



Round : Forensic medicine.....

Group no : A4.....

Done By : Batool ALzubaidi.....

Gunshot & Explosions



Introduction :

- Gunshot wounds are a public health concern all around the world.
- The forensic pathologist is often required to identify ^{1.} gunshot wounds, the ^{2.} direction and the ^{3.} distance of fire, the ^{4.} manner of injury (suicidal, ^{5.} homicidal, or accidental) and determine the ^{6.} nature and type of firearm.

Doctor's Duty :

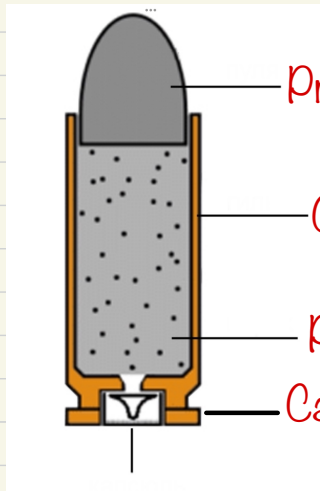
- in the living, all efforts must be directed to saving life but, if possible, the treating doctor should make good notes of the original appearances of the injuries before any surgical cleaning or operative procedures are performed.
- must ensure that accurate drawings and measurements of the site, size and appearance of the wound are obtained and that distant and close-up photographs are taken of each injury with an appropriate scale in view.
- Any missiles, foreign bodies and any skin removed from the margin of a firearm wound during treatment should be carefully preserved for the police.

- ALL firearm wounds, whether they are fatal or not , must be reported to the police!!
- The same general rules apply to the post-mortem recovery of exhibits.
 - The skin around the wounds may be swabbed for powder residues.
 - Swabs of the hands of the victim should be taken.
 - Observation for lead toxicity – in cases of shotgun injury.



COMPLICATIONS AND CAUSES OF DEATH

- Chest injuries: hemo-mediastinum, cardiac injuries and hemopericardium with cardiac tamponade, major blood vessel rupture, tension pneumothorax, sucking chest wound.
- Abdominal injuries: liver, spleen, kidney, vessel injuries, bowel injuries, etc.
- Limb injuries: Bones, nerves, tendons and vessels are endangered, so examine neurovascular bundle.
- Head injuries: brain hemorrhage, brain edema, herniation, brainstem injuries.
- Hypovolemia, shock and Sepsis



ال primer يكون بالقاعدة و هو زي عجينة من مجموعة مواد زي :

mercury fulminate, potassium chlorate, powdered glass

highly inflammable هاد
يعني سريع الاشتعال

Oxygen doner

بينتج الشرارة

يعني وظيفة ال primer انه powdered glass يعمل شرارة الي

تخلي potassium chlorate يتبرع باكسجين عشان ال

mercury fulminate يولع

Primer / percussion cap

ال powder الي هو البارود و في منه نوعين black and smokeless الي راح يولع بس يولع ال

primer

ال projectile هي الجزء الي يسمى بال bullet لما يولع البارود بطلع كمية هائلة من الغازات الي

راح تضل محبوسة بمكانها و تتراكم لحد ما توصل نقطة معينة انها تحرك ال bullet الي هي

ال طلقة و هاي فكرة ال firing

TYPES OF FIREARMS :

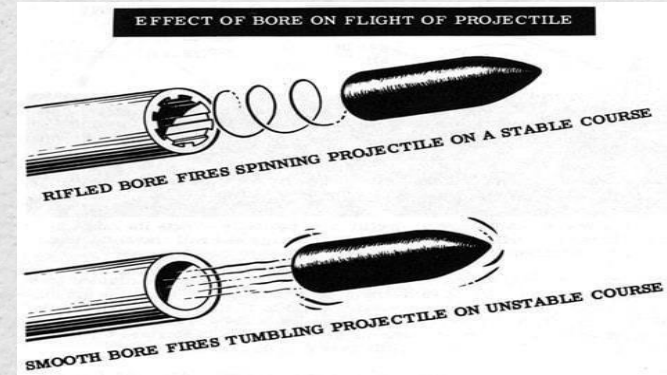
Grooved or rifled barrels vs Smooth or non-rifled barrels :

Rifle → Spinning bullet

has a rough Inner Surface of barrel,
it has elevations and depressions
(longitudinal ridges) providing
stability for the bullet while it's
moving , giving a precise and
accurate movement of bullet.

