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FIREARM INJURIES

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FIREARM INJURIES

Firearm injuries are meeting in our region rarely.

As a rule, there are accidents, sometimes are suicides and rarely homicides.

The doctor of any specielty must know the injuries from action of shotgun because may be attracted for examination of scene of occurrence.

FORENSIC BALLISTICS

Firearm is any instrument which discharges a missile by the expansive force of the gases produced by combustion of an explosive substance.

Forensic ballistics is the science dealing with the investigation of firearms, ammunition and the problems arising from their use.

FORENSIC BALLISTICS

General Make-up and Mechanism:

Firearms consist of a metal barrel in the form of hollow cylinder of varying length, which is closed at the back end and is called the breech end and the front open end is called the muzzle end.

FORENSIC BALLISTICS

General Make-up and Mechanism:

The inside of the barrel consists of three parts:

1) The chamber, at the breech end to accommodate the cartridge,
2) the taper, connects the chamber to the bore,
3) the bore, which lies between the taper and the muzzle.

CLASSIFICATION

I. Rifled weapons :

1) Rifles.
2) Single-shot pistols.
3) Revolvers.
4) Automatic pistols.
5) True automatic weapons (machine-guns).

II. Smooth-bored weapons (shotgun):

1) Single barrel.
2) Double barrel.
3) Semi-automatic.

Rifled weapons

Rifles

Revolvers

Single-shot pistols

Automatic pistols

True automatic weapons (machine-guns)

I. **Rifled weapons** - the bore is cut internally with a number of shallow, spiral "grooves", varying from two to more than twenty, the most common being six, which run parallel to each other but twisted spirally, from breech to muzzle.

These grooves are called "rifling", and the projecting ridges between these grooves are called "lands“ .

RIFLED ARMS

1) Rifle:

A rifle is a gun with a long barrel, the bore of which is rifled.

2) Revolvers:

Revolvers are so-called because the ammunition is put in chambers in a metal cylinder which revolves or rotates before each shot, to bring the next cartridge opposite the barrel, ready to be fired.

RIFLED ARMS

3) Automatic Pistol (machine guns)

In this, when a cartridge is fired, the empty cartridge case is thrown out and a new cartridge slips into the breech automatically by a spring. The cartridges are contained in a vertical magazine in the stock, which can accommodate 6 -10 cartridges.

RIFLED ARMS

Calibre of Rifled weapons

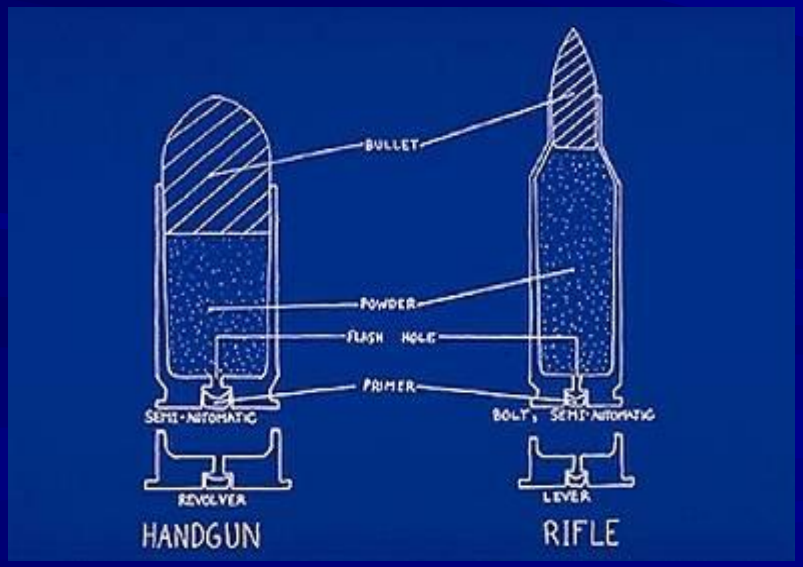
The dimension of the rifled weapon is measured between lands and not grooves.

Most often are meeting caliber

5, 45; 7,62; 9,0-10,0

Cartridge:

It consists of a metal cylinder with a flat base. The gunpowder lies between the detonator and the bullet.



The shotgun cartridge

Calibre of the shotgun:
it is measured by the internal dimension of the barrel .

The shotgun cartridge consists of a case of short metal cylinder which is continuous with a cardboard or plastic cylinder.
The length of the cartridge varies from 5-7 cm.

