

**FORENSIC MEDICINE**

Notes compiled by PJ Louw for LLB from the UNISA Study Guide & other material. Whilst care has been taken to ensure accuracy you are advised to also verify facts independently.

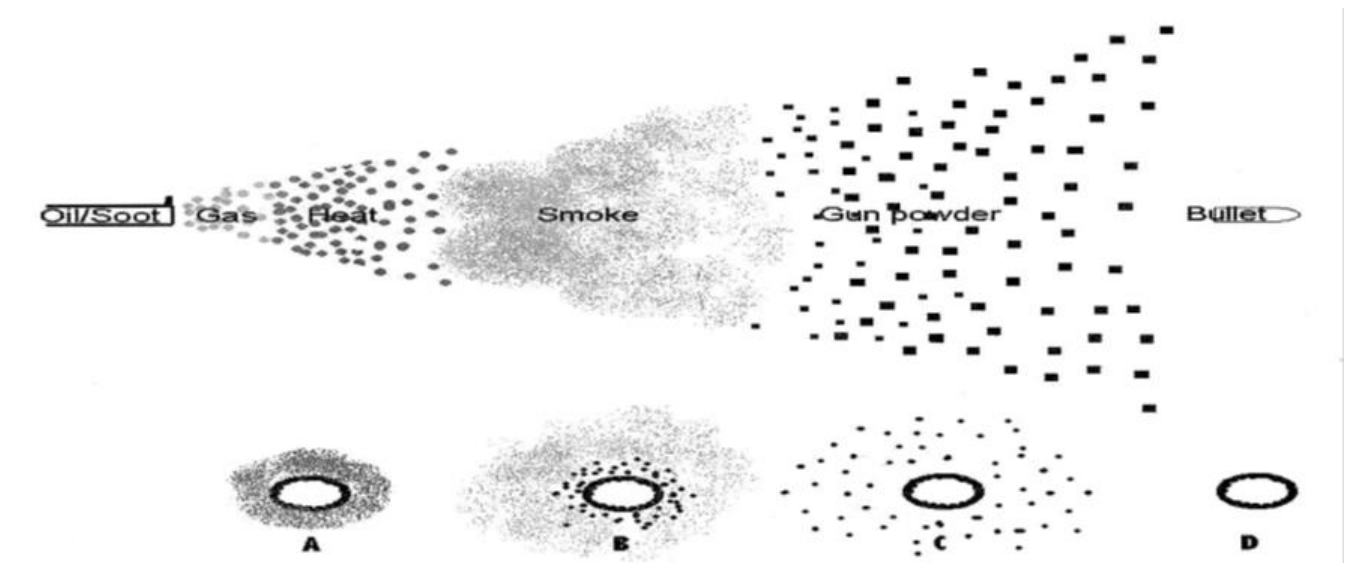
**FIREARM INJURIES**★ **Barrel rifled**

- spinning movement given to projectile {**Hand arms** → Pistols / Revolvers
- spin stabilises projectile in flight {**Shoulder arms** → Rifles / Machine guns

★ **Smooth-bore firearms** → no grooves {**Shotguns**

- **gas pressure** drives projectile along barrel → projectile soiled by oil & gas in barrel

