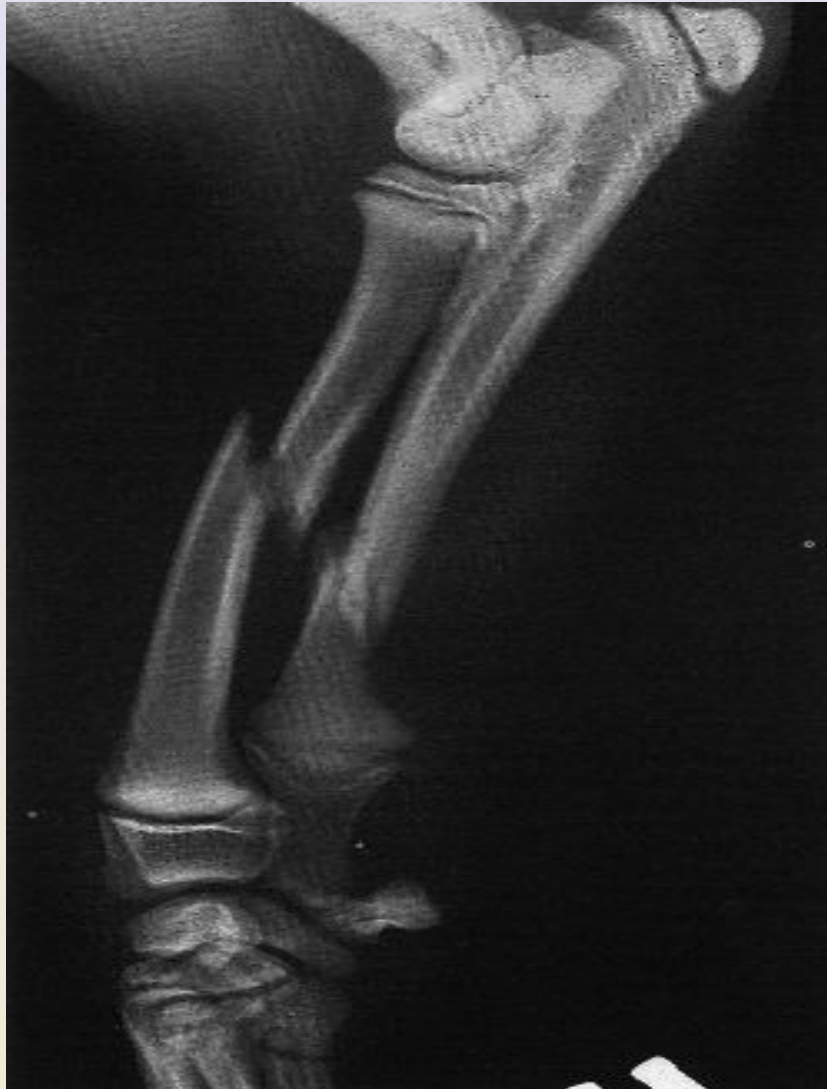
# Fracture



# Fracture



# Fracture



# Fracture



# Fracture





## **Definition of Incision**

**It is due to cutting motion with a sharp-edged instrument like knife or straight edged razor.**

# Incision



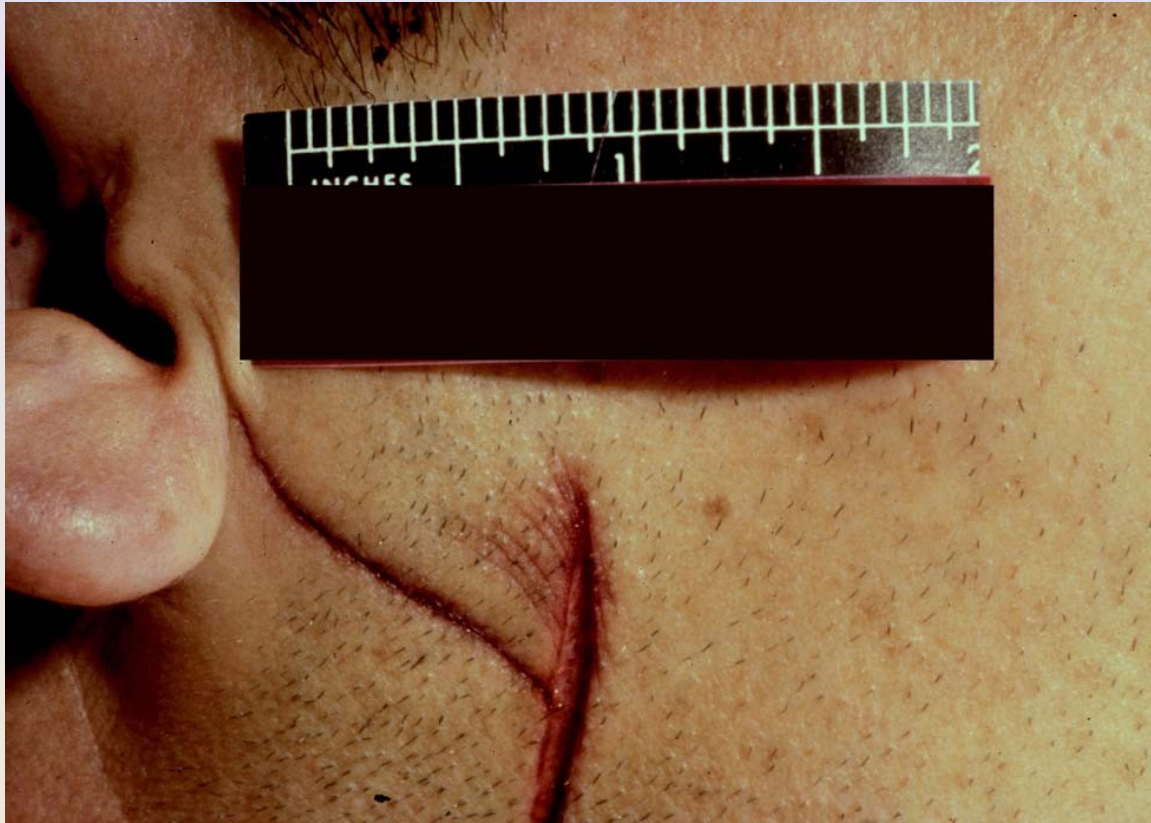
# Incision



# Incision



# Incision



# Feature of Incision

<b>feature</b>	<b>Character</b>
<b>Margin</b>	<b>Smooth, Even, Clean-cut &amp; Everted</b>
<b>Shape</b>	<b>Linear, Spindle-shaped</b>
<b>Dimensions</b>	<b>Usually longer than deep. Often gaping</b>
<b>Depth</b>	<b>Equal to width inserted</b>
<b>Hemorrhage</b>	<b>Usually profuse.</b>

# Feature of Incision

feature	Character
<b>Hair Bulbs</b>	<b>Clearly cut</b>
<b>Bones</b>	<b>May be cut</b>
<b>Foreign bodies</b>	<b>Absent</b>
<b>Abrasion on Edges</b>	<b>Absent</b>
<b>Bruising</b>	<b>No adjacent bruising of soft tissue</b>

## Age of Incised injury

Age	Appearance
<b>Fresh</b>	<b>Bright Red Clot with bleed</b>
<b>12 – 24 hrs.</b>	<b>Margin swollen &amp; Red. Neutrophils</b>
<b>24 – 48 days</b>	<b>Epithelial cells from both edges migrate &amp; proliferate along the dermis, meeting in the midline beneath the surface Scab. Monocyte</b>
<b>2 – 3 days</b>	<b>Macrophages &amp; granulation tissue invade the incisional space.</b>
<b>4 - 5 days</b>	<b>Neovascularization with granulation tissue &amp; collagen fiber, reaches it's peak.</b>
<b>&gt; 7 days</b>	<b>A soft, reddish scar is left</b>



