



# Firearm Injuries

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A dark grey arrow points to the right from the left edge of the slide. Below it, several thin, curved lines in shades of blue and grey sweep across the left side of the slide.

# Definitions

- ❓ Ballistics (Greek ba'llein: throw): It is the science of projectile motion, and conditions affecting that motion. ❓
- ❓ Forensic ballistics: Science which deals with the investigation of firearms, ammunition and the problems arising from their use.
- ❓ Firearm: Any instrument or device that discharges a missile by the expansive force of gases produced by burning of an explosive substance

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# Velocity

- ❓ Muzzle velocity: The velocity of the projectile as it emerges from the muzzle end. Depending on it, firearms can be of low, medium and high velocity. ❓
- ❓ Striking velocity: Velocity of the projectile at the point of impact. The velocity diminishes as the missile travels ahead to strike the target



# Classification of Firearms

- ❓ Firearms are broadly classified into two categories depending on the type of barrel:
- ❓ i. Rifled weapons
- ❓ ii. Smooth bore Rifles:

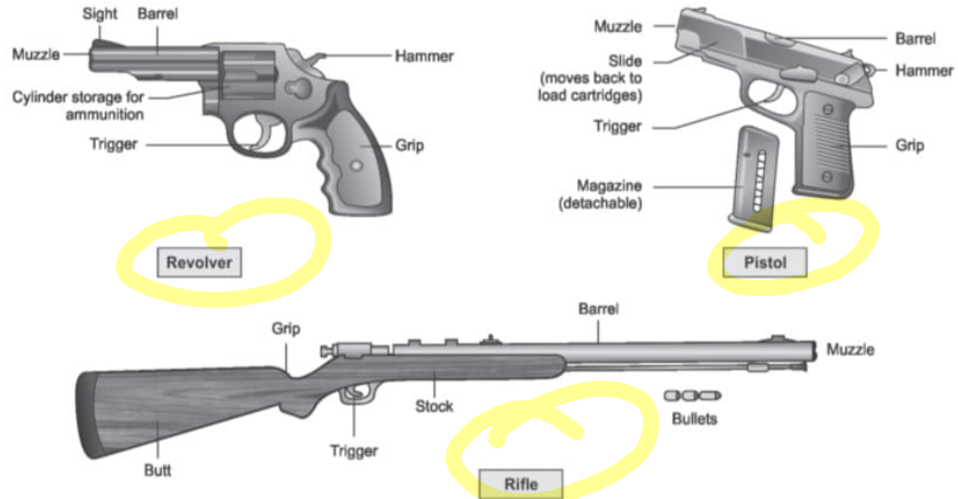


Fig. 12.1: Parts of rifled weapon

# Rifled Firearms

? The bore is scored internally with number of shallow spiral grooves varying from 2 to 22, most common are 4, 5 or 6, which run parallel to each other, but twisted spirally from breech to muzzle end. These grooves are called 'rifling' and the projecting ridges between the grooves are called 'lands'

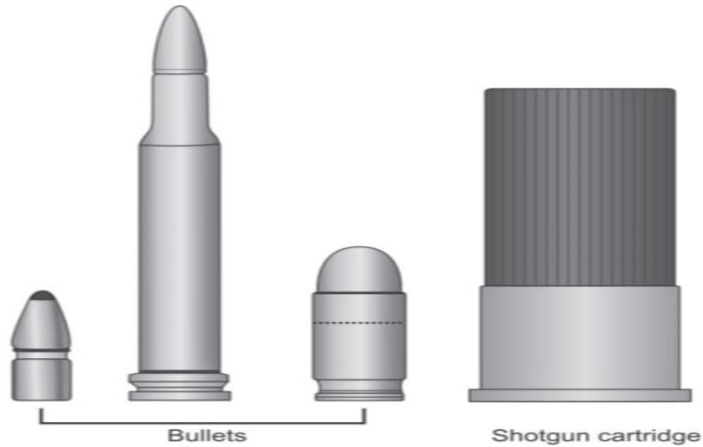
## ? Advantages of rifling

- ? Imparts gyroscopic stability
- ? Increases accuracy and range
- ? Prevents wobbling or tumbling end-over-end
- ? Gives greater power of penetration

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# Smooth Bore Firearms/Shotguns

- ❓ In smooth bore firearms, the bore or the inner surface of the barrel is uniformly smooth. It is intended to be fired from the shoulder, and is designated to fire multiple pellets from the barrel.