The shotgun cartridge

The cartridge case is filled as follows from the base:

- percussion cap (primer battery cup, detonator cap),
- gunpowder,
- a thick felt-wad with cardboard discs lying in front and behind it,
- the shot,
- and finally the retaining cardboard disc, over which the edges of the cartridge cylinder walls are pressed.

RIFLED ARMS

Primers:

Centre fire rifle and pistol primers are small metal cups containing the priming mixture and an anvil.

The blow of the firing pin on the primer cup crushes the priming mixture against the anvil centre and burns it, which then flashes through the flash-holes (fire-holes or vents) and burns the powder.

RIFLED ARMS

Powders:

1) Black Powder:

It consists of potassium nitrate 75%; sulphur 10%; and charcoal 15%. It burns with production of much heat, flame and smoke. One gram of powder produces 3,000 to 4,500 c.c. of gas.

2) Smokeless Powder:

Nitrocellulose (single base) or nitroglycerine and nitrocellulose (double base), produce much less flame and smoke and are more completely burnt than black powder. One gram produces 12,000 to 13,000 c.c. of gases.

RIFLED ARMS

Bullets:

The traditional bullet is made of soft metal and has a rounded nose.

The metal is lead with varying amounts of antimony added to provide hardness.

The caliber of a bullet is its cross-sectional diameter.

In revolver and pistol, the bullet is short and the point usually round.

In rifle, the bullet is elongated with pointed end.

MEDICO-LEGAL QUESTIONS

1) Is the injury caused by discharge of firearm?
2) What kind of weapon fired the shot?
3) From what distance and direction was the shot fired?
4) When was the firearm discharged?
5) Where are an entrance and an exit wounds?
6) What was direction of wound canal?
7) How many shots have been effected, which shot was fatal?
8) Whether there are signs of injuries which can be caused by own hand?

FIREARM WOUNDS

WOUNDS FROM REVOLVERS AND AUTOMATIC PISTOLS

A) Entrance wound:

One of the most important attributes of an Entrance Wound is defect **"minus-tissue"**. It is result of penetrative action of a bullet.

At attempt to pull together edges of a wound between fingers it is formed pleats on the skin.

FIREARM WOUNDS

WOUNDS FROM REVOLVERS AND AUTOMATIC PISTOLS

A) **Entrance wound:**

Entrance wound are classified on the distance of the muzzle of a firearm from the body:

contact shot,
close shot,
near shot
and distant (long) shot.

FIREARM WOUNDS

WOUNDS FROM REVOLVERS AND AUTOMATIC PISTOLS

Accompanying Components of a Shot (additional factors)

Flame
Powder gases
Soot black
Unburnt and partially burnt powder grains

FIREARM WOUNDS

WOUNDS FROM REVOLVERS AND PISTOLS

A) Entrance wound:

The flame extends up to 3-5 cm. (Burning on the skin)

Powder gases up to 5-10 cm.;

Soot black – 30-35cm (Blackening)

and unburnt and partially burnt powder grains and small metallic particles up to 100 cm. (Tattooing)

ENTRANCE FIREARM WOUND

Next signs of entrance wound are: The Abrasion Collar (marginal abrasion) and “Grease or dirt 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.

ENTRANCE FIREARM WOUND

After the bullet has perforated the skin, the elasticity of the skin causes the defect to contract. The skin is abraded around the hole due to rubbing of the gyrating body of the bullet against the inverted epidermis.

ENTRANCE FIREARM WOUND

"Grease or dirt collar":

A black ring "grease or dirt collar" is seen as a narrow ring of skin, lining the defect and is sharply outlined.

This results from the removal of substances from the bullet as it passes through the skin, i.e., bullet lubrication, gun oil from the interior of the barrel, lead from the surface of the bullet, barrel debris, etc.

ENTRANCE FIREARM WOUND

Soot is dark in the centre and fades towards the periphery. The abrasion collar surrounds the dirt collar. The abraded collar becomes reddish-brown as it dries.

Some contusion is present in abraded collar, and as such, it is also called "contusion collar".

The abrasion and contusion collar is one to three mm. wide.

These two features are proof of an entrance wound.

ENTRANCE FIREARM WOUND

1) **Contact Shot:** The discharge from the muzzle, i.e., gases, flame, powder, smoke and metallic particles are blown into the track taken by the bullet through the body.