**Correlate products produced during firing of cartridge with possible effect & appearance on skin of victim**



**A to C** → **intermediate wounds**

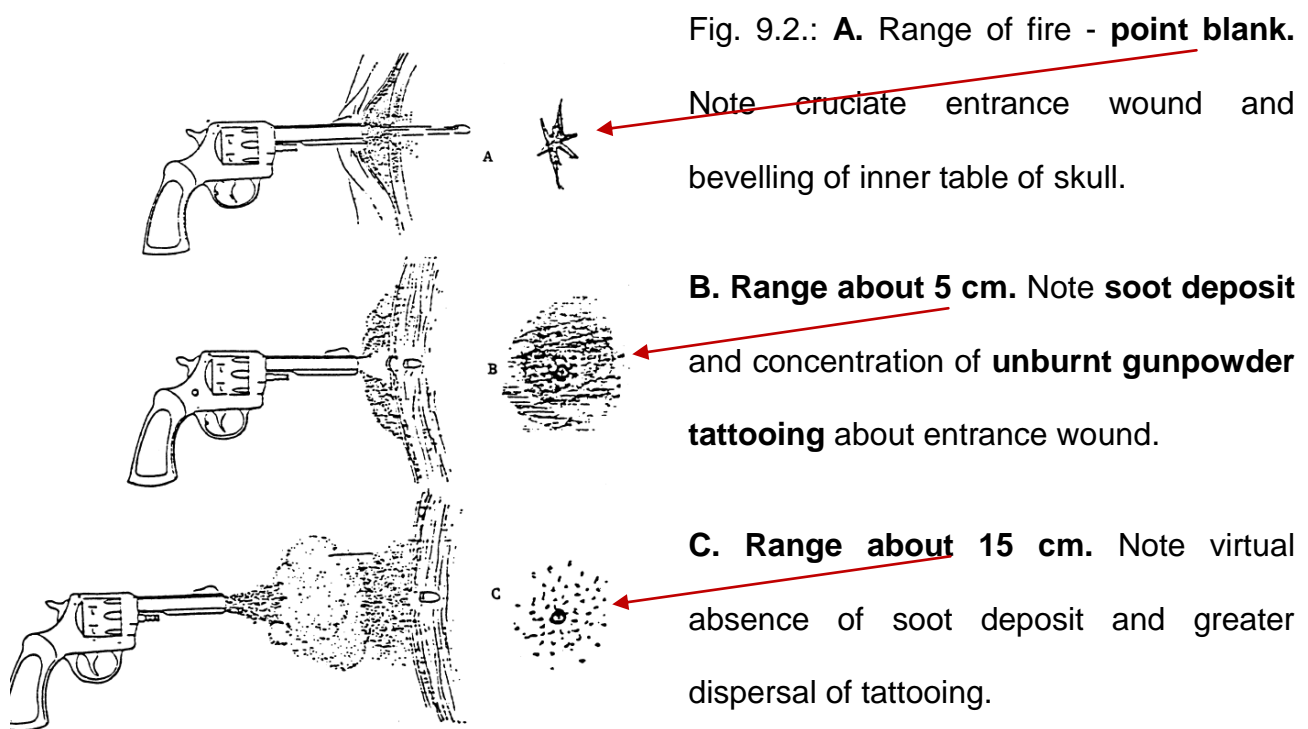
**D** → **distant wound** (usually more than 75 cm from muzzle)

**(30) Discuss cutaneous\* entrance wounds due to firearms?**

(\*Of, relating to, or affecting the skin).

**CUTANEOUS (SKIN) ENTRANCE WOUNDS CAUSED BY RIFLED FIREARMS**

- » Number of **products released** when shot is fired → **Oil & soot / Gas / Heat / Smoke / Gun powder / Bullet**
  - » **Bullet / projectile coated with oil or soot** which may be present in barrel
  - » **Products travel certain distance from muzzle** → Burned / Partially burned powder particles travel furthest
- Important to note** → appearance of wound will differ with different firearms
- Each case to be compared with relevant firearm by means of ballistic tests
- » **Shot fired through clothes** - some features will be visible on clothing



### 1) **Entrance wounds**

- » **round or oval with abrasion ring** where bullet abraded skin during entrance

#### Entrance wound **shape**

- » (round / oval / star-shaped / cross-shaped) must be described precisely

#### Entrance wound **size**

- » must be described precisely

## 2) **Abrasion ring**

- » **caused by projectile at entry** when outermost layers of epidermis are stripped away

### **Wider area of abrasion**

- » located on side of entrance wound **closest to gun**

## 3) **Bullet strikes....**

- » **at angle (perpendicular\*)** (\*It just means **at right angles (90°)** to).

produce **round entrance wounds with abrasion ring**

- » **at acute\* angles** (An **acute Angle** is **less than 90°**)

produce **oval entrance** wounds with asymmetrical abrasion ring

## 4) **Cutaneous injury & features**

**Soiling/abrasion ring** → should be accurately measured recorded

**Circular wound** → requires only diameter measurement

**Elliptical wound** → measured across widest & narrowest diameters

**Peripheral fouling or stippling** → due to unburnt powder residues TO be specifically noted

### » **Concealed & unusual entrance wounds**

- **Possibility** of ent/wounds in **concealed or unusual sites** **always** be **borne in mind**

