



GUNSHOTS AND EXPLOSIONS



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Lesson objectives :

- Introduction
- Doctors duty
- Complications and cause of death
- Types of firearms



Tuleen Badran

Steps to the mechanism of shooting :

step 1: pull the trigger



Step 2 : The firing pin will strike the primer of the CARTIDGE ,this will cause the powder explosives to ignites it inside CARTIDGE creating high pressure gas that propels the bullet to move forward,driving it down the barrel of the gun



firing pin

primer of the
CARTIDGE



Powder



Powder ignited to propel bullet forward



Bullet travelling in the barrel

- Key idea: tissue damage $\neq$ just bullet size — it's how much kinetic energy the bullet gives to the tissues when it hits.
- Kinetic energy (KE) = $\frac{1}{2} \times m \times v^2$
- m = mass of projectile (kg)
- v = velocity (m/s)
-
- Because velocity is squared, small increases in speed cause big increases in energy. That's why a small, fast rifle bullet often causes more destruction than a bigger, slower bullet.

Two quick numeric examples (to show effect of velocity)

- Example 1: 9 mm pistol (typical bullet mass $\approx 7.5 \text{ g} = 0.0075 \text{ kg}$) at 350 m/s:
KE = $0.5 \times 0.0075 \times 350^2 \approx 459 \text{ J}$ (joules).
- Example 2: High-velocity rifle (mass $\approx 4 \text{ g} = 0.004 \text{ kg}$) at 900 m/s:
KE = $0.5 \times 0.004 \times 900^2 = 1620 \text{ J}$.

→ Even though the rifle bullet is lighter, its much higher speed gives it several times more energy and thus typically far more destructive wounds.

- Revolvers have a low muzzle velocity of (150 m/s)
- In pistols the muzzle velocity may be (300-360 m/s).
- For Rifles; The muzzle velocity varies greatly, from (450-1500 m/s).



Wounds:

Though the construction and performance of weapons is of vital interest to the forensic firearms examiner, the relevance to the pathologist is concentrated in those aspects which affect the nature of the wound:

- whether the weapon is smooth-bore or rifled; if rifled, the muzzle velocity of the weapon.
- The nature of the projectile(s).
- the nature of the propellant .
- the degree of choke, if any.
- the range of discharge.
- the angle of discharge.



GUNSHOT WOUND

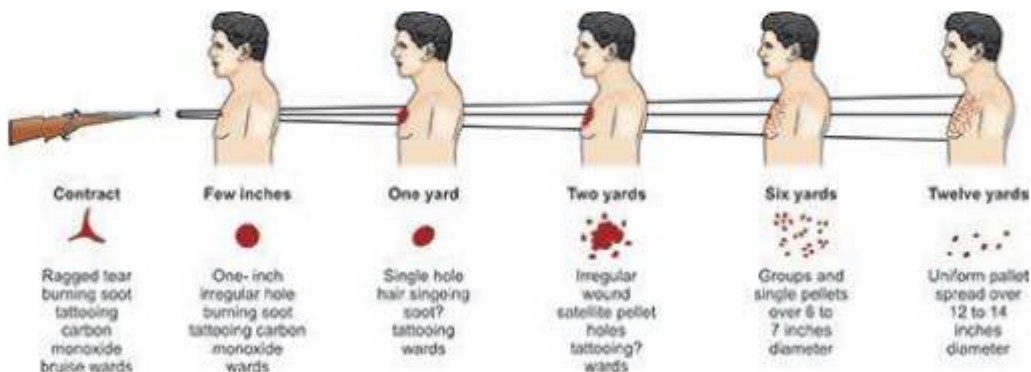
DONE BY:GHAITH MAHER AL-SHAWABKEH

GUNSHOT WOUNDS:

- When any weapon is fired, smoke, flame and the gases of combustion will leave the barrel, together with portions of unburned, burning and burnt propellant.
- These contaminants will usually follow the projectile, but in some guns they may also precede them.
- The distance they will travel from the end of the muzzle is extremely variable, depending mainly on the type of weapon and the type of propellant.
- These contaminants also escape from small gaps around the breech and will soil hands or clothing that are close to the breech at the time of discharge.

