

FIREARM INJURIES

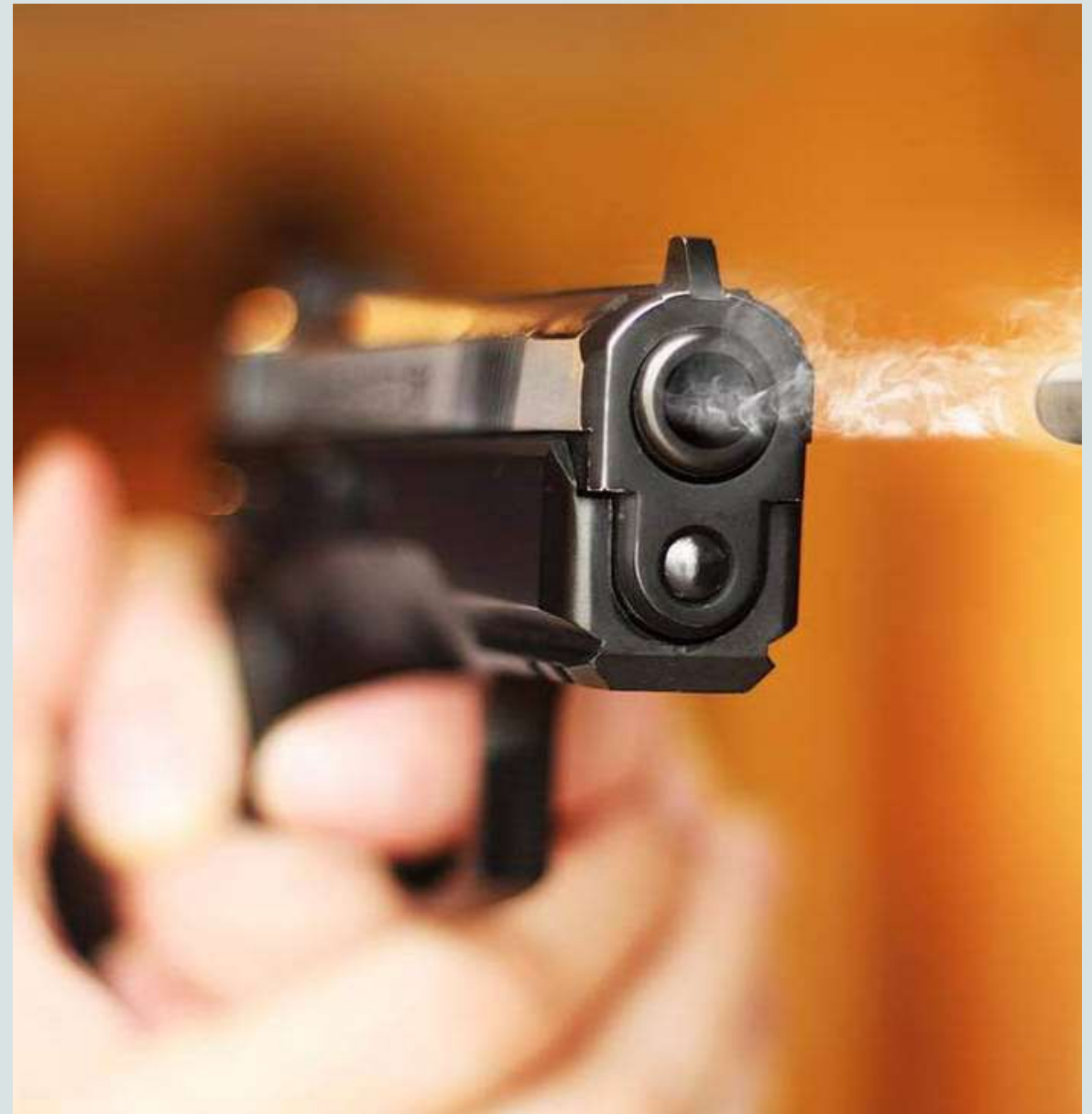


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What is a firearm?

firearm is any weapon which discharges a missile by the expansive force of the gases produced by burning of an explosive substance.