Non-Rifle → Straight shots

barrel has a smooth inner surface ; therefore, the bullet is prone to
experience resistance from the air , giving a more dispersed
movement of bullet.



- Both of these types of weapon rely upon the detonation of a solid propellant to produce the gases that propel the projectile(s).

SMOOTH BARRELS (SHOTGUN):

- The barrel, has a smooth internal surface.
- Shotguns, commonly used as sporting weapons.
- fire groups of pellets or shot.
- These guns may have one or two barrels; the double barrelled weapons are arranged either side by side or over and under.
- A shotgun is designed for use up to about 30-50m and is unlikely to kill a man at this extreme range.
- The barrels can be shortened - sawn off - for criminal activities.
- This shortening has little effect on the properties of the gun.



✦ اسم الوحدة الي بتعبر عن ال diameter

SMOOTH BARRELS (SHOTGUN): اللي هو عرض الاسطوانة او الماسورة

اللي بتمشي فيها الرصاصة ✦

-The size of shotgun is usually given in relation to the 'gauge' or 'bore' ,
which relates to the diameter of the barrel.

The **commonest size** is the 12-bore or 12-gauge shotgun (which has a
barrel diameter of **18.2 mm**).

✦ نعرف شغلة انه كل ما صغر ال gauge number يعني ال barrel

shotgun will be more powerful ال diameter will be larger يعني

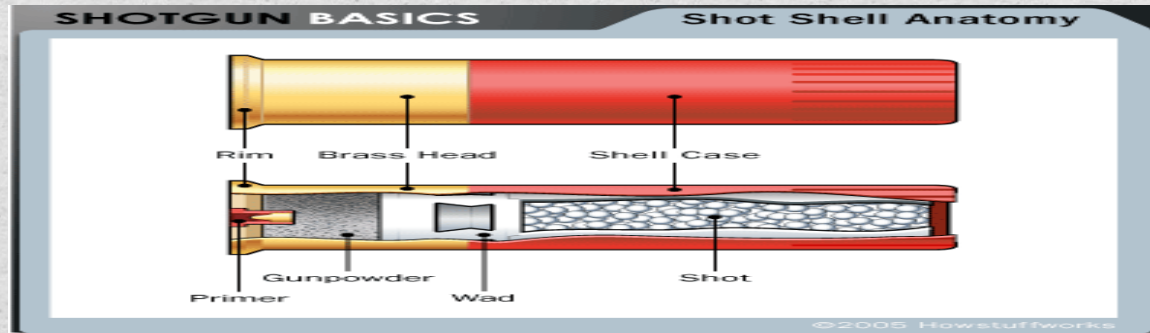
The other shotgun has a barrel that is **0.410 inches** (10.2 mm) in
diameter and it is called, simply, a '410'.

✦ وهاي طريقة تانية للتعبير عن ال diameter ✦

THE CARTRIDGES FOR SHOTGUN:

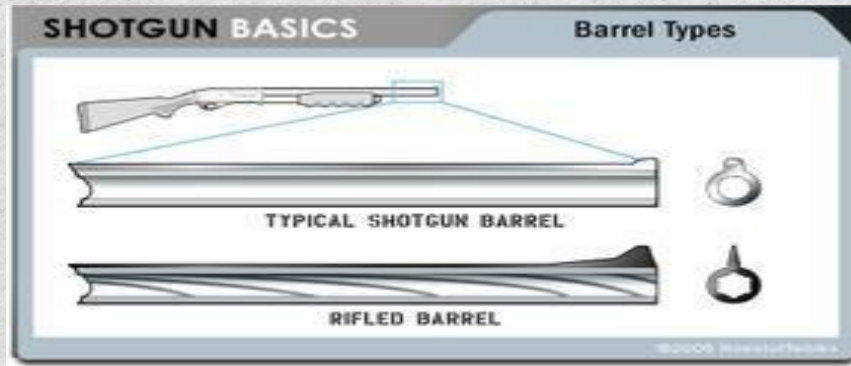
- ❖ Tampering with the contents of cartridges may markedly alter the spread and other characteristics of the shot and hence the resulting wound
- * Alternating the contents of shotgun cartilage can change how the shot spreads affecting the pattern and severity of the wounds
- ❖ the cartridges are numbered according to the size of the shot they contain.
- بيع مناطق يستخدموا firearms بصنعوها هم ممكن يحطوا فيها اشياء زي اضافر، قطع معدنية او حجار الي راح تعمل جروح with abnormal pattern
- ❖ The shot in the cartridges falls into one of two In some areas homemade guns, sometimes called 'country guns'. These weapons may be used to fire collections of debris and any wounds resulting from these weapons will obviously not comply with the usual descriptions.
- * The smaller the number size the larger the shots .. smaller shots cause multiple small entry wounds, larger shots cause fewer but deeper wounds (more tissue damage)