WOUNDS FROM SMOOTH-BORE GUNS :

- The shot describes a long, shallow cone with its apex close to the muzzle of the shotgun.
- the further along this cone the victim is situated, the larger the wound pattern will be



TYPES OF WOUNDS FROM SMOOTH-BORE GUNS :

A) contact wound : occurs when the muzzle is touching the skin and usually results in :

1. Circular entrance wound that is about the size of the muzzle.
2. The wound edge will be regular and often has a clean-cut appearance with no individual pellet marks apparent.



3. There will commonly be smoke soiling of at least some of the margin of the wound. Due to recoil if the muzzle is not pressed firmly, flame, gas and soot may escape sideways and affect the skin in the immediate vicinity.

4. There may be a narrow, circular rim of abrasion around some or all of the entrance wound, caused when the gases of the discharge enter through the wound and balloon the tissues upwards so that the skin is pressed against the muzzle.



IF THE DISCHARGE WAS OVER AN AREA SUPPORTED BY BONE, THE GASES CANNOT DISPERSE AS QUICKLY AS THEY WOULD IN SOFT AREAS SUCH AS THE ABDOMEN, AND THE GREATER BALLOONING OF THE SKIN RESULTS IN SPLITS OF THE SKIN, WHICH OFTEN HAVE A RADIAL PATTERN.

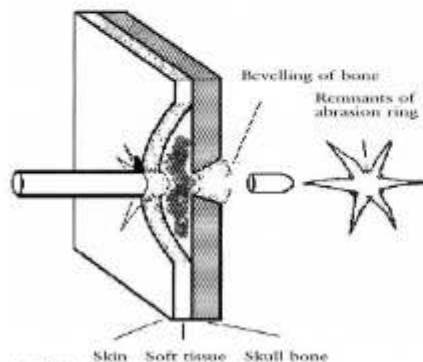


Fig 9.4.

CONTACT ENTRANCE WOUND OF THE HEAD

Stellate entrance wound. Bullooning 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.



5. The wads or plastic cup will usually be recovered along the wound track.

6. The tissues along the wound track will be blackened and the surrounding tissues are said to be pinker than normal as a result of the carbon monoxide contained within the discharge gases.



TYPES OF WOUNDS FROM SMOOTH-BORE GUNS :

B) CLOSE DISCHARGE WOUND

- within a few centimetres of the surface $<20\text{cm}$
- produce a wound with a similar appearance of contact wound, but as there is now room for gas escape , there will be no muzzle mark.
- More smoke soiling can occur, and burning of skin with singeing and clubbing of melted hairs can be seen around the wound. Where clothing is present, then it will trap most, but not necessarily all, of the soot and powder grains. It will reduce the flame effects.

Close discharge of shotgun to the chest.
There is a large hole, partly due to
disruption by gas, and no evidence of
pellet scatter is seen.



TYPES OF WOUNDS FROM SMOOTH-BORE GUNS :

C) INTERMEDIATE RANGES :

- between 20 cm and 1m.
- There will be diminishing smoke soiling and burning of the skin, but powder tattooing may persist.
- The spread of shot will begin, first causing an irregular rim to the wound. Often called a 'rat-hole' because of the nibbled edges, or called 'scalloping'.
- Separate injuries caused by the wads or plastic shot containers may be seen.

Intermediate-Range Gunshot Wound Punctate abrasions present on the forehead are the result of impact with unburned or partially burned gunpowder. This phenomenon is termed tattooing.



PINK COLORATION

If a shot is fired from a very close range or in contact with the skin, some carbon monoxide (produced in the combustion of propellants) gets absorbed in the skin and flesh. It gives a pink coloration to the skin around the wound which indicates firearm injury and injury from a close range.



BLACKENING

blackening is caused by the smoke deposits. The smoke particles are light. They do not travel afar. Therefore, smoke deposit i.e. blackening is limited to a short range.



TATTOOING

The tattooing is also known as peppering or stippling. It is the deposit of unburnt or semi-burnt powder particles under the skin. Tattooing, normally, cannot be removed with a washoff.