## **MLC of Incised injury**

- 1) Nature of Weapon – Sharp edged**
- 2) Age of injury – Time of crime**
- 3) Direction of Injury – Direction of Force**
- 4) Position & Character – Suicidal/Homicidal/ Accident**

## **Incised injury- Suicidal/Homicidal (Cut-throat)**

<b>Trait</b>	<b>Suicidal</b>	<b>Homicidal</b>
<b>Situation</b>	<b>Lt. side of neck &amp; passing across the front</b>	<b>Usually on the both sides</b>
<b>Level</b>	<b>Above the Thyroid Cartilage</b>	<b>Below the Thyroid Cartilage</b>
<b>Direction</b>	<b>Above downwards &amp; From Lt. to Rt.</b>	<b>Transverse or below upwards</b>
<b>Number</b>	<b>Multiple</b>	<b>Not more</b>

## **Incised injury- Suicidal/Homicidal (Cut-throat)**

<b>Trait</b>	<b>Suicidal</b>	<b>Homicidal</b>
<b>Hesitation cut</b>	<b>Present</b>	<b>Absent</b>
<b>Tailing</b>	<b>Present</b>	<b>Absent</b>
<b>Severity</b>	<b>Usually less</b>	<b>Usually more</b>
<b>Defense wound</b>	<b>Absent</b>	<b>Present</b>

## **Incised injury- Suicidal/Homicidal (Cut-throat)**

<b>Trait</b>	<b>Suicidal</b>	<b>Homicidal</b>
<b>Hand</b>	<b>Weapon grasped</b>	<b>Fragment of clothes</b>
<b>Weapon</b>	<b>Usually Present</b>	<b>Usually Absent</b>
<b>Carotid A. &amp; Jugular V.</b>	<b>Escape usually</b>	<b>Cut usually</b>
<b>Clothes</b>	<b>Not damaged</b>	<b>Damaged</b>
<b>Crime scene</b>	<b>Quite</b>	<b>disarrangement</b>

# Punctures

**The wound due to pierce with a pointed object instrument.**

# Punctures

# Punctures



# Punctures





# Stab Wound



# Stab Wound



# Stab Wound





# Punctured Wound



# Punctured Wound-Type

- 1) Penetrating Wound- Terminate into the body cavity.
- 2) Perforating Wound- weapon pierces through whole thickness of body cavity.

- 1) Incised Punctured- sharp-pointed
- 2) Lacerated Punctured- blunt-pointed

# Punctured Wound- Feature

## Margin-

- 1) Sharp + Pointed – Clean cut
- 2) Blunt + Pointed – Abraded
- 3) Right Angle strike – Symmetrical
- 4) Downward strike – prominent above stab
- 5) Upward Angle – Prominent below stab

# Punctured Wound-Feature

**Length** 1) Slightly less than the width of weapon up which it has been driven

**Width** 1) Distance between two Margin. It is nearly equal to thickness of Weapon.

**Depth** 1) Length of Tract.  $>$  Width & Length.  
2) equal or slightly less than the length of the Blade.

# **Influencing factor for Shape of Stab**

- **Single Edges Knife- Triangular**
- **Double Edges Knife- Elliptical**
- **Round Pointed – Circular**
- **Squared Pointed- Cruciate**
- **Two Pronged Sharp Pointed- Paired Pattern**
- **Pin Pointed- by pin or Needle on Fronanelle, Nape of Neck**



# **Influencing factor for Depth**

- 1) Condition of Knife-**
- 2) The Resistance offered by tissue-**
- 3) Clothing**
- 4) Force of Strike**
- 5) Stretched skin > lax skin**
- 6) Right angle strike >**
- 7) Force of Body.**

# Punctured Wound-Feature

**Direction** 1) Entry W. to Exit W.

2) Beveled Margin on side with undercut on other.