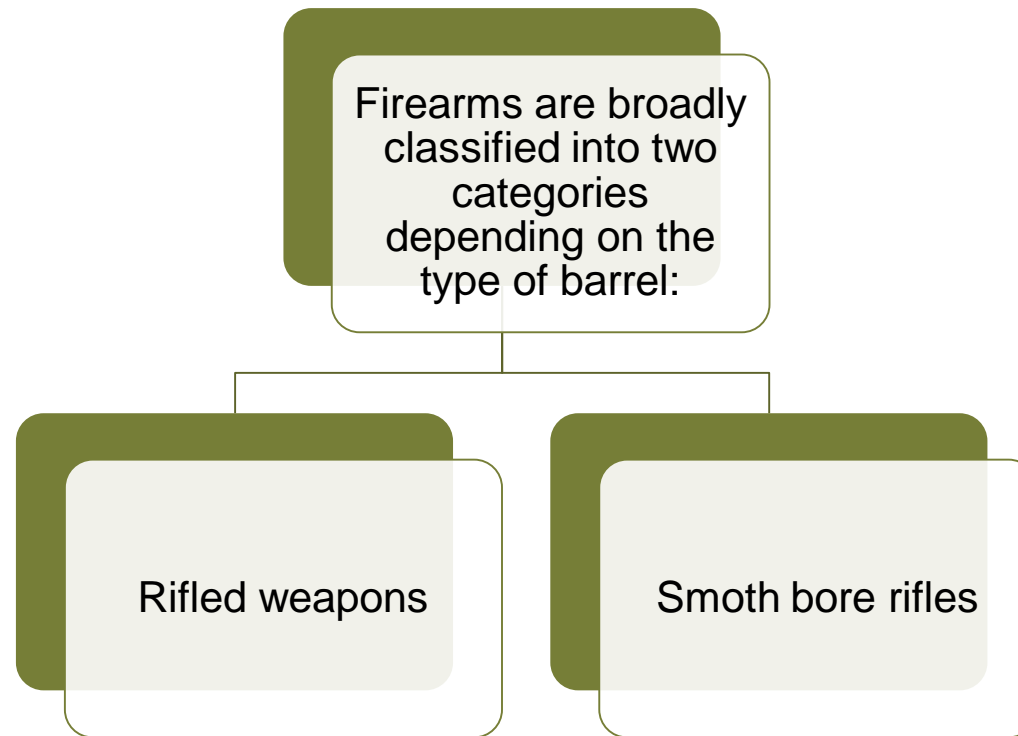


What is ballistics?

Ballistics is the science dealing with firearms, ammunition and the effects from their use