**Fig. 12.6:** Cartridges of rifled and shotgun weapons



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- ❓ **Bullet** (French boulette: little ball) is the projectile of a rifled firearm that leaves the muzzle when it discharges
  - ❓ **Cartridge is one unit of ammunition.**
  - ❓ **Cartridge consists of:**
    - ❓ i. Cartridge case with percussion cap containing primer
    - ❓ ii. Propellant charge (gunpowder)
    - ❓ iii. Projectile (bullets/pellets)
    - ❓ iv. Wads (in smooth bore weapons only)9

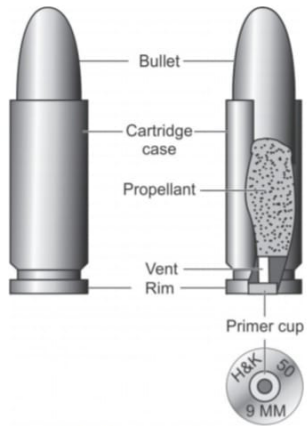


Fig. 12.9: Parts of a rifled cartridge

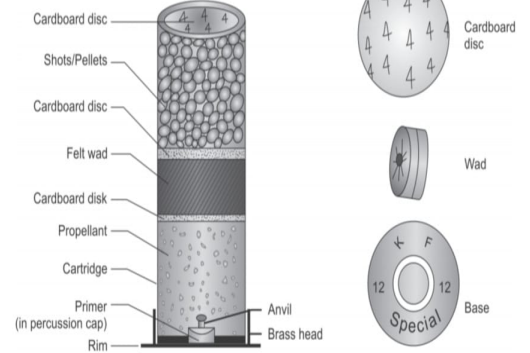



Fig. 12.8: Parts of a shotgun cartridge



# Gunpowders (Propellant Charge)

- ❑ i. **Black powder:** It produces flame, smoke and heat, and consists of granular ingredients, like sulfur, charcoal and saltpeter (potassium nitrate)
- ❑ ii. **Smokeless powder:** It is more effective than black powder as it burns more efficiently and produces much less smoke, resulting in less blackening and tattooing around the entry wound.



? **When the bullet emerges from the barrel, it is accompanied by:**

? i. Unburnt propellant particles

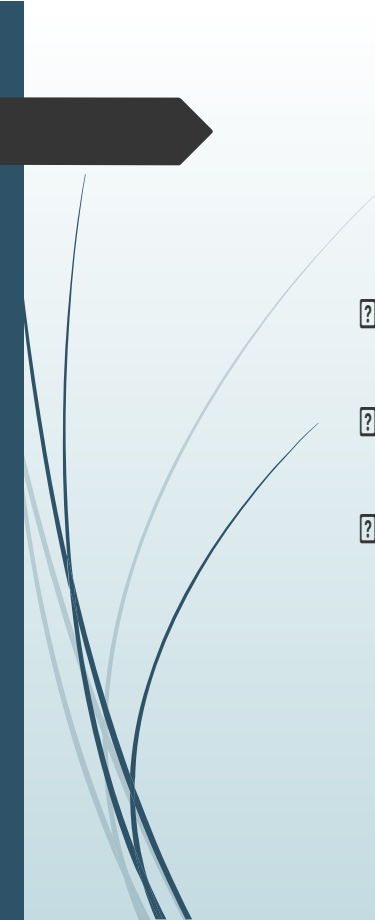
? ii. Partially burnt propellant particles

? iii. Soot from combustion of propellant

? iv. Nitrates and nitrites from combustion of propellants

? v. Particles of primer residue (oxides of lead, antimony and barium)

? vi. Vaporized metal and metallic particles stripped from the bullet and cartridge case



? Gunshot wounds are either penetrating or perforating. ?

? **Penetrating wounds**: The bullet enters an object and does not exit. ?

? **Perforating wounds**: The bullet passes completely through an object.

