WOUNDS & INJURIES

Done by:
Maram Al-anbar
Rubia Al-sheyab
Nadeen Ta'ani
Sura Al-faris
Introduction

• One of the most important aspects of forensic medicine – both clinical and pathological – is the assessment, classification and documentation of injury..

• Any healthcare professional should be able to appropriately document injury in a way that can be understood and interpreted by others..

• Most non-forensic healthcare professionals will not be trained in the interpretation of injuries and wound causation..

• accurate documentation can greatly assist the legal process at a later stage..
General terms

• Injury:
  damage to tissues by an external force (trauma) ex. heat, cold, chemicals, electricity, radiation, & mechanical force.

• Trauma:
  bodily harm that is imparting energy to tissues;
  <> physical (mechanical): blunt force or sharp force..
  <> non-physical: thermal,, chemical,, electrical,, radiation.. and result in:
  ** morphologically apparent damage (wound)
  ** physiological imbalance (eg reflex cardiac arrest)
Wound

• **Medical definition:**
  it is an *injury*, usually restricted to a *physical* type of *trauma*, with disruption of normal continuity of *tissue* either *internal* or *external*..

• **Legal definition:**
  *breach of the full thickness of the skin* (the continuity of the skin is broken). 
  This *excludes* abrasions, bruises, internal injuries and fractures.
Wound Classification

**Depth of wound**
- **Superficial** (loss of epidermis only)
- **Partial thickness** (involve the epidermis and dermis)
- **Full thickness** (involve the epidermis, dermis, subcutaneous fat and sometimes bone)

**Involvement of skin**
- **Open wound** (there is a break in the skin)
- **Closed wound** (there is no break in the skin, it involves the underlying tissue ex. internal bleeding as in bruises)

**Appearance & Causative method**
- **Abrasions**
- **Contusions**
- **Lacerations**
- **Incised wounds**
Description of Wounds

• Determine **type** of wound.
• **Measure the dimensions** (length, width, depth).
• **Position** relative to anatomical landmarks.
• Determine **initial location** (if wound involves cutting, slashing...etc).
• Determine **height** from the heel.
Interpretation of Wounds

- **Causative** object or weapon..
- **Manner of infliction:**
  - **Self**-inflicted..
  - **Accidentally** inflicted..
  - **Deliberately** inflicted by another..
Abrasions

• The most **superficial** type of injuries that do not penetrate the full thickness of the skin,, *(usually confined to the epidermis)* ..

• They are **clinically trivial** (less severe than the others) ,, although they are **painful** ,, **bleeding/exudation is slight** ..

• Heals **without scarring** (by re-epithelialisation) ..

• They are often **associated** with bruising and laceration ..

• **FORENSICALLY VERY IMPORTANT** ; Often the most **informative** of all injures:
  **Always reflect site of impact**
  **Often indicate causative object/surface**
  **Often indicate direction of impact**
Types of Abrasions

1** Abrasions caused by **Tangential impact** (graze, scratch, brush abrasions).

2** Abrasions caused by **Vertical impact** (crushing abrasions).
Tangential (graze,, brush,, scratch)

- Loss or scraping of epidermis by tangential friction due to either
  **a moving sharp object against stationary body causing linear abrasions (scratch) "5dsh"**

  OR

  **moving body against rough stationary surface (graze, brush, shearing) "Kash6"**
Fingernail Abrasions

- They are **important** because of their **frequency in assaults** especially child abuse, sexual attacks and strangulations..
- Often associated with **focal bruises**..
- Most often seen on the neck, face, upper arms and the forearm..
Fingernail Abrasions

- Superficial abrasions caused by fingernails
- Deeper abrasions caused by fingernails
• **Direction** of the impact:

  the **starting** edge has bevelled **descent**, where as the **finishing** edge has **tags** of heaped epidermi (raised by the impact)
• Note the **raised skin layers** on the left side of the abrasion (finishing edge).

• The **black arrow** indicates the direction of the abrasive movement.
Direct Vertical Impact (Crushing)

- Superficial crushing of epidermis caused by Direct Vertical Impact..
- The causative object may stamp its shape or surface pattern on the skin --> IMPRINT ABRASION

- e.g. **Rope weave** in hanging or ligature in strangulation..
  **Fabric weave of seat belt**..
  **Bite mark**..
Rope weave mark
Seat belt mark
Bite mark
Post-mortem Abrasions

• abrasions that are caused at about the time of death or after, e.g. due to dragging the body after death.

• Here the damaged skin has exuded tissue fluid, which has dried post-mortem to produce the dark, leathery appearance.
Bruises (contusions)

- It is a type of Hematoma in which there is leakage (extravasation) of blood from ruptured (damaged) small vessels (capillaries, venules and arterioles) into the surrounding tissues; skin, muscle or any internal organ (with Intact Epidermis).

- Usually it's due to BLUNT FORCE TRAUMA:
  **Moving object strikes the stationary body (BLOW with fist or weapon).**
  **Moving body strikes a stationary object (FALL).**
Factors Affecting the Appearance of Bruises

• Force applied ..