زي مثلا انه يزيد كمية البارود الي فيها
راح يخليها اسرع و اقوى و قاتلة اكثر



RIFLED WEAPONS :

- These are weapons that fire one projectile at a time through a barrel that has a number of **spiral grooves**.
السلاح ال automatic هو الي بطلع الجزء الفارغ من
الطلقة لحاله مش محتاج انت تطلعهم
- Rifled weapons fall into three main groups - **revolvers**, **'automatic'** **pistols** and **rifles**.
١. ٢. ٣.



REVOLVERS AND PISTOLS :

Both are **short-barrelled** weapons and the difference between them is the **method of presenting a bullet to the breech.**

يعني الطريقة الي بتتعبى فيهم الرصاصات و كيف بتوصل للbreech الي هي النقطة الي بتكون فيها الرصاصة قبل ما تضغط على الزناد



Revolver

من اسمه المكان الي بتتعبى في الرصاصات اشي بدور و عددهم ٦ يكون و لما تطلق رصاصة بلف و بجهازك الي بعدها



pistol

هون الرصاص موجود بمسكة الاید اسم هاد الجزء ال magazine يكون فيه مشط السلاح عدد الطلقات فيه ٨ كل ما تطلق وحدة برفع الي تحتها لفوق

RIFLED WEAPONS :

Rifles are **long-barrelled** weapons whose **muzzle velocity and accuracy are much greater** than those of the revolver or pistol.



Muzzle velocity » the speed at which the bullet exits the barrel

THE AMMUNITION FOR RIFLED WEAPONS :

1.

- The bullet may be made of lead or it may have a lead core covered a cupro-nickel, steel or other hard metal jacket.

+ Covering the bullet with a metal jacket

↳ makes it stronger, reduces lead fouling in the barrel and improves penetration

+ The chemical inside the cartridge that burns to generate gas pushing the bullet forward ↑

- Modern propellants consist of nitro-cellulose or other synthetic compounds prepared as small coloured flakes, discs or balls.

+ صاروا يستخدموهم بدل البارود الاسود

- There may be a soft tip or an air space in the tip of the bullet, which is designed to distort and thus decelerate the bullet on impact. Some modern bullets have a small explosive charge in the tip for the same purpose

+ On impact the explosion fragments the bullet increasing it's damage

+ They expand upon impact increasing tissue damage but decreasing the penetration

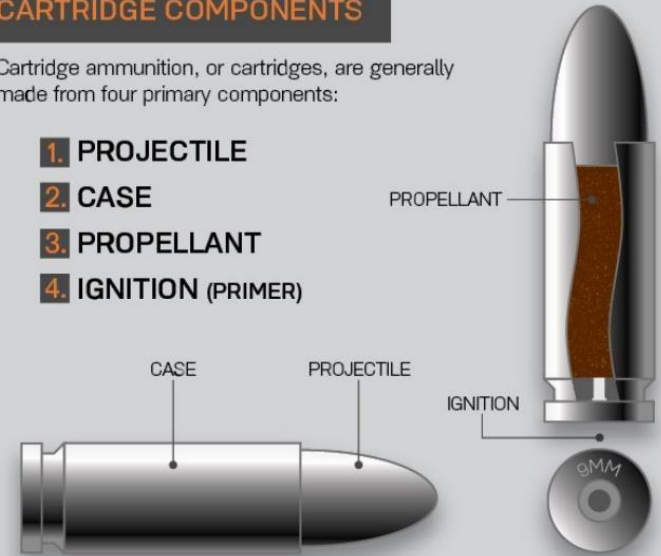
THE AMMUNITION FOR RIFLED WEAPONS :