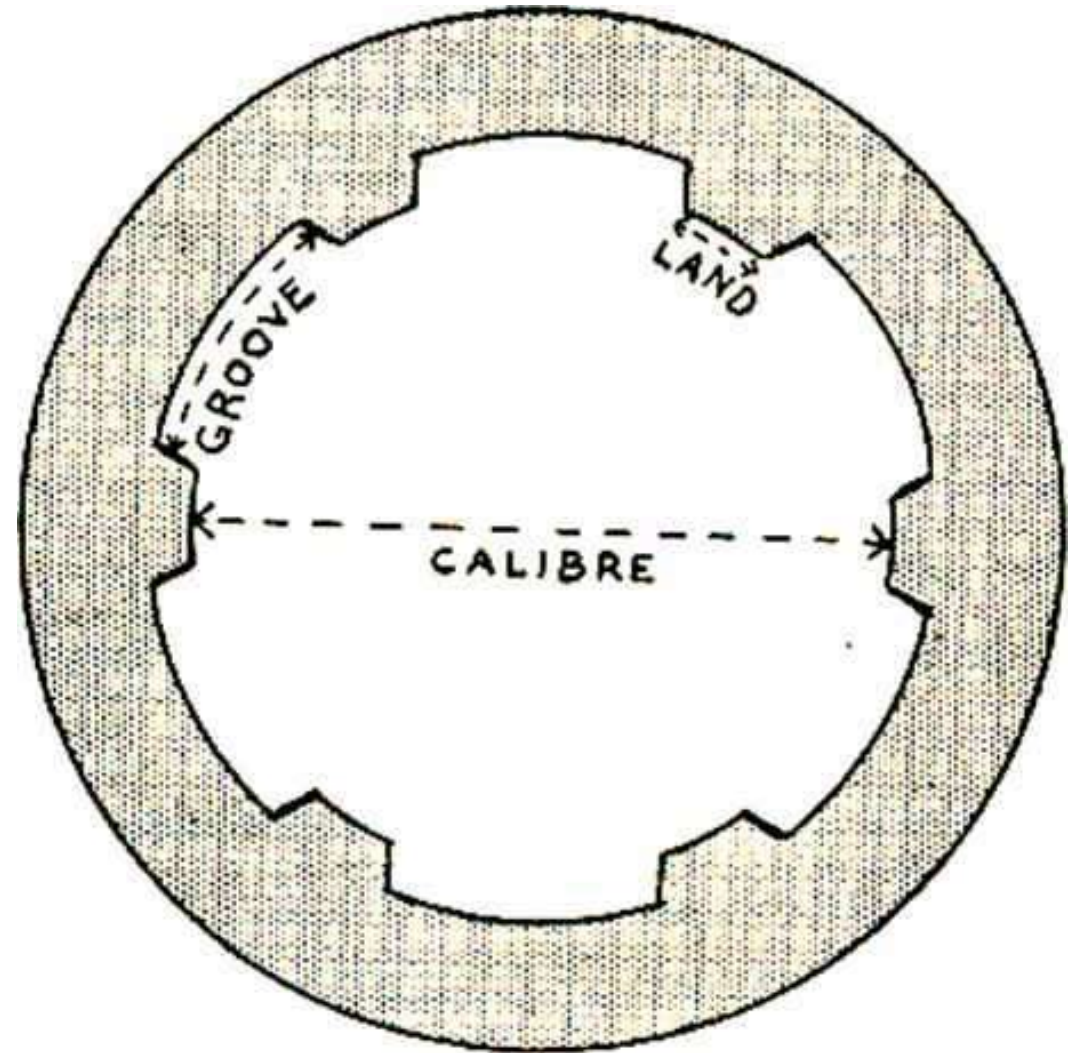
- Proximal ballistics
- Intermediate ballistics
- Terminal ballistics
- Wound ballistics

Classifications of firearms



Rifled Firearm

- Rifling means the inner surface of bore of the weapon from breech to the muzzle end is thrown into spiral grooves, varying from 2 to 22 or more (usually 4-7), which run parallel to each other but are twisted spirally. These 'grooves' are called 'rifling' and the projecting ridges these grooves are called 'lands'.



What does rifling do to the bullet?

Gives the bullet a spinning or spiraling motion.

A greater power of penetration.

A straight course and prevents it from unsteady movement as it travels in the air.

Smoothbore firearm

No rifling	Bore- Internal diameter of	shotgun	Internal diameter of shotgun
expressed by a system k/as -	Gauge	No. of lead balls, each fitting	the bore, which can be made
	from 1 pound (454gm) of	lead	

Smoothbore firearm

- 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.



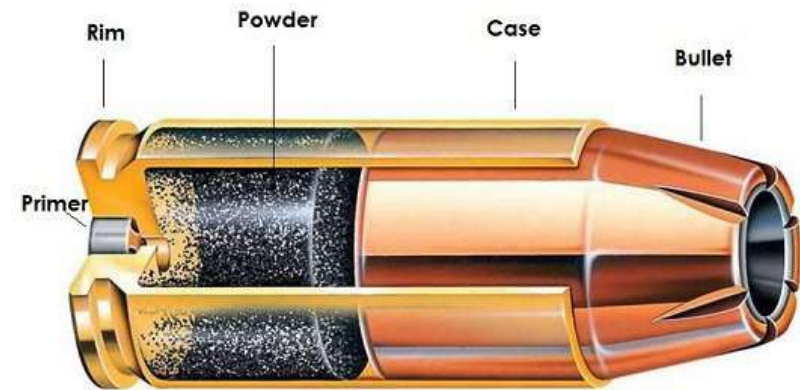
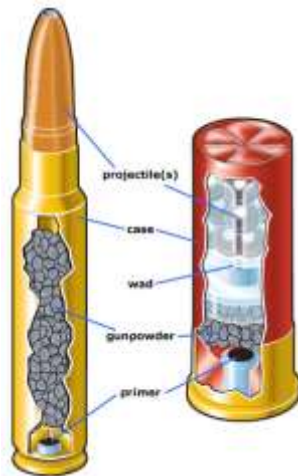
BULLET