**Hemorrhage** 1) Usually Profuse & internal.

**Hair Bulbs** 1) Usually clean cut.

**Bone** 1) May be punctured

**Foreign bodies** 1) Usually absent

**Abrasion on a edge** 1) Usually absent

**Bruising** 1) Usually absent

# Difference- Incised, Lacerated & Stab

Feature	Incised	Stab	Lacerated
Weapon/ Force	Sharp edged	Pointed	Blunt
Site	Anywhere	Chest & Abdomen	Bony Prominence
Margin	Smooth, Even, Clean- cut, Everted	Clean-cut/ Abraded & as per angle	Irregular, often Undermined
Shape	Linear/ Spindle	Linear Irregular	Usually Irregular

# Difference- Incised, Lacerated & Stab

Feature	Incised	Stab	Lacerated
Dimension	Longer than Depth; often Gapping	Depth greater than Length	Longer than Depth
Depth	Structure Clearly Cut	Structure Clearly Cut	Small strand of tissue
Hemorrhage	Profuse & External usually	Profuse & External usually	Slight & External except Scalp
Hair Bulb	Clearly Cut	Clearly Cut	Crushed or torn

# Difference- Incised, Lacerated & Stab

Feature	Incised	Stab	Lacerated
Abrasion on Edge	Absent	Absent	Present
Bruising	No Adjacent bruising of Soft tissue	Rare	Bruising of Surrounding & Underlying tissue
Bone	May Cut	May Punctured	May Fracture
Foreign Bodies	Absent	Absent	Present usually

# AM & PM Wound- Hemorrhage

Feature	AM Wound	PM Wound
Quantity	Copious	Slight
Tissue staining	Deeper	Not so
Spurting Mark	++ve	--ve

# AM & PM Wound- Blood clot

Feature	AM Wound	PM Wound
Clotting	++ ve	-- ve / + ve
Color	Variegated	Yellow (chicken fat) Red (Curran jelly)
Consistency	Firm & Rubbery	Soft & Loose
Friability	++ve	--ve
Adherence to endothelium	Firm & rubbery	Weak

## AM & PM Wound- wound edges

Feature	AM Wound	PM Wound
Gaping	++ve	--ve
Everson	++ve	--ve
Swelling	++ve	--ve



# AM & PM Wound- vital reaction

Feature	AM Wound	PM Wound
Inflammation	+ve	-Ve
Healing	+ve	-Ve
Pus	+ve	-Ve
Slough	+ve	-Ve

## AM & PM Wound- microscopy

Feature	AM Wound	PM Wound
RBC	+ve	-ve
WBC	+ve	-ve
Platelets	+ve	-ve
Fibrin	+ve	-ve

# AM & PM Wound- enzyme histochemistry

Feature	AM Wound	PM Wound
ATP ase	+ve	Nil
Aminopeptidase	+ve	Nil
Acid Phasphatase	+ve	Nil
Alkaline Phasphatase	+ve	Nil

# AM & PM Wound- wound biochemistry

Feature	AM Wound	PM Wound
Serotonine	Peak at 10 min.	Nil
Free Histamine	Peak at 10 min.	Nil

# IPC 320 – Grievous Injury

Sr. No.	Trait
First	Emasculation
Second	Permanent privation of the sight of either eye
Third	Permanent privation of the hearing of either ear
Fourth	Permanent privation of any member or joint

# IPC 320 – Grievous Injury

Sr. No.	Trait
<b>Fifth</b>	<b>Permanent impairing of the powers of any member or joint</b>
<b>Sixth</b>	<b>Fracture or Dislocation of a bone or tooth</b>
<b>Seventy</b>	<b>Permanent disfiguration of the head or face</b>
<b>Eighty</b>	<b>Any hurt which endangers life or which causes suffer &gt; 20 days.</b>