- ❖ Projectile – Bullet
- ❖ Case – container which holds the contents
- ❖ Propellant (powder) : chemical component that propels the projectile when ignited → اشتعال
- ❖ Primer (ignition) : is the component that explodes when the trigger is pulled to ignite the propellant

CARTRIDGE COMPONENTS

Cartridge ammunition, or cartridges, are generally made from four primary components:

1. PROJECTILE
2. CASE
3. PROPELLANT
4. IGNITION (PRIMER)



THE AMMUNITION FOR RIFLED WEAPONS :

- ❖ The speed with which the projectile leaves the end of the barrel (the muzzle velocity) varies from a few hundred metres per second in a shotgun to a thousand or more in a high-velocity military weapon.
- ❖ The formation of wounds is related to the transfer of the energy of the bullet to the body tissue.
+ كبر الرصاصة لا يعني انه ال damage تااعها اكبر .. رصاصة صغيرة سرعتها عالية راح تحمل velocity عالية بالتالي راح تقوت بالجسم deep اكثر بالتالي ال damage تااعها اكبر
- ❖ The energy of the projectile is calculated from the kinetic energy ($\frac{1}{2}MV^2$) of the bullet, so higher muzzle velocities are considerably more effective at delivering energy to the target than larger bullets.

- 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).

VELOCITY VERSUS BARREL LENGTH



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 WOUNDS:

نوايج احتراق البارود

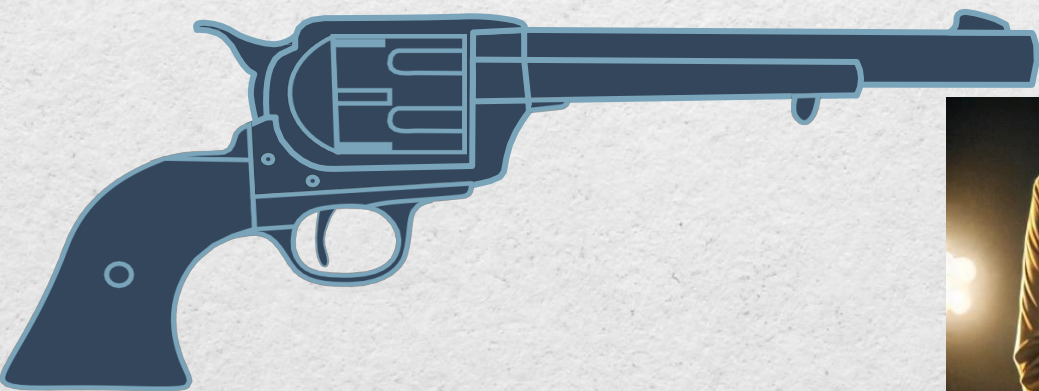
- When any weapon is fired, smoke flame and the gases of combustion will leave the barrel, together with portions of unburned, burning and burnt propellant.

بالغالب هاد المواد و الغازات بتطلع بعد اطلاق الرصاصة بس في انواع اسلحة ممكن الغازات تطلع قبل الرصاصة زي ال revolver



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.



ACCIDENT, SUICIDE OR MURDER ?

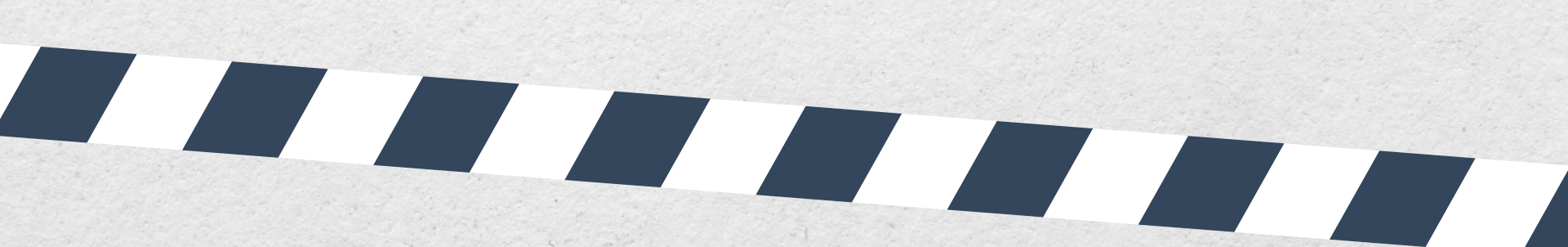
Zaid Alzaghatet A6



➤ يعني الجرح لازم يكون ب arm range تاعت الضحية بنفعش يكون بمكان ايده ما بتقدر توصله

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.