- **Injuries** which **do not look like gunshot wounds** can be difficult to interpret

- **Similar to gunshot wounds** I.E. if victim was **beaten with nail-studded plank**

## **CLASSIFICATION of cutaneous gunshot ENTRANCE WOUNDS**

A) **CONTACT**

B) **INTERMEDIATE**

C) **DISTANT**

- DEFINITIVE FACTOR**
- **determining appearance** of cutaneous entrance wound)
  - **muzzle-to-skin distance**
- ESTIMATES of firing range**
- **cannot be made accurately unless**
  - **exact type of firearm** is known - and -
  - **ballistic experts** firing **test shots** at varying distances under controlled conditions

### INTERMEDIATE ENTRANCE WOUND WITH FIREARM PERPENDICULAR TO SKIN

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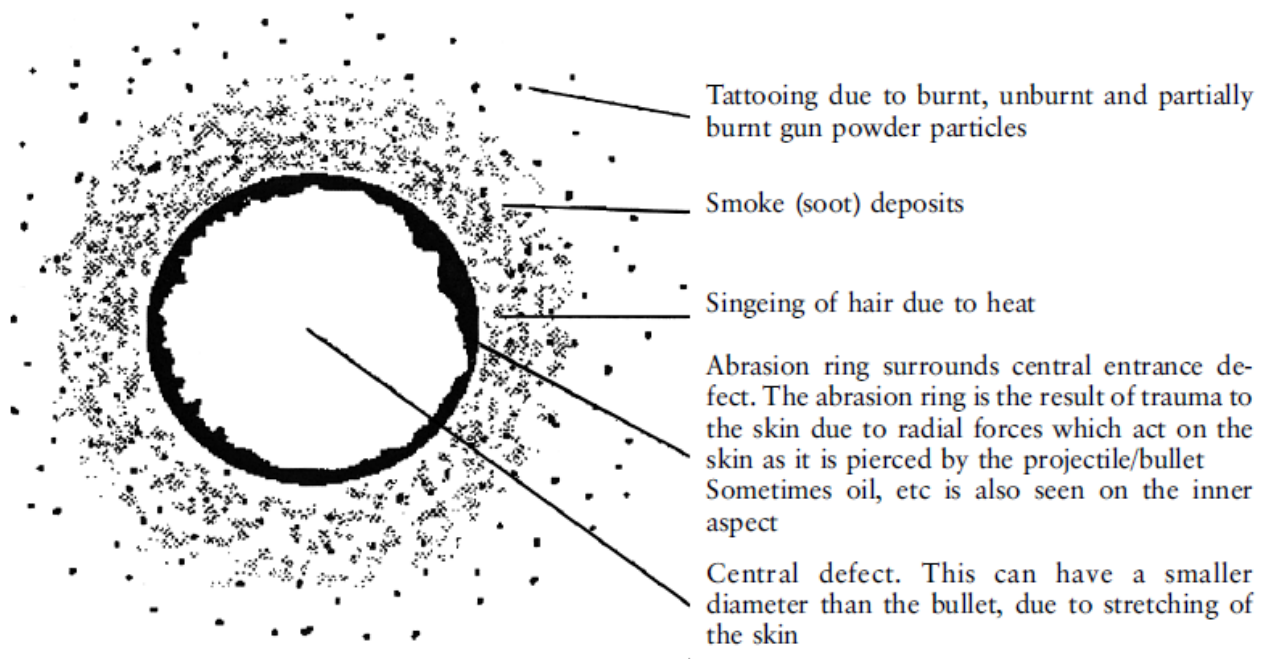


Fig 9.3. The appearance of an intermediate cutaneous entrance wound with the barrel 90 degrees (perpendicular) to the skin. As the unburnt and partially burnt powder particles travel the furthest, their distribution on the skin is therefore the widest.

**(30) Discuss cutaneous\* entrance wounds due to firearms?**

(\*Of, relating to, or affecting the skin).

**CUTANEOUS (SKIN) ENTRANCE WOUNDS CAUSED BY RIFLED FIREARMS**

## A) CONTACT WOUND

- **Point blank** - Cruciate\* entrance wound (\*cross-shaped. \*star-shaped)
- Margins of skin perforation charred by flame from muzzle
- Abraded border soiled with powder residue
- Surrounding abrasion ring of uniform width with
- Muzzle imprint resulting from expansion of subcutaneous tissue when gas is blown into tissue - elevating skin surface & pressing it tightly against muzzle.