# IPC related to Injury

IPC	Feature
299	Defination of Culpable Homicide(Intended)
300	Defination of Murder
301	Defination of Culpable Homicide (Non-Intended)
302	Punishment for Murder
304	Punishment for Culpable Homicide
304- A	Punishment for Medical Negligence
304- B	Punishment for Dowry Death

# IPC related to Injury

IPC	Feature
306	Abatement of Suicide
307	Attempt to murder
308	Attempt to commit culpable homicide
309	Attempt to commit suicide
312-316	Criminal abortion
319	Hurt
320	Grievous Injury



# Defense Wounds #1



**Defense wounds on the hand of a victim whose assailant was attacking with a knife.**

# Defense Wound #2



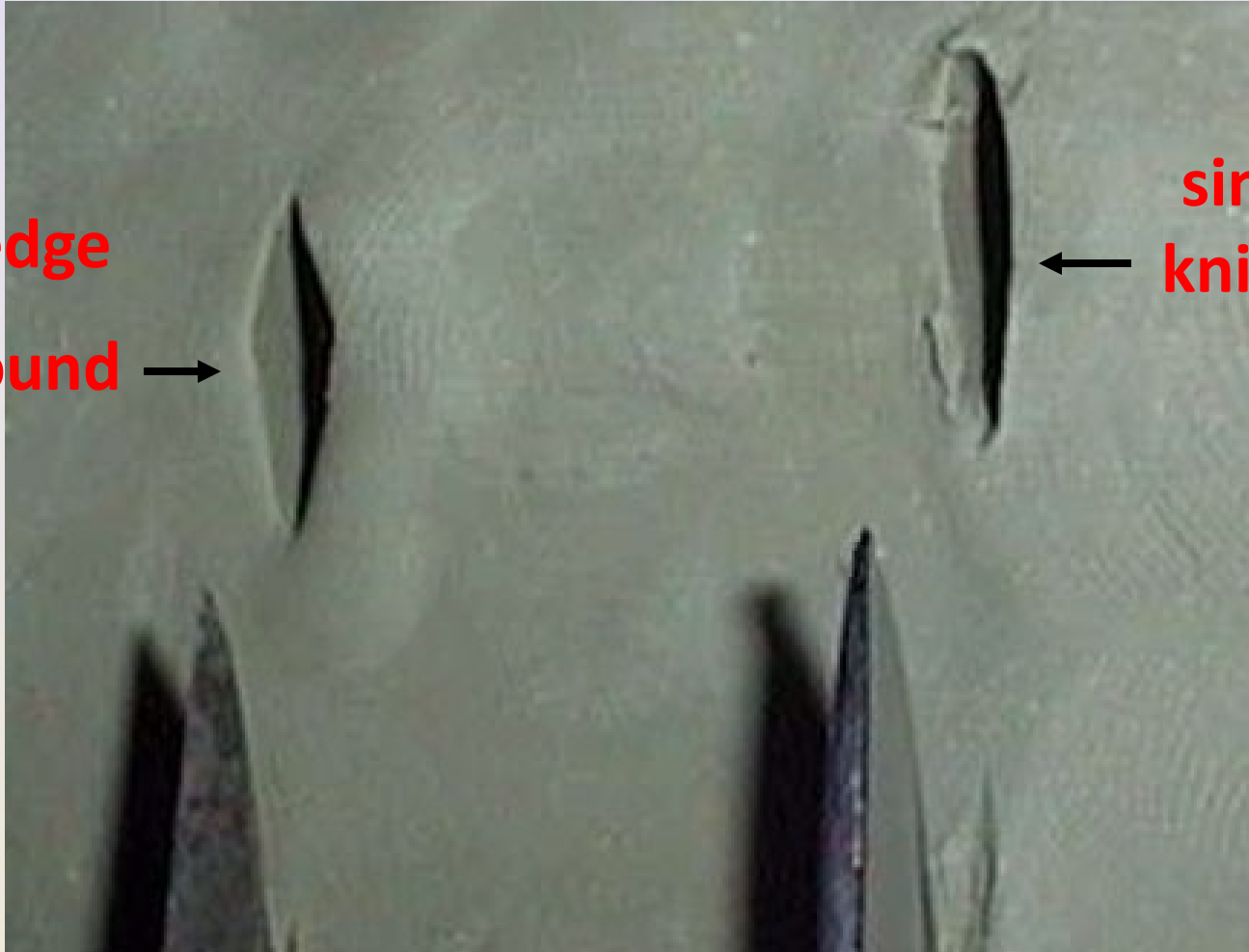
**Here is a typical "defense wound" on the forearm of the victim of an assault with a sharp weapon, producing the laceration.**