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# Characteristics of firearm wounds depend upon:

- ❑ Nature of the firearm, whether shotgun or rifle
- ❑ Shape and composition of the missiles
- ❑ Range (distance) of firing
- ❑ Part of the body struck (head or trunk)
- ❑ Direction of firing



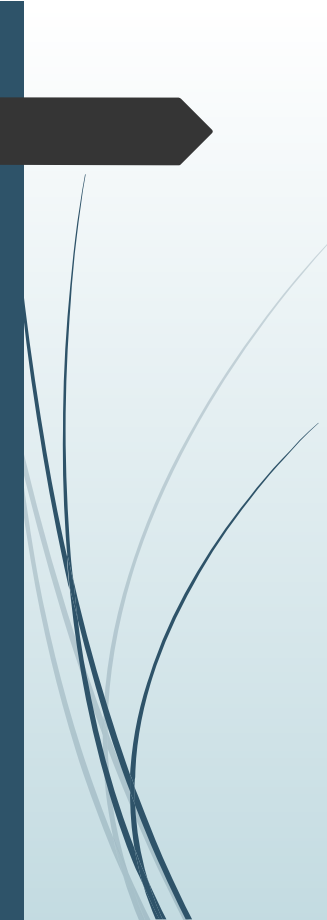
**-Tattooing:**

It consists of unburnt or partially burnt powder particles that are embedded in and under the skin

It consists of numerous reddish-brown punctate abrasions surrounding the wound of entrance

**-Blackening** (soot or smoke soiling/smudging):

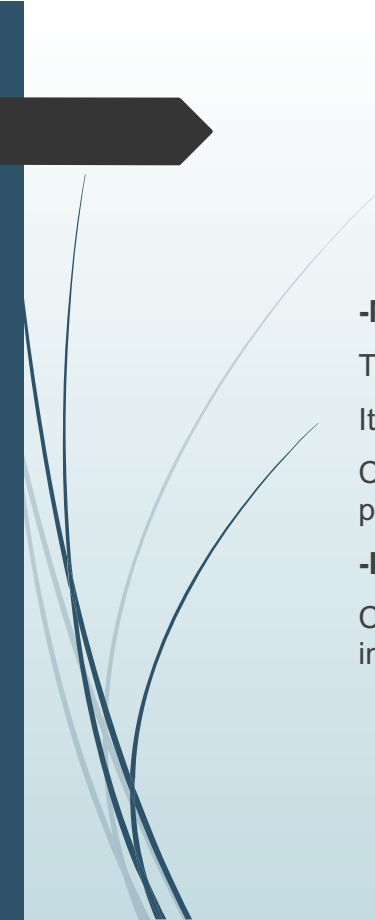
Deposition of powder soot (carbon) produced by combustion of gunpowder.



**-Abrasion collar/ring:**

As the bullet strikes the skin, it first indents and then stretches the skin surface so that perforation takes place through a tense area which produces a rim of flattened reddish-brown zone of abraded epidermis, surrounding the entrance wound





### **-Muzzle/recoil imprint mark**

This is a sign of a contact shot.

Its shape depends on the firearm, the ammunition and the anatomical conditions

Characteristic imprint marks can provide clues to the type of the firearm and its position at the time of discharge

### **-Blowback phenomenon:**

Cruciate, stellate or ragged laceration is seen, especially if there is a thick bone immediately under the skin, such as the skull

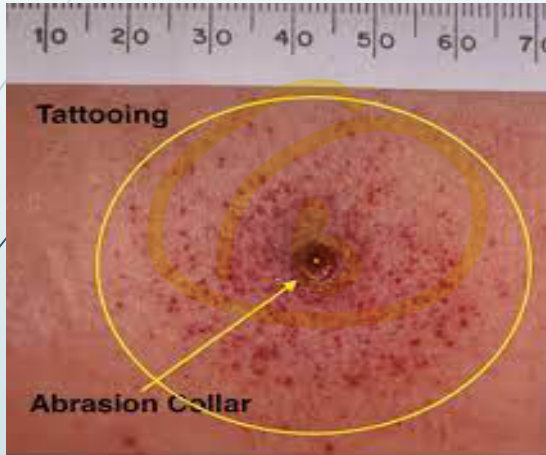


❓ **Back spatter:**

In a contact shot, the muzzle blast and negative pressure in the barrel may suck blood, hair, fragments of tissues and cloth fibers back into the barrel

❓ **Grease/dirt collar (bullet wipe):**

A black/gray colored ring is seen lining the defect, sharply outlined, caused from removal of substances from bullet as it passes through the skin. It consists of bullet lubrication, paraffin, lead from surface of bullet, barrel debris and gun oil from interior of the barrel.