**Discuss unique appearance of CONTACT FIREARM ENTRANCE WOUND to head?**

### CONTACT ENTRANCE WOUND of the HEAD

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**If the muzzle is held tightly against the scalp**, the gases, heat and other products of

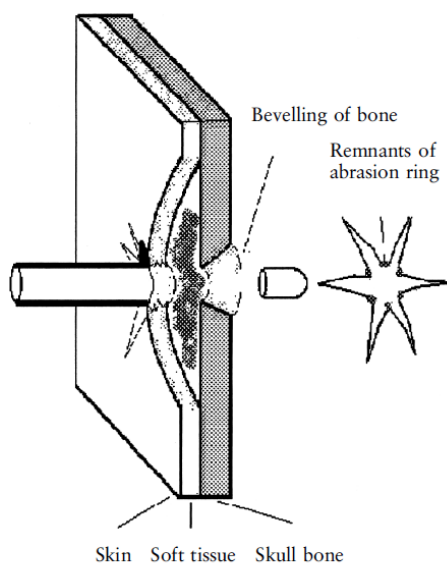


Fig 9.4.

Stellate entrance wound. Ballooning of skin due to gas in soft tissue, with subsequent tearing of overstretched skin.

All the components of combustion are expelled into the underlying soft tissue.

The underlying bone shows bevelling.

combustion cannot escape. The gases will elevate the skin from the underlying skull, and this will result in tearing forces at the site of entry, with a stellate or star-shaped wound. All the products of combustion will be visible in the wound, including a cherry-red

appearance due to carbon monoxide. When the bullet passes through the skull, it bevels (chips away) the opposite aspect of the skull bone.

- **Contact-range entrance wounds to scalp are star-shaped lacerations**
  - » due to expansion of explosion gases between scalp & skull & within cranial cavity
  - » result in tearing forces at site of entry
- **Explosion skull fractures** may produce **bone fragments** which can act as **secondary missiles**

- **All products of combustion will be visible in wound**
- **Direction of projectile through skull can be readily determined**
  - » **ENTRANCE** into bone will be **sharply cut & about same diameter as projectile**
  - On inner table bone will exhibit **beveling effect**
  - » As projectile **EXITS** skull wound on outer table will be **bevelled**

## **B) INTERMEDIATE WOUNDS (Medium distance)**

### **(13) Discuss**

appearance of **ENTRANCE** wound of skin sustained **by rifle fired 25cm from body?**

- **at range ± 5cm** - soot deposit & concentration of unburnt gunpowder **tattooing about entrance wound**
- **at range ± 15 cm** - absence of soot deposit & **greater dispersal of tattooing**
- **Muzzle-to-target distances within range of muzzle blast**
  - » target & muzzle are NOT in contact
- **Maximum muzzle-to-target distance to cause dermal damage & soiling**
  - » vary to type of gun & ammunition
- **Handguns & ammo in civilian homicides**
  - » NO powder deposit on target at ranges < than 50 to 75cm
- **Unburnt & partially burnt powder particles travel furthest** → distribution on skin is widest

## **C) DISTANT WOUNDS**

- **Defect where bullet entered skin**
  - » with surrounding **abrasion ring evident**
  - » **range to about 3m in case of SHOTGUNS** – massive tissue disruption close to point of penetration

## EXIT WOUNDS

### CUTANEOUS (SKIN) **EXIT WOUNDS** CAUSED BY RIFLED FIREARMS

Diagrammatic representation of a wound penetrating the head, and which was caused by a firearm projectile. Note the **entrance wound (X)** and the bevelling of the inner