The wound is large, round, stellate, cruciate or oval, and shows cavitation due to the expansion of the liberated gases in the skin and tissues, which show laceration.

ENTRANCE FIREARM WOUND

1) **Contact Shot:**

The margins are contused and everted due to gases coming out of the entering wound under pressure. There is no burning, blackening, and tattooing around the wound of entrance.

ENTRANCE FIREARM WOUND

1) **Contact Shot:**

The margins of the wound of entry and the subcutaneous tissues may show pinkish-red discoloration due to presence of CO.

The powder residue is usually grossly visible in the subcutaneous and deeper areas.

The entrance track is blackened and burnt.

In some contact wounds, the imprint of the muzzle ("schtanz-mark") of the gun is found as patterned abrasion on the skin around the wound.

ENTRANCE FIREARM WOUND

1) **Contact Shot:**

In contact shot, the muzzle blast and the negative pressure in the barrel following discharge may suck blood, hair, fragments of tissues and cloth fibres several cm. back inside the barrel called "back spatter".

Abdominal wounds show cavitation because of the blast effect.

Head wounds show, as very large explosive type of injury with bursting fractures.

ENTRANCE FIREARM WOUND

1) **Contact Shot:**

This results in undermined, ragged, cruciform opening with everted margins. Such wounds are usually produced by large calibered pistols.

A subcutaneous pocket containing blood mixed with gunpowder is formed by separation of the tissues. Soot may be deposited on the bone surrounding the bullet hole.

ENTRANCE FIREARM WOUND

2) Close Shot:

This term is applied when the victim is within the range of the flame, i.e. up to 5-8 cm.

The term 'point blank' is used when the range is very close to or in contact with the surface of the skin.

The entrance wound is circular with inverted edges and is surrounded by blackened, tattooed and burnt area.

ENTRANCE FIREARM WOUND

2) Close Shot:

The wound track may be pinkish due to CO. Hair in the surrounding area may be clubbed, swollen at intervals by heat, or burnt.

ENTRANCE FIREARM WOUND

2) Close Shot:

- The blackening can be wiped off the skin.
- Unburnt and partially burnt powder grains will be driven into the skin producing tattooing.
- This cannot be wiped off the skin.

ENTRANCE FIREARM WOUND

2) Close Shot:

Abraded collar and grease or dirt collar are present.

The internal injuries are similar to the contact shot.

ENTRANCE FIREARM WOUND

3) Near Shot:

This term is applied when the victim is within the range of powder blast and outside the range of flame, i.e., 60 to 100 cm.

If the discharge occurs at a distance of about fifteen cm., the lacerating and burning effects of the gases are usually lost due to the dispersion cooling of the gases before they reach the skin.

The entrance wound is seen as a round hole about the size of the bullet with a bruised margin, and a zone of blackening and tattooing.

ENTRANCE FIREARM WOUND

4) Distant Shot:

The entrance wound is smaller than the bullet due to the elasticity of the skin, round, and margins are inverted. There is no burning, no blackening and no tattooing.

The skin adjacent to the hole shows two zones, the inner of grease collar arid the outer of abraded collar.

EXIT FIREARM WOUNDS

Exit wounds may vary considerably in size and shape.

They may be stellate, cruciate, elliptical, crescent-shaped, or appear as linear lacerations or even incised wounds.

EXIT FIREARM WOUNDS

The edges of the exit wound may be puckered or torn and everted, and broken pieces of contused, haemorrhagic subcutaneous fat may protrude through the defect.

The edges are free from signs of burning, blackening or tattooing and there is no contusion or abrasion collar.

EXIT FIREARM WOUNDS

If the skin at the exit wound is supported, the exit wound appears as a circular defect surrounded by a margin of abrasion resembling a wound of entrance (shored or supported exit wound).

EXIT FIREARM WOUNDS

Many shored exit wounds are caused if a firm object e.g., a belt, the waist band of trousers, etc., brassiere, collar are pressed against the body at the site of exit wound, or if the body is leaning against a hard surface, such as a wall, back of a chair or the floor if the person was lying down.

EXIT FIREARM WOUNDS

The variation in the shape, and large size of the exit wound are due to:

1) The bullet tumbles in the body and fails to exit nose-end first.
2) The bullet is deformed.
3) The bullet breaks up in the tissues and exits as several pieces.
4) Fragments of the bone may be blown out of the body with the bullet.