• Connective tissue support :
  <> Easier bruising around the eye, and on the scrotum ..
  <> Rarity of bruises on the palms and soles ..
  <> Fat > thin (more subcutaneous fat) ..
  <> Areas with underlying bones are more likely to bruise (chest, shin vs. abdominal wall) ..

• Fragility of blood vessels ..
• 2 Types:

**External bruising (superficial):**
Bleeding in the subcutaneous tissue seen as discolouration through the semi-translucent skin..

**Internal bruising (Deep):**
Deeper bruise in muscle or internal organ will not be visible through overlying fat and skin at time of injury, it takes up to 24 hours to appear at surface (come out), Re-examination of a body or live victim after this time may reveal bruises not initially apparent, e.g. neck in strangulation, blows to the abdomen..

Note >> Ultraviolet light may disclose an otherwise unidentifiable bruise
"shifting" of bruises

- The site of bruising does not necessarily reflect site of trauma EXCEPT Intra dermal bruises

- **Bleeding** into tissues may continue for some time under circulatory pressure after impact where the extravasated blood tracks along natural/traumatic tissue planes of least resistance, influenced by gravity and body movement
  
  e.g.
  
  fractured jaw --> bruising on neck
  fractured hip --> bruise on thigh
  scalp injury --> black eye
Patterned bruise - intradermal bruising caused by stamping on back with textured clothing intervening.
Color changes and bruise aging:

1. **Red**: 0 - 2 days (hemoglobin with Oxygen)
2. **Blue to Purple**: 2 - 5 days (hemoglobin without Oxygen)
3. **Greenish tinge**: 5 - 7 days (biliverdin)
4. **Yellow**: 7 - 10 days (bilirubin)
5. **Resolution** (Disappearance): 10 - 15 days (range 1-4 weeks)
petechiae

- small bruises ..
- often described as "pin-point haemorrhages" ..
- < 2 mm in size ..
- they can develop and evolve and coalesce ..
- **Compression** may produce petechiae at the level of or above the compressing force (e.g. in strangulation) ..
Fingertip bruises

• Due to gripping by fingertips in forceful restraint as in child abuse --->

• or on the neck of children or adults in manual strangulation --->
Tram-line Bruises

- It appears as two parallel lines of bruising with an undamaged zone in the center, due to a rod shaped weapon.
Love Bites

- small lesions caused by oral suction on the skin.
The Black Eye

• It is peri-orbital haematoma caused by:
  <> fist blow to orbit..
  <> fractured orbital roof (RTA)..
  <> shifting (tracking) from forehead bruise..
Lacerations
• The skin surface is split or torn following blunt trauma, and the force causes the full thickness of the skin to be damaged therefore bleed profusely.

• Common sites of lacerations are those with underlying bony support, such as above the eyebrows, on the scalp and face, or over the knees etc
• Lacerations have ragged wound edges, as they have been torn apart and not neatly incised as in a surgical wound.
• If the wound is examined closely ** the ragged edges can be visualized, along with;
  **crushing and bruising
  **hairs driven into the tissue
• **tissue strands (nerves, fibrous brands, vessels) may cross the depths of the wound.
Medico-legal importance

• Shape and size not usually related to causal but some can give a hint:
  – Blows to the scalp with the circular head of a hummer or a spherical knob of a poker tend to cause crescentic laceration.
  – Weapon with square or rectangular face such as the butt of an axe may cause laceration with a Y-shaped split at its corners.

• Rarely self-inflected.
• Trace evidenced in wound (rust or dirt).
Incised Wounds…

Incised wounds are sharp cut-like injuries, made by knives or broken glass etc. The edges of the wound will vary according to the nature of the cutting edge of the object. They might be self-inflicted (unlike lacerations).

They are of 2 types:
**Slash wounds: length > depth. they are not as serious as stab wounds.
**Stab wounds: depth > length
**Stab wound**:

- These are wounds where the depth of injury is greater than the length. They penetrate more deeply than slash wounds and tend to come into contact with vital organs in the chest and abdomen.

- Penetrating injuries can be caused by any long object, which can penetrate the skin, but are more usually due to knives.

- Stab wounds can be made with minimal force. The faster the stabbing action, the easier it is to penetrate skin.
<table>
<thead>
<tr>
<th><strong>Lacerations</strong></th>
<th><strong>Incised wounds</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Trace evidence</td>
<td>Clean</td>
</tr>
<tr>
<td>Shape is not according to causal agent</td>
<td>Shape is according to cause</td>
</tr>
<tr>
<td>Ragged edge</td>
<td>Everted edge</td>
</tr>
<tr>
<td>Rarely self-inflected</td>
<td>May be self-inflected</td>
</tr>
</tbody>
</table>
• The length, width and thickness of the blade.
• Whether it is single or double-edged.
• The nature of the back edge in a single edged knife (for example, serrated or squared-off).
• The face of the hilt guard adjacent to the blade.
• Any grooving, serration or forking of the blade.
• The sharpness of the edge and especially of the extreme tip of the blade.
type of wounds have the following features;

- are usually slit-like, but when the object is removed the skin contracts slightly, leaving a wound that is slightly shorter than the blade width. The centre of the wound often widens muscle and skin contracture around the wound often obscures the size of the knife blade. the size of the wound depends upon the depth of penetration of the knife.
• self-inflicted injuries

• Cuts are usually superficial, multiple and parallel.
• In right handed people most of injuries are on the left side

• Most deliberate self-inflicted injuries are caused by those with psychiatric or mental health issues, or in association with stressful situations and anxiety.