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:
- Cartridge case with percussion cap containing primer
- Propellant charge (gunpowder)
- .Projectile (bullets/pellets)
- Wads (in smooth bore weapons only)9

Cartridge



Anatomy of a Cartridge

Gunpowders



BLACK POWDER: IT PRODUCES FLAME, SMOKE AND HEAT, AND CONSISTS OF GRANULAR

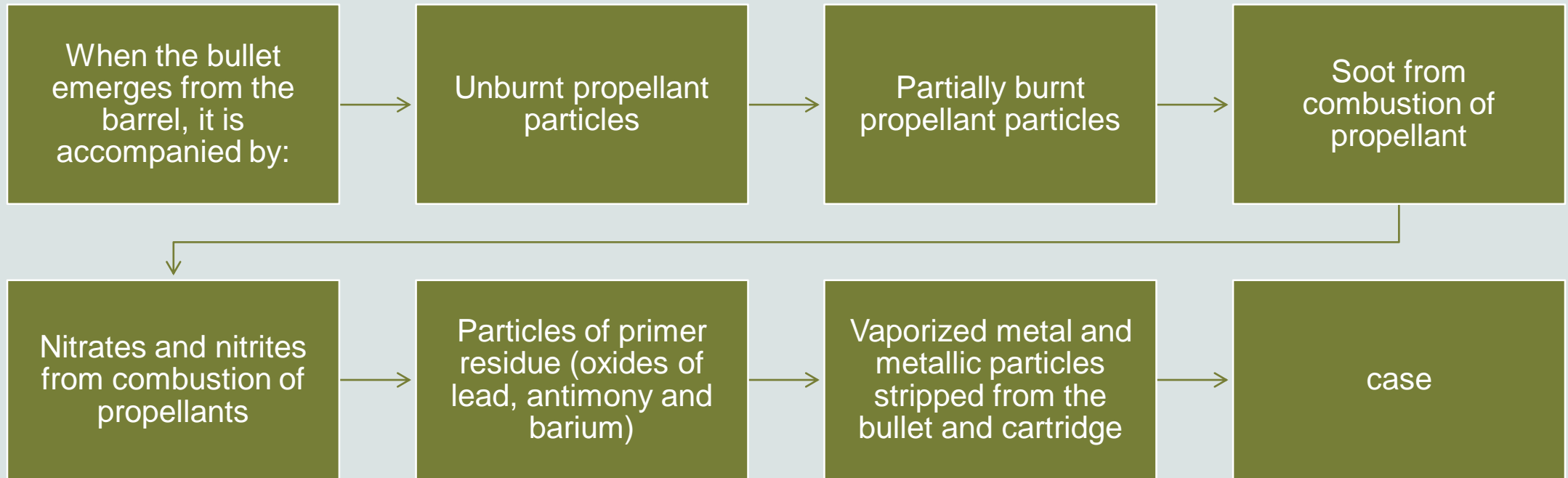


INGREDIENTS, LIKE SULFUR, CHARCOAL AND SALTPETER (POTASSIUM NITRATE)



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.

Gunpowders



Factors responsible for the injurious effects of missile:

1

Speed of the bullet

2

Size and shape of
the bullet

3

.Character of the
missile's
movement in flight

Wounds

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:



1

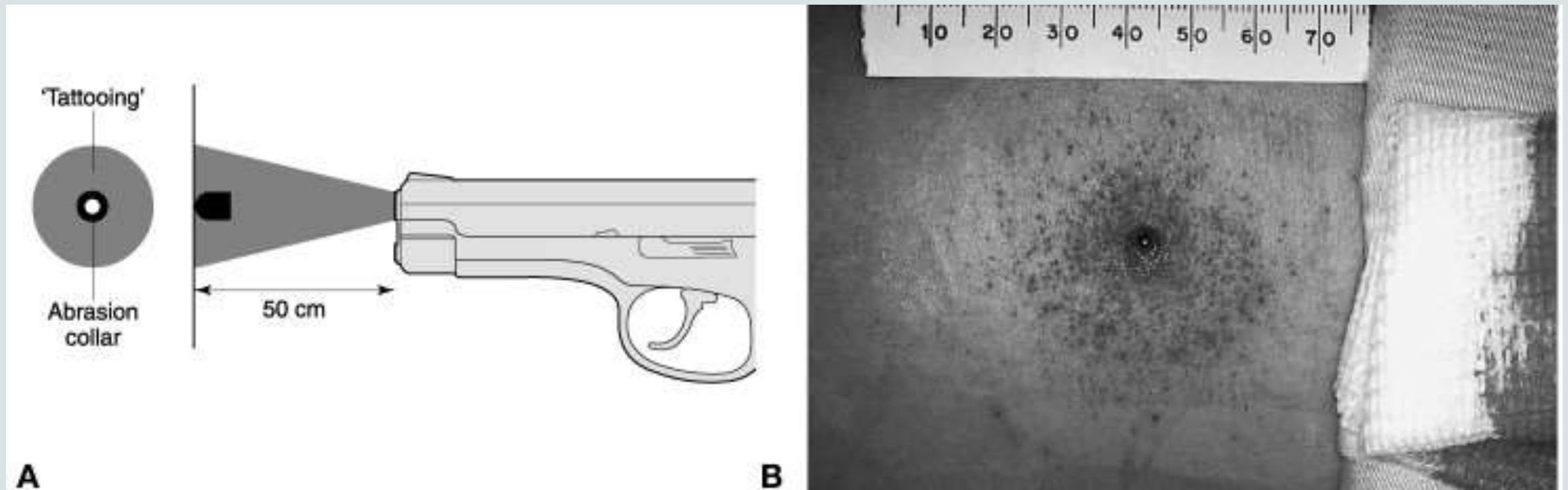
It consists of unburnt or partially burnt powder particles that are embedded in and under the skin

2

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:

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.

Grease/dirt collar (bullet wipe):

Black coloured narrow ring of skin, lining the defect and is sharply outlined from the removal of substances from the bullet as it passes through the skin.

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

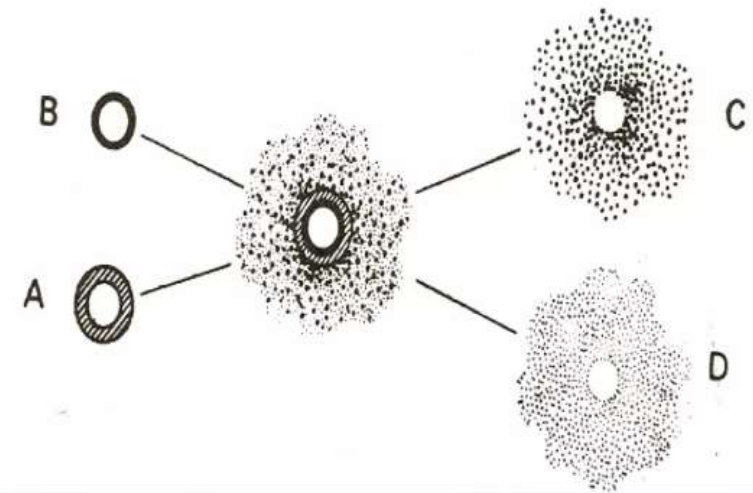
Blowback phenomenon:

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

Back spatter:

Suck of blood, hair, fragments of tissues, cloth fibers back to the barrel.

- (A) abraded collar or contusion ring;
- (B) grease/dirt collar;
- (C) powder distribution (tattoo marks);
- (D) blackening



Classification of Gunshot Wounds

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.

Firearm injury: Entry and Exit wound

Entry wound

1- 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

Rifled wound: Point blank shot, Cruciate/stellate/star shaped when over a dense area like cranial vault (explosive effects of gases), Circular when over thin bone/abdomen with abrasion or contusion collar, Burning, blackening and tattooing are slight or absent, Surrounding hair are singed, Imprint of muzzle end may be found stamped on skin, Tissues saturated with CO and show cherry red color, Diameter of hole + collar = Approx. diameter of the bullet,

Shotgun wound: Large irregular hole (Explosive blast effect), Scorching, tattooing and blackening may be present, Imprint abrasion may be present, Shot enters as a solid mass, Cherry red colored injured tissue, In cranium, large and irregular wound with fissured fractures radiating outwards from the margin.