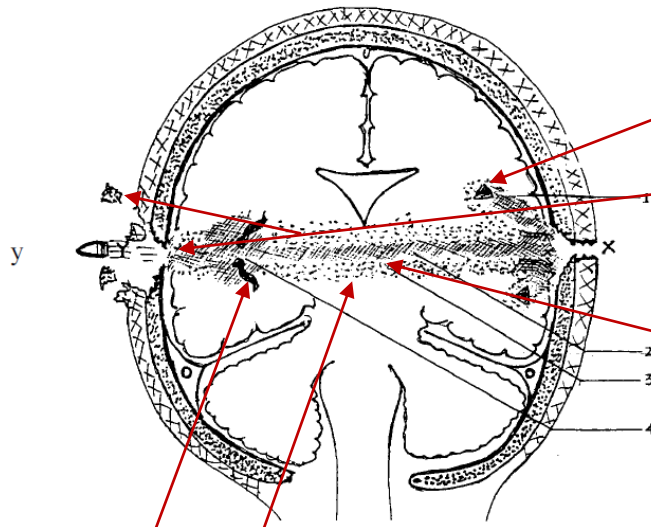


Fig 9.5. Cross section of the head

table of the skull and the **secondary bone missiles (1)**, which cause brain damage, and the converse picture at **the exit (Y)**, and the damage to the scalp caused by the breaking away of the bone chips from the outer table of the skull. Besides the damage caused directly by the **passage of the projectile (2)**, note also the secondary damage caused by the

**percussion waves** set up by the projectile (3), and the damage caused by the **rupture of an artery in the path of the projectile (4)**. On occasion, bone chips may also rupture such vessels.

### EXIT WOUNDS USUALLY LARGER THAN ENTRANCE WOUNDS

#### ☆ 2 x Factors acting individually or together:

##### 1) **Tumbling of missile**

- missile turned sideways with larger missile diameter

##### 2) **Bullet deformation**

- due to striking hard object (bone) causes flattening & larger missile diameter

#### » **Bullet fragmentation** major cause of **tissue disruption**

- close connection between large exit wounds & bullet fragmentation

#### » **Greater missile's velocity** on exit

- the larger & more jagged the exit wound

- » Limits of **elasticity of dermis & epidermis** are exceeded
  - produced by **stretching force applied** to skin from it's under surface
  - causing **surface defects** that vary in shape & configuration (may be stellate / cruciate (crucifix) / round / oval / linear cutaneous-lacerations)
- » **Skin edges** often inside-out & shreds of underlying flesh may extrude through defect
- » **Characteristic features of dermal entrance wounds**
  - ABSENT from exit wounds
- » **Marginal abrasion ring may surround exit wound**
  - where wound is located beneath or pressed against firm surface (leather belt / wall / ground)

**GUNSHOT WOUNDS CAUSED BY SMOOTH-BORE FIREARMS (Shotguns)**

**Shotguns & their ammunition DIFFER FROM rifled weapons & their ammunition**

**DEFINITIVE FACTOR**

- determining characteristics of shotgun injuries
- range / barrel diameter / size & number of pellets in shell

**Explosive effect & burns created by muzzle flame**

- can cause additional damage if sufficiently close

**Additional trauma may result**

- from wadding striking victim (unique feature to shotguns)

**Wadding / Plastic casing** usually enter wound when **muzzle-to-victim distance** is less than 150 to 180mm      SIMILAR to single-bullet entrance

**Contact & close-range cutaneous shotgun ENTRANCE wounds**

- round or oval - depending on angle between muzzle & skin
- Smoke / Powder residue with scorching
- Marginal abrasion surrounding entrance wound present



## Contact shotgun wounds to head

- commonly cause **extreme mutilation**

## Close-range shots (up to 120 to 150mm)

- wound margins show abrasion + scalloped defects

## Distance shots

- central defect becomes smaller & pellet wounds become **numerous as pellets fan out**

### A rough estimate

- usually accepted that pellets will disperse 2,5 to 3,0cm for every meter

## SUICIDE WOUNDS

### 1) Found in **classic locations**

- ➔ MOST OFTEN - Temple / Anterior left chest / Roof of mouth / forehead
- ➔ OCCASIONALLY - Epigastric / Below chin
- ➔ EXTREMELY RARE - Suicide gunshot wounds of limbs

### 2) Usually **contact or close-range wounds**

- » **Multiple firearm wounds** → do not necessarily rule out suicide

## HOMICIDE GUNSHOT WOUNDS

### 1) Found on **any part of body**

### 2) Mostly **intermediate** or **distant wounds** (*beyond arm's reach*)

### 3) **Contact & close-range** wounds found in **homicide cases**

- » may be difficult to interpret

### 4) Wounds found **on face / back / any inaccessible part** of body

- » presumed to be homicide wounds
- » until accidental infliction definitely ruled out