TYPES OF WOUNDS FROM SMOOTH-BORE GUNS :

D) LONG RANGES:

- At a range of over 1 m, smoke damage and tattooing do not occur and injuries caused at longer ranges will depend upon the spread of the shot, which in turn is dependent upon the construction of the barrel.
- With a normal shotgun, satellite pellet holes begin to be seen around the main central wound at a range of about 2-3 m.
- Once beyond 2 m, there will be no burning or smoke staining, rarely will there be powder tattooing and the presence of the wads will be variable.

- beyond 6-10m, the central hole may shrink to nothing. There will naturally be no wad injuries, no smoke flame or tattooing, It is important to measure the spread of the shot so that if the weapon is recovered, test firings using identical ammunition can be performed to establish the range at which a particular spread of shot will occur.
- At long ranges, such as 20-50 m, there is a uniform peppering of shot, and this is rarely fatal.
- The pellets, if they penetrate the skin, will lie just in the subcutaneous tissues.
- Death may occur, however, from an unlucky shot in the eye or from natural disease precipitated by pain and shock.

- Secondary damage is caused by the mass of pellets striking bone and releasing fragments that then act as secondary missiles, damaging adjacent tissues and sometimes emerging to form exit wounds.
- These may sometimes cause confusion to inexperienced observers, including police officers, who may wrongly suspect multiple shots or the use of some other type of weapon.



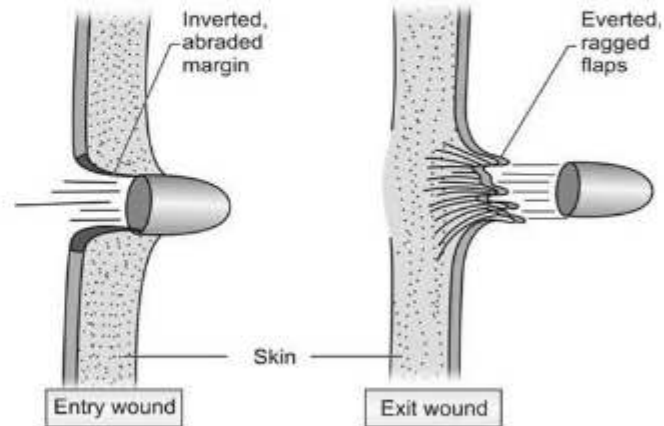
EXIT WOUND

- Shotguns rarely produce an exit wound when fired into the chest or abdomen, although single pellet exit wounds can occasionally be seen.
- Exit wounds can be seen when a shotgun is fired into the head, neck or mouth. The exit wound in these cases may be a huge ragged aperture, especially in the head, where the skull may virtually explode with the gas pressure from a contact wound, ejecting part or even all of the brain from the cranial cavity.

WOUNDS FROM RIFLED WEAPONS

Bullets fired from rifled weapons will commonly cause both an entry and an exit wound.

However, exceptions to this rule are numerous and many bullets are retained within the body because they did not possess enough energy to complete the passage.



FIREARM AND EXPLOSION INJURIES

Understanding Wound Patterns, Mechanisms, and Forensic Importance



Done by: WALID OMOSH

ENTRANCE WOUNDS:

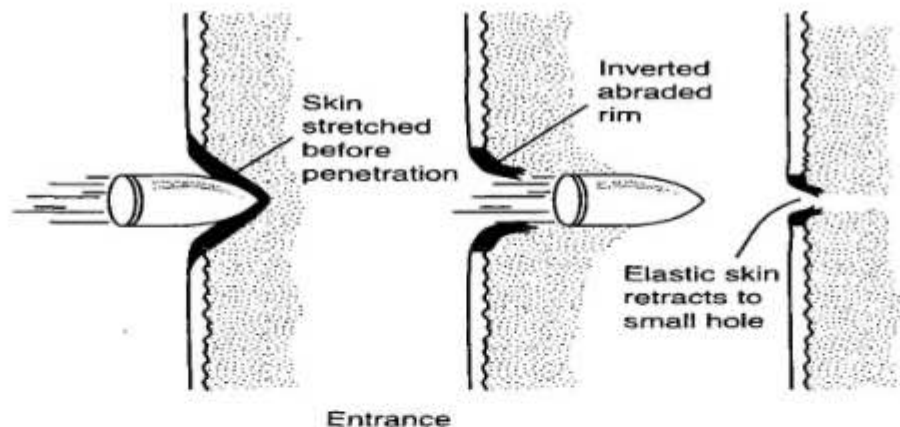
- Contact wounds from a rifled weapon are generally circular, unless over a bony area such as the head, where splitting caused by the propellant gas is common.
- There may be a muzzle mark if the gun is pressed hard against the skin.
- There may be slight escape of smoke with some local burning of skin and hair if the gun is not pressed tightly. unless clothing is interposed.
- Bruising around the entry wound is not uncommon.