Source: K.J. Knopp, L.B. Stalk, A.B. Storrow, R.J. Tharman:  
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PISTOL MISSILE—LOW VELOCITY



Rifled weapon-Contact Shot

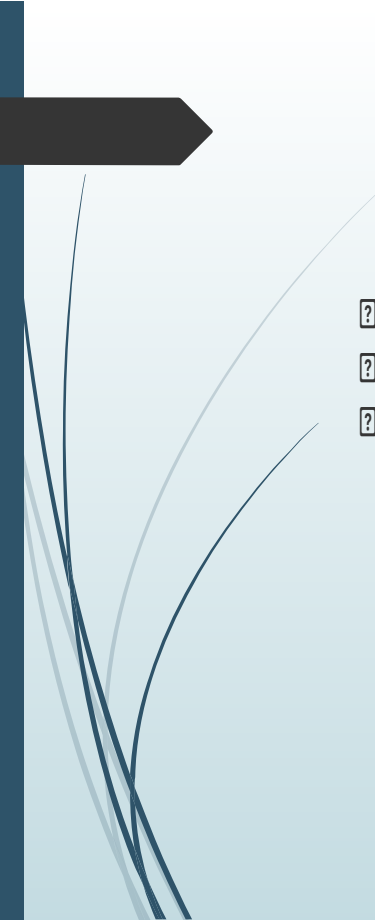




# Characteristics of Rifled Firearms Wounds

## ? Contact Shot

- ? Whole of the discharge containing flame, gases, powder smoke and metallic particles will be blown under pressure into the track taken by the bullet through the body
- ? In case of contact shot over forehead or mastoid region (head) where the bone is thick, entry wound will be **large and irregular**, stellate or cruciform shaped having **everted margins** because of expansion of gas between the skull and scalp
- ? Contact wound over abdomen will show cavitations, because of blast effect.

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- ? Muzzle impression may be present around the wound
  - ? There is little or no evidence of burning, singeing, blackening and tattooing
  - ? Muscles around the track taken by bullet will be cherry-red due to presence of CO.

## ? Close Shot (Flame Range)

- ? Body lies within the range of flame, smoke and powder blast, i.e. within 2–3 inches (5–8 cm).
- ? Entry wound is small and circular in shape having inverted and contused lacerated margins
- ? Skin adjacent to the entry wound shows evidence of grease/dirt collar on the inner zone, and abraded contused collar on the outer zone
- ? Evidence of burning, singeing, blackening and tattooing of the skin in and around the entry wound.
- ? ? Clothings over the part will be burnt from flame of discharge
- ? Hair, in and around, show singeing and will look clubbed
- ? The length of the barrel of a firearm has considerable effect on the pattern of smoke produced on the target
- ? The blood and injured soft tissues in the track will be cherry-red due to CO.



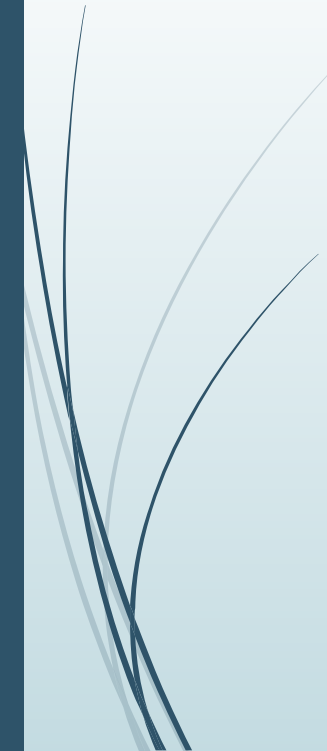


## ? Near Shot (Medium-Range or Intermediate Range)

- ? when the range is within 24 inches (60 cm).
- ? Gunshot entry wounds with powder tattooing, but no soot
- ? Entry wound will be circular in shape, approximately the same size as the bullet, with lacerated, inverted edges surrounded by a narrow zone of grease and abrasion collar, with no evidence of any burning and singeing
- ? Beyond 15 cm, the burning effects of gases and singeing of hair is absent
- ? zone of tattooing will be present around it. In case of handguns, soot is absent beyond 30 cm
- ? . normally beyond arm's length. For handguns, powder tattooing extends to a maximum distance of 18–24 inches (45–60 cm)