The abrasion ring, and a very clear muzzle imprint, are seen in this contact range gunshot

2- Close shot (Flame Range): Body lies within the range of flame, smoke and powder blast, i.e. within 2–3 inches (5–8 cm).

Rifled wound: Circular hole surrounded by scorching, singeing and smudging, Abrasion collar, grease collar and tattooing are present.

Shotgun wound: Circular defect with irregular inverted borders, Edges show scorching and blackening, Fairly wide zone of tattooing, Cherry red appearance of tissues, Pellets enter enmasse, Wads and cartridge parts may contribute to the wound.





3- Near Shot (Intermediate Range): here victim is within the range of powder deposition but outside the range of flame (within 60cm).

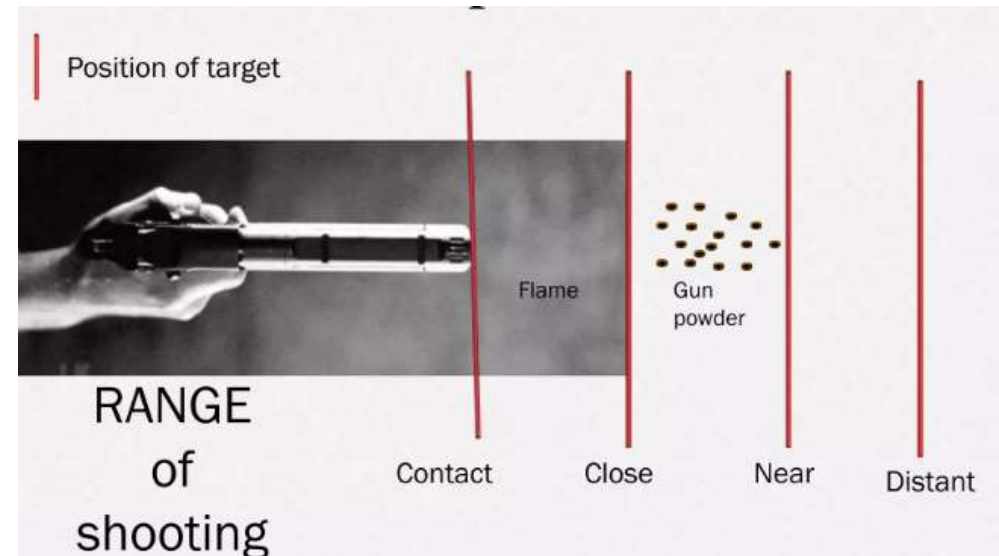
Rifled wound: Circular or oval, Singeing of hair and scorching are absent, Smudging not seen beyond 30cm, Grease collar and abrasion collar are present.

Shotgun wound: Circular or oval, Blackening may be evident around the wound up to a maximum distance of 30cm, Sometimes the wound produces mild abrasions if fired within a range of 30 cm, Tattooing is present over a wide area, The entry wound is approximately 2.5cm in diameter.

4- Distant shot: the firearm outside the range of flame and powder blast.

Rifled wound: Circular with inverted margins, Scorching, tattooing and smudging are all absent, Grease collar and abrasion collar are present

Shotgun wound: Beyond 2m, no burning or blackening, Tattooing is rare, Wads may contribute up to 5m, Significant dispersion of pellets beyond 2m and increases progressively, Beyond 6m central defect diminishes to nothing and lethality is very less.



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.

Entry and exit wounds

Trait	Entrance wound	Exit wound
Size	Smaller than the diameter of the bullet. In close discharge, skin is torn	Bigger than the bullet
Edges	Inverted	Everted, puckered or torn
Bruising, abrasion and grease collar	Present	Absent
Burning, blackening, tattooing	May be seen around the wound	Absent
Bleeding	Less	More
Fat	No protrusion except in contact shot	May protrude
Tissues within and around the wound	May be cherry-red due to CO of explosive gases	No colour change
Approximation of edges	Retains a small central defect	Re-establishes skin's integrity
Fibres of clothing	Turned in and may be carried into the wound	Turned out
Lead ring or metal ring	May be seen around the wound by radiological examination	Absent
Spectrography	More metal is found around entrance wound, if bullet has only passed through soft tissues	Contain more metal if a bone is struck nearer to it.