Contact Gunshot Wound with Muzzle

Abrasion : A contact gunshot wound to the right temple with **stellate tears, seared skin, soot deposition, and muzzle imprint.**



Source: Knoop KJ, Stadi LB, Storrow AB: *Atlas of Emergency Medicine*, 2nd Edition: <http://www.accessemergencymedicine.com>
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The size of the hole is rarely equal to the diameter of the missile and therefore the caliber of the weapon cannot instantly be determined by inspection of the wound · in spite of the apparent ease with which television drama doctors and detectives can instantly spot 'a thirty-two' or a 'thirty-eight'.

ENTRANCE WOUNDS:

At close range, up to about 20 cm, there will be some smoke soiling and powder burns, and skin and hair may be burnt, although this is variable. (The soot rarely carries more than 15 cm from the gun , whereas powder grains will travel 30-45 cm)

The shape of the entry wound gives a guide to the angle that the gun made with that area of skin:

circular hole indicates that the discharge was at right angles to the skin, whereas an oval hole, perhaps with visible undercutting indicates a more acute angle.

ENTRANCE WOUNDS:

- Examination of the entry wound will show that the skin is inverted; the defect is commonly slightly smaller than the diameter of the missile due to the elasticity of the skin.
- Very commonly, there is an ·abrasion collar· or ·abrasion rim· around the hole, which is caused by the friction, heating and dirt effect of the missile when it indents the skin during penetration



ENTRANCE WOUNDS:

- Over 1 m or so, no smoke soiling, burning or powder tattooing.
- At longer ranges (which may be up to several kilometres with a high-powered rifle), the entrance hole will have the same features of a round or oval defect with an abrasion collar.
- At extreme ranges, the gyroscopic stability of the bullet may be lost, and this instability may well result in larger, more irregular wounds.