## **[?] Distant Shot**

- [?] Gunshot entry wounds with no associated soot or gunpowder stippling are referred to as 'distant' wounds, i.e. range is beyond 2 feet.**
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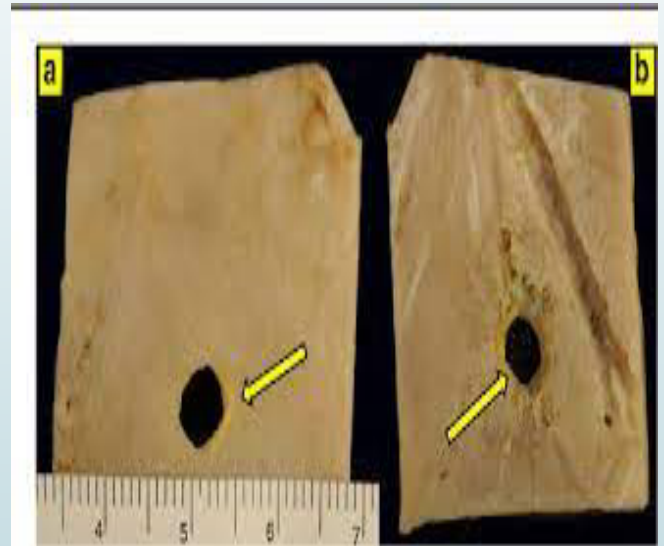
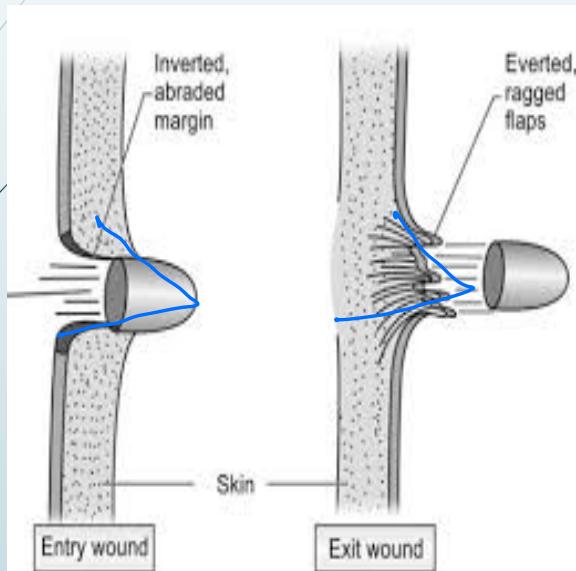
# Exit Wounds

- ❓ Exit wounds, whether they are from contact, intermediate or distant firing, all have the same general characteristics
- ❓ In contact wounds and very close range, exit wound is smaller than entry wound due to elastic nature of the skin. However, as range increases, the size of exit wound also increases.
- ❓ Exit wounds do not show burning, blackening, tattooing, abrasion or contusion collar. The edges are everted, torn or puckered with pieces of contused, hemorrhagic subcutaneous fat or muscle protruding out of the defect



# Firearm Wounds on Skull

- ❓ The entry wound shows a **punched out hole (clean cut)** on the outer table and beveled appearance on the inner table (as it remains unsupported, chipping of the bone occurs).<sup>27</sup> Fissured fracture may radiate from the hole.
- ❓ The exit wound on the inner table shows clean cut hole and beveling on the outer table. The wound is larger than the entry wound due to the deformity and tumbling of the bullet on entering the skull. The beveling helps to assess the angle of fire





# Postmortem Examination

- ❑ Collection of evidence
  - ❑ i. Clothes with trace evidence.
  - ❑ ii. Victim's hair, clothing, fibers and blood.
  - ❑ iii. Gunpowder and other evidence on the hands.
  - ❑ iv. Unspent ammunition and empty cartridges.
  - ❑ v. Gun used in the crime