# Defense Posture

**Scene illustrates mechanism for "defense wounds".**



# Clay Model Used to Demonstrate Knife Wounds



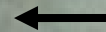
double edge

knife wound



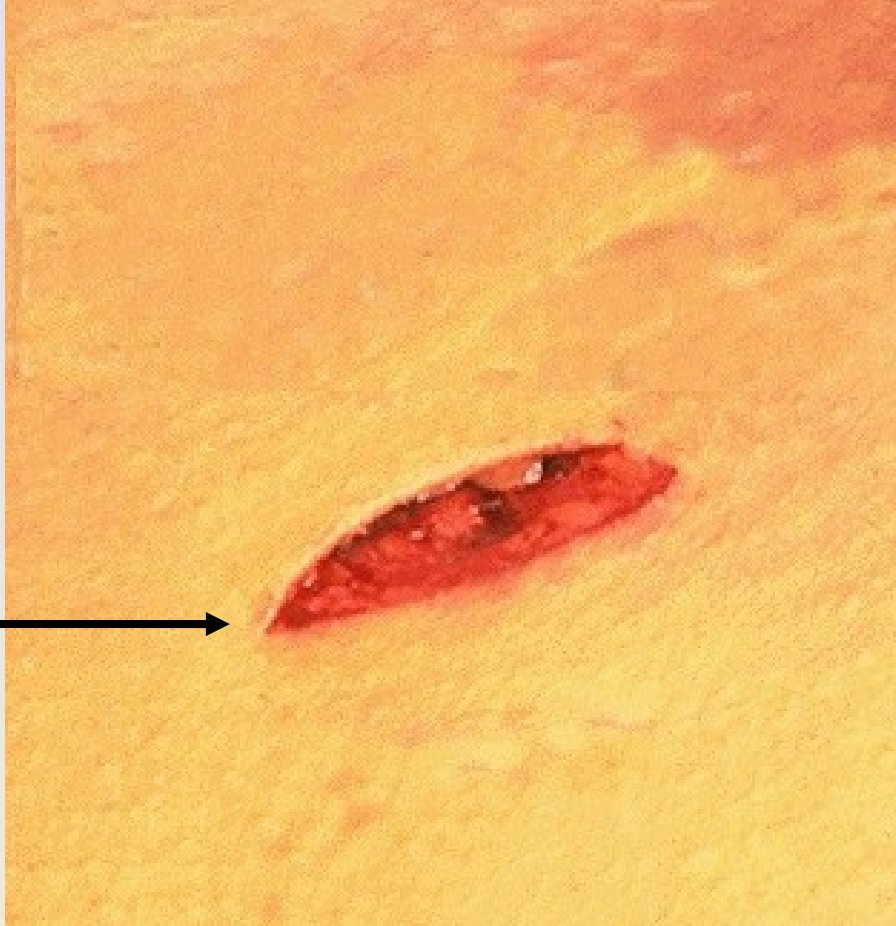