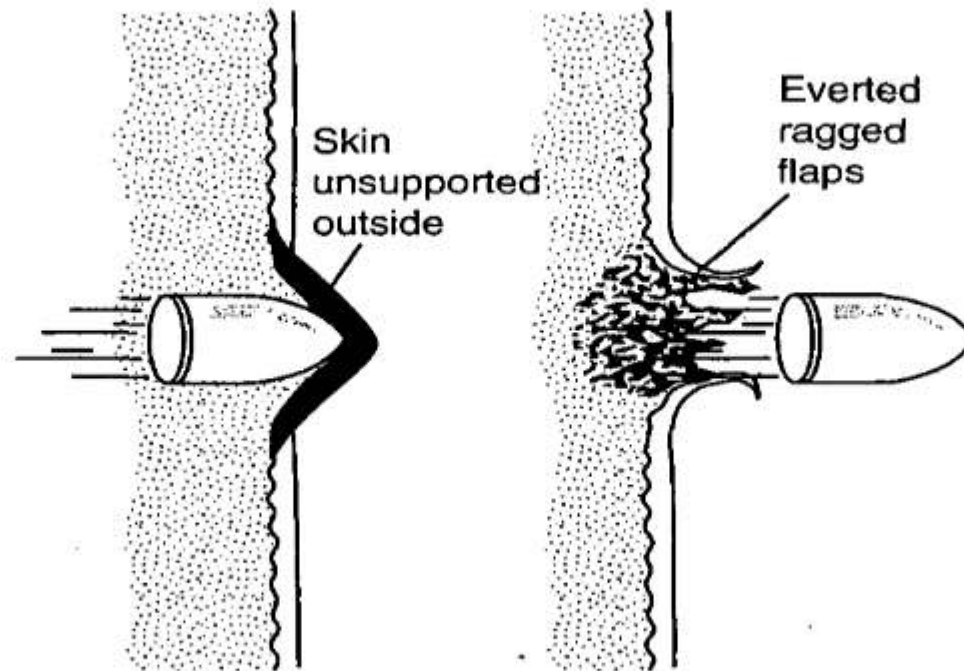
EXIT WOUNDS

- The internal effects of bullets depend upon their kinetic energy
Low-velocity, low-energy missiles, such as shotgun pellets, cause simple mechanical disruption of the tissues by pushing them aside.
- High-velocity bullets cause far more damage to the tissues as they transfer large amounts of energy, which results in the formation of a temporary cavity in the tissues.
- This cavity is many tens or hundreds of times larger than the calibre of the bullet itself. This cavitation is especially pronounced in dense organs (liver and brain), but occurs in all tissues if the energy transfer is large enough.

Exit Gunshot Wound: A **stellate exit wound**.

Exit wounds may take on a variety of appearances. Stellate exit wounds should not be confused with contact wounds. The lack of soot and seared skin tells the physician that this is an exit wound





Exit

	<i>Inlet</i>	<i>Exit</i>
<i>Loss of substance</i>	<i>More</i>	<i>Less</i>
<i>Edges</i>	<i>Inverted, abraded, regular</i>	<i>Everted, not abraded, irregular</i>
<i>Powder marks</i>	<i>Present in near firing.</i>	<i>absent</i>
<i>Size</i>	<i>Small "elastic recoil"</i>	<i>Large</i>
<i>Soiling ring</i>	<i>Present "lubricant grease"</i>	<i>absent</i>
<i>Color of tissues around</i>	<i>Pink "COHb in near firing"</i>	<i>Absent</i>
<i>CoHb%</i>	<i>Up to 60%</i>	<i>Normal</i>
<i>Beveling</i>	<i>Internal</i>	<i>External</i>
<i>bleeding</i>	<i>Slight</i>	<i>Profuse</i>



RUBBER GUNS

- In riot control, police may use plastic rounds fired from specially adapted guns.
- They should not be fired at ranges less than about 20m and should only be fired at the lower part of the body.
- Some deaths and many serious injuries including fractures of skull, ribs and limbs and also eye damage and internal injuries, have occurred and these are usually associated with improper use.

ACCIDENT, SUICIDE OR MURDER ?



1. Suicides must have wounds whose site and range are within the reach of the deceased's arm, unless some device has been used to reach the trigger.
2. The weapon must be present at the scene, though it may be at a distance from the body.
3. Suicidal gunshot injuries are most commonly in the 'sites of election' , which vary with the length of the weapon used.
4. Discharges into the temples are almost unique to handguns and are usually on the side of the dominant hand, but this is not an absolute rule.

5. People almost never shoot themselves in the eye or abdomen or in inaccessible sites such as the back.
6. women rarely commit suicide with guns and are rarely involved in firearms accidents.

EXPLOSIVES



- It is the rapid liberation of heat that causes the gaseous products of most explosive reactions to expand and generate high pressures.
- In military bomb, the release of energy may be so high that death and disruption from blast effects may occur over a wide area.
- A minimum pressure of about 700 kilopascals is needed for tissue damage in humans
- The pure blast effects can cause either physical fragmentation or disruption of the victim solely from the effects of the wave of high pressure and hot gases striking the body.

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Effect of Bomb :

- burns : directly from the near effects of the explosion and secondarily from fires started by the bomb
- Missile injuries from parts of the bomb casing or shrapnel or from adjacent objects
- Peppering by small fragments of debris and dust propelled by the explosion
- All types of injury due to collapse of structures caused by the explosion. .

Doctor's Duty:

- Examination essential, with careful documentation of the sites and sizes of the abrasions, bruises, and any other injuries.
- If a near or massive explosion disrupts one or more bodies, identification of the fragments is essential, not least to determine how many victims were killed. And to identify and recover the material that might have formed part of the bomb.

THANK YOU!