The preferred anatomical locations where people most commonly shoot themselves.



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.

- Suicides typically involve quick, fatal shots to areas like the head (temple, mouth, under the chin) or the chest (heart region), where death occurs rapidly.

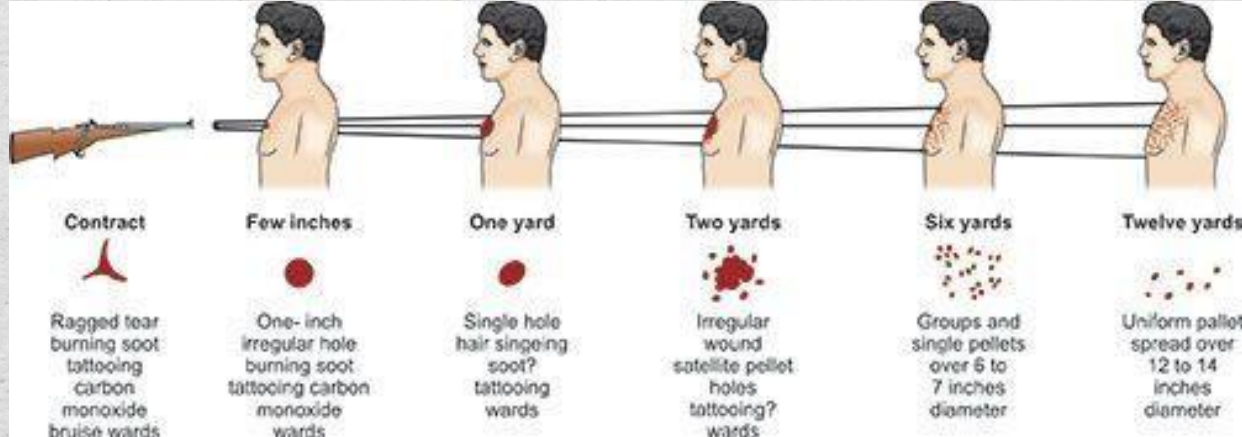


● WOUNDS FROM SMOOTH-BORE GUNS :

- 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 :

Shape is symmetrical creating the impression of the muzzle's shape

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.



The edges are smooth, well defined with minimal tissue disruption outside the area of impact

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.

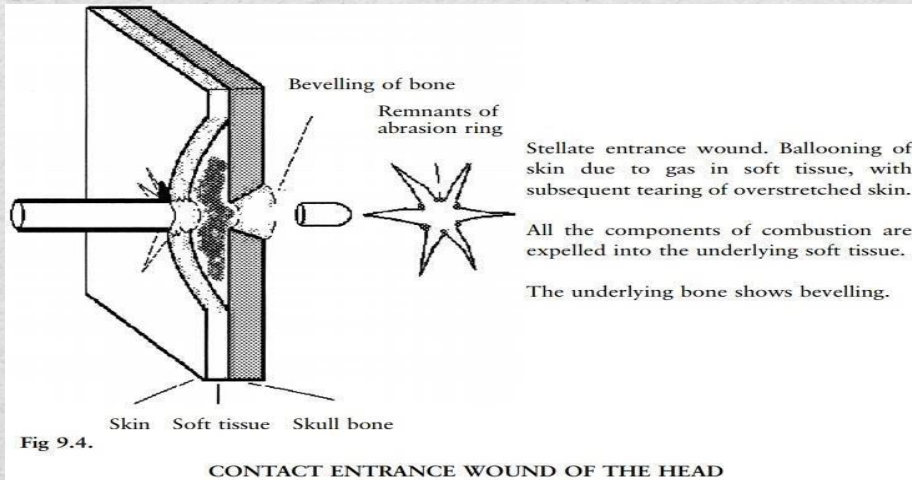
4. There may be a **narrow, circular rim of abrasion** around some or all of the entrance wound, caused when the **gases of the discharge enter through the wound and balloon the tissues upwards** so that the skin is pressed against the muzzle.

Darker and more localized around the margins

The blackening or staining of the skin or clothing due to the deposition of soot



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.