## HOMICIDE GUNSHOT WOUNDS

Examination of firearm entrance wound shows **oval-shaped central defect** surrounded by **irregular abrasion ring**, which is **wider on right-hand aspect of wound**. **NO signs of soot deposits or singeing/burning of skin**, but **irregular distributed tattooing present** with more concentrated distribution over right-hand aspect compared with left side. **What conclusions can be drawn?**

**2 findings relate to direction & distance**

- (1) direction is from right to left
  - (2) distance is approx. an arm's length (50±75 cm)
- **Test / Experimental shots must ALWAYS be fired with same firearm & type of ammunition**

Examination of **shotgun shooting** accident shows **central defect with cremated margin surrounded by smaller individual entrance wounds**. Distance between peripheral wounds is 30 cm. **From how far was firearm fired?**

- **Pellets disperse approx. 3cm for every 1 meter**
  - In this case - distance therefore roughly  $30/3 = 10$  m
- **Experimental shots essential**
  - barrels & muzzles of shotguns vary
  - distribution of pellets may also vary

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### Forensics: Gunshot wounds

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**General....**

- **Entry wounds are categorized based on range**

**Contact:** muzzle is pressed against the skin when fired

- **In areas of “loose” skin** (abdomen, chest): **circular wound** with **blackened, seared skin margins**
- **On head, where the scalp is tightly covering the skull**, entry wounds can have several **different appearances**
  - **Round wound** with blackened, seared skin margins
  - **Stellate shaped** wound, due to **tearing of skin** from expanding gas dissecting between the scalp and skull
  - **Round wound with muzzle imprint**, also due to gas expanding under the skin causing it to press back against the gun

**Near contact:** muzzle of the gun is held a short distance from the skin (< 1 cm from skin with handguns)

- Appears as **circular wound** with blackened and seared edges that are **wider than seen with contact wounds**

**Intermediate:** defined by the presence of **stippling (“powder tattooing”)** on the skin surrounding the entry wound

- **Stippling** is due to **unburned powder grains** exiting from the gun causing **pinpoint abrasions on the skin**; these are not burns
- **Actual distance** from skin **varies** according to the gun; generally from a few centimeters up to several feet

**Distant:** any distance beyond that which produces stippling

- Appear as **round wounds** with **sharp margins** and an **abrasion ring** on the surrounding skin

**Centerfire rifle wounds:**

- In **contact wounds** of the head with centerfire rifles, there is **massive tissue destruction of the skin, skull, and brain**
- **Full metal jacketed bullets produce less tissue damage** and tend to travel through the body undeformed

- **Semi-jacketed ammunition creates the classic “lead snowstorm”** appearance on x-ray due to peeling back of the jacket as it travels through the body, **releasing numerous small lead fragments** through the body.

### Shotgun wounds:

- Shotgun bullets contain **numerous pellets**
- At **contact range** up to a few feet, the entrance wound is a **single round defect**
- At a range of **3-4 feet**, the pellets begin to **spread out** before reaching the body, producing one **large entry wound** surrounded by **scalloping or several smaller defects** due to penetration by individual pellets
- As the **range increases**, the **central defect becomes smaller** and the number of surrounding pellet holes increases

### Exit wounds:

- Usually **more irregular in shape** than entry wounds
- NO soot deposition, muzzle imprint, stippling, or blackening of the skin edges
- A **shored exit wound** is one in which the **skin is in contact with another object** when the bullet exits; this causes an **irregular area of abrasion** on the skin, **which can be confused with the abrasion ring of an entrance wound**

### Gunshot wounds in bone:

- **In flat bones (i.e. skull)**, entrance wounds are **round** with **sharp margins** and show **internal beveling**: the inner table of the skull is more eroded than the outer table, producing a **“cone” shape in the direction of the bullet path**.
  - **Fragments of bone travel in the direction of the bullet path through the cranial vault**.
  - Exit wounds may be **more irregular** and show **external beveling** (**outer table of the skull is more eroded than the inner table, producing a cone shape facing outward**).
  - In the skull, gunshot wounds often **produce numerous fractures** due to **rapidly increasing pressure as the bullet travels through the skull**
-