Postmortem and Anti-mortem firearm

Anti-mortem injuries bleed profusely while postmortem injuries bleed a little unless some blood vessel is punctured.

In anti-mortem injuries the entrance wound is smaller than the diameter of the projectile due to elasticity of skin whereas in postmortem injury the entry wound will be of the same as the diameter of the projectile as skin loses its elasticity after death.

Medico legal Importance

- Death due to firearm injury may be suicidal, homicidal or accidental.

-Tests for the presence of powder residues:

On the skin:

- Dermal nitrate test (Paraffin test, Diphenylamine test, Lung's test, Gonzales' test)

On clothing:

- Walker's test (C-acid test, H-acid test)

Feature	Accidental	Suicidal	Homicidal
Site of entry wound	Any part	Head/Chest	Any part
Range	Close	Contact/Close	Any range
Direction	Any direction	Upward/backward	Usually upward
No. of wounds	One	Usually one	One or multiple
Firearm residue on hand	Present	Present	Absent
Weapon at scene	Present	Present	Usually absent
Location	Anywhere	Usually home	Anywhere
Sex	Usually males	Usually males	Either sex
Motive	Absent	Depression, mental illness	Robbery, revenge

Skull wounds due to firearm

In perforating gunshot wounds to the head, entrance and exit wounds show a typical feature called beveling, distinguishing between entrance and exit

Beveling is a sort of cone shaped bone erosion in the direction of the bullet path through the cranial vault

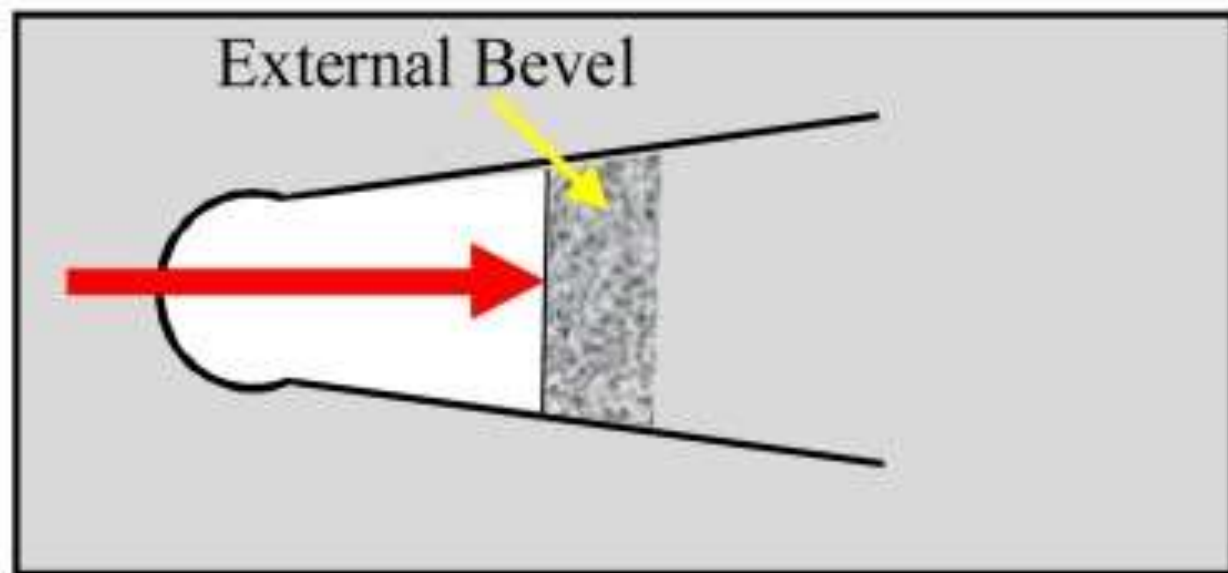
entrance wounds can be round / oval or stellate in shape and show an internal beveling

Exit wounds are usually irregular and show an external beveling

In the skull, gunshot wounds often produce numerous fractures due to rapidly increasing pressure as the bullet travels through the skull

Even if the bullet does not penetrate into the cranial cavity, its energy is still transferred to the bone and central nervous system, resulting in fractures and severe damage

A



B