Staging assault for attention-seeking and similar motives.
• To deliberately implicate others in criminal acts.
• For financial gain (e.g. insurance fraud).
features of suicidal knife wounds:
1- certain sites: throats, wrists and the front of the chest
2- they are often multiple, but there is usual cut that is deep.
3- deliberate cutting of the wrists is rarely effective as a sole method of suicide but it is a common injury
5- suicidal injury of the chest are almost always stab wounds
6- stab wounds are common in suicide
Defense Wounds

an injury received by the victim of an attack while trying to defend against the assailant. Defensive wounds are often found on the hands and forearms, where the victim has raised them to protect the head and face or to fend off an assault, but may also be present on the feet and legs where a victim attempts defense while lying down and kicking out at the assailant.
Firearm Injuries
Types of firearm weapons
- Long & Short
- Non-rifled: only long
Rifled: short and long
Wounds due to rifled weapons

Usually cause both an entrance and exit wound. There are exceptions, in which the bullet is retained within the body because it did not possess enough energy to complete the passage.

Entrance and exit wounds of rifled weapons
Wounds from shotguns:

The following are the main components found in a shotgun wound:
1) Lead pellet
2) Soot in the form of smoke and debris
3) Propellant particles unburnt and burning
4) Gases
5) Carbon monoxide (pink tissue discoloration)
6) Wads either cardboard or plastic
7) Fragments of the cartridge case
Types of Entrance wounds:
1) Contact wound
2) Near discharge wound
3) Intermediate range wound
4) Long range wound
• **Contact Gunshot Wound:**
  - Are circular unless over a bony area such as the head, where gas splitting may occur.
  - There may be a muzzle mark if pressed hard against the skin.
  - If not pressed tight to the skin, there might be local burning of the skin and the hair.
  - Surrounding bruising is possible.

  The barrel has contacted the skin, and the gases released have passed into the subcutaneous tissues, causing the stellate shaped laceration.

- **Carbon monoxide:** combines with hemoglobin and myoglobin to give a pink coloration but the tissue will be black inside. The wound will be regular and the wad will be inside the wound.
2) The close discharge (Near contact): < 15 cm
- There is no muzzle mark.
- Burning of hair around the wound.
- Burning of the skin with hyperemia or blistering.
- Tissue within and around the wound is cherry pink due to CO. Smoke soiling or soot staining from carbon deposition
- The wad will be in the wound.
- The wound will be circular if the weapon is held at a right angle and elliptical if slanted.
Intermediate Gunshot Wound - powder tattooing
( rat-hole)
• Long range > 2 m
  - No burning or smoke staining
  - > 2 m, the number of satellite pellet holes will increase around the main wound
  - > 6-10 m, no central hole, It is rarely fatal
Exit Wound: slit-like exit wound. No powder or soot. Could be mixed up with a stab wound

- The exit wound of a bullet is everted with split flaps causing satellite appearance
- There is no burning, smoke or powder soiling
- If the bullet has been distorted, the exit wound may be irregular, multiple and larger in size
## Differences between inlet & exit

<table>
<thead>
<tr>
<th></th>
<th>Inlet</th>
<th>Exit</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Size</strong></td>
<td>Small</td>
<td>Large</td>
</tr>
<tr>
<td><strong>Edges</strong></td>
<td>Inverted</td>
<td>Everted</td>
</tr>
<tr>
<td><strong>Regularity</strong></td>
<td>More regular</td>
<td>Less regular</td>
</tr>
<tr>
<td><strong>Powder marks</strong></td>
<td>Present</td>
<td>Absent</td>
</tr>
<tr>
<td><strong>Beveling</strong></td>
<td>Internal</td>
<td>External</td>
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</tbody>
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Factors affecting wound healing:

- Blood supply.
- Infections.
- Age.
- Site of wound.
- Nutritional status.
- Inter current diseases.
- Drugs: corticosteroids, immunosuppressive, radiotherapy, chemotherapy.
Complications of wounds:

- Infection and sepsis.
- Bleeding.
- Hypovolemic shock.
- Injury to internal organs.
- Formation of scar.

Causes of death due to wound

- Injury to a vital organ eg: brain.
- Sever hemorrhage.
- Shock.
- Pulmonary embolism.
- Septicemia.
- Renal failure due to rhabdomyolysis (crush syndrome).
The End
and
Thank you