+ Bone acts as a border so the gases will be trapped between the skin and the bone, build up of gases will increase the pressure causing the skin to buldge resulting in tearing

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:

- When shooting occurs within a few centimetres of the surface (less than 20 cm), the resulting wound may resemble a contact wound.
- However, because there is space for gas to escape, there will be no muzzle mark present.
- More smoke soiling may be observed, along with burning of the skin and singeing of melted hairs around the wound. If clothing is present, it will likely trap most, though not all, of the soot and powder grains, which will also reduce the visible effects of flames.

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.



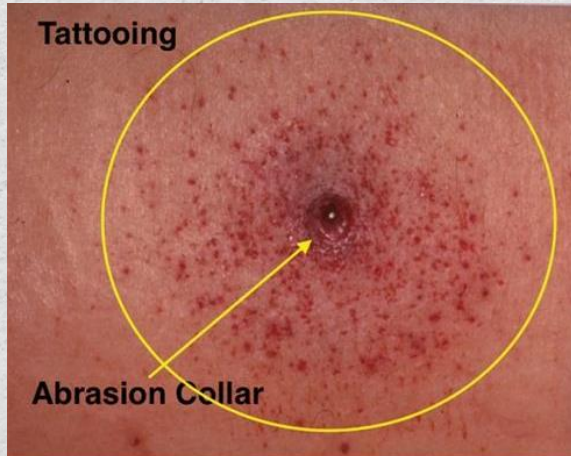
TYPES OF WOUNDS FROM SMOOTH-BORE GUNS :

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 seen.

Powder tattooing

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.

●RUBBER GUNS

- Definition: Firearms that shoot rubber-coated or solid rubber projectiles to control crowds and riot without causing fatal injuries.
- 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.

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.



ENTRANCE WOUNDS

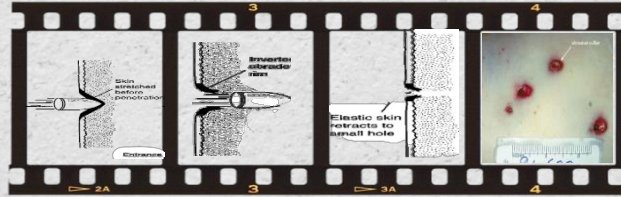
- Contact wounds from a rifled weapon are generally circular, unless over a bony area such as the head, where splitting caused by the propellant gas is common.
- There may be a muzzle mark if the gun is pressed hard against the skin.
- There may be slight escape of smoke with some local burning of skin 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.

ENTRANCE WOUNDS

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 – despite the apparent ease with which television drama doctors and detectives can instantly spot 'a thirty-two' or 'a thirty-eight'.



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

- 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 → Perpendicular (عامودي)
 - oval hole, perhaps with visible undercutting indicates a more acute angle.

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)

Over 1 m or so, no smoke soiling, burning or powder tattooing.



At longer ranges (which may be up to several Km 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.

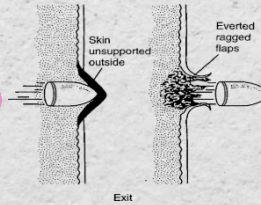
EXIT WOUNDS

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.



✦ star-shaped wound which occurs when the bullet or projectile exits the body at high velocity, tearing through the tissue in such a way that the skin or underlying tissue is stretched and disrupted, creating multiple radial tears that radiate from the center of the 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



[illegible][illegible][illegible][illegible][illegible][illegible][illegible][illegible][illegible][illegible]

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 inden som almindelig
 Kr. 2.50 pr. Kvartal
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 Forsendt til Udlandet
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 Abonnements tegnes fra
 1ste og 1de i hver Maaned.

139 Aarg. No. 139.

Udgaar til mandag Aften, den 2de
 1846, for 1ste Aars Indtægt.

**Everted,
 raggad
 haps**



Indhold ved tilføjet. 3 R
 om de Tilværelses af Sids
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 Abonnements tegnes fra
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 om de Tilværelses af Sids
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Indhold
 om 1846, 1846, 1846
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 6008 71
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 Indholdet af
 1846, 1846

Explosions



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.

According to the inverse square law, the energy developed by an explosion decreases rapidly as the distance from the epicentre increases.

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.

EFFECT OF BOMBS

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.





References:

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