single edge

knife wound

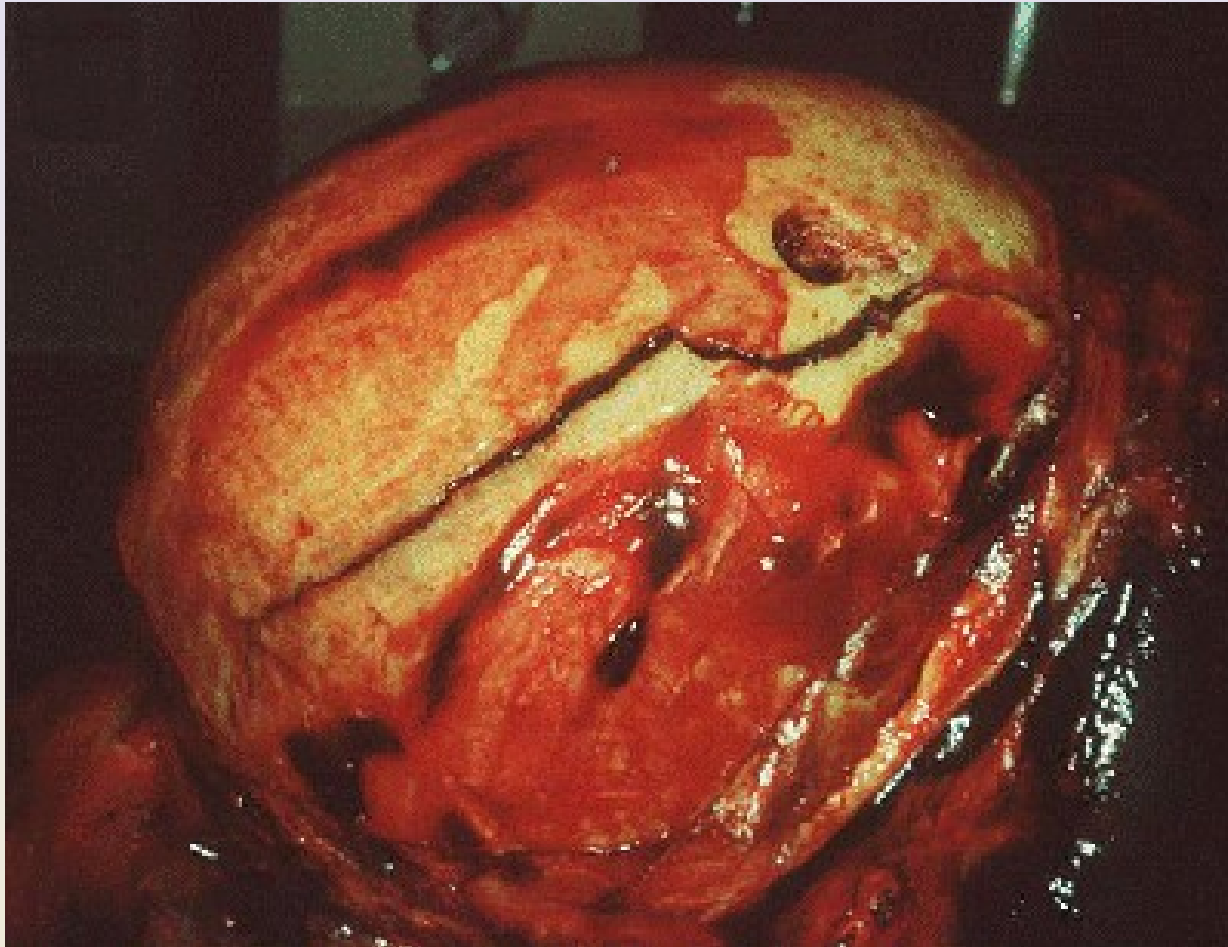


# Stab Wound: Single Edge Blade

**Sharp edge  
of blade**



Deadly blow to head that resulted in fractured skull and bleeding.



# Fractured Liver: Blunt Force Injury