FIREARM WOUNDS

SKULL:

In the skull, the wound of entrance shows a punched-in (clean) hole in the outer table. The inner table is unsupported and a cone-shaped piece of bone is detached forming a crater that is larger than the hole on the outer table, and shows beveling (sloping surface).

FIREARM WOUNDS

SKULL:

Fissured fractures often radiate from the defects.

FIREARM WOUNDS

SKULL:

- Pieces of bone from wound of entrance are often driven into the cranial cavity and may establish the bullet track.
- Pieces of bone may produce short accessory wound tracks.
- At the point of exit, a punched-out opening is produced in the inner table and beveled opening on the outer table.

EXIT FRACTURES

FIREARM WOUNDS FROM SHOTGUN

The smoke (powder gases) extends up to 30 cm., Soot black up to 50-70 cm. and unburnt and partially burnt powder grains up to 100 cm. The cards travel for 2 metres, and wad for 2-6 metres. Up to a distance of three metres wadding can produce minor injury.

I. Entrance wound from shotguns:

The character of a wound depends on the distance from which the Weapon is Discharged:

FIREARM WOUNDS FROM SHOTGUN

Contact Wounds:

They are single, usually round or oval, large, often ragged because of tearing due to gases.

The margins of the skin perforation are charred by flame, and the abraded border is usually soiled with powder residue.

FIREARM WOUNDS FROM SHOTGUN

Contact Wounds:

As the gases are blasted within the wound, the subcutaneous and deeper tissues show severe disruption.

Particles of unburnt powder are driven to some distance through the wound, and some of them are found embedded in the wound.

ENTRANCE WOUND FROM SHOTGUN

Contact Wounds:

These particles cause haemorrhage in deeper tissues and in the margins of the wound. Thus, the margins of the wound will be contused.

If the contact is tight, muzzle impression (copy or recoil abrasion) is seen.

ENTRANCE WOUND FROM SHOTGUN

Contact Wounds:

If the muzzle is not pressed firmly, and also due to the recoil of the gun, flame, gas, and soot escape sideways and cause singeing and blackening of the surrounding skin.

If the part is clothed, smoke will escape sideways and may be found in each layer of clothing and on the skin.

ENTRANCE WOUND FROM SHOTGUN

Contact Wounds:

The cloth may be singed at the edge of the hole, and there may be a ring of burning around the skin wound. CO in the gases combines with haemoglobin due to which the wound of entry and the wound track appear pink.

Cruciate, stellate, or ragged lacerations are seen especially if there is a thick bone immediately under the skin.

Burning and blackening of the tissue also take place in the depths of the wound.

ENTRANCE WOUND FROM SHOTGUNGS

Close Range (up to 1 m):

Within a distance of about 30 cm., the tissues surrounding the wound are singed by flame and blackened by smoke and tattooed by unburnt or partially burnt powder granules.

The deposit of smoke is known as smudging, fouling or blackening.

This spreads more widely than powder tattooing.

ENTRANCE WOUND FROM SHOTGUNGS

Close Range (up to 1 m):

The tissues within and around the wound may be cherry-red due to absorption of CO.

The wound is single, circular or oval similar to contact wounds, though the blackening and tattooing are more extensive.

The margins of the skin wound may be clean-cut or slightly ragged.

If the powder is smokeless, there may be grey or white deposit on the skin round the wound.

The deeper tissues show marked disruption.

Felt, wads or plastic cups from the cartridge will be found in the depths of the wound.

ENTRANCE WOUND FROM SHOTGUN

Near Range (up to 4-5 m):

Between 1 and 2 m, the shot mass enters the body in one mass, producing a round hole, 4-5 cm in diameter.

At a distance of 2 m, the shot mass begins to spread and individual pellet holes may be detected, which are usually round and show a rim of abrasion at their margins.

The wound of entry is irregular. Wad may be found deep inside the wound. Beyond 2 m, the wads often Strike the body below the shotgun wound.

ENTRANCE WOUND FROM SHOTGUN

Near Range (up to 4-5 m):

It may penetrate the skin or it may only bruise or abrade the skin.

At a distance of 3 meters the central aperture is surrounded by separate openings in an area of about 8 to 10 cm. in diameter.

As muzzle-target distance increases, the main entrance defect progressively becomes smaller, and individual pellet wounds increase in number.

Occasionally, several individual pellet entrance wounds are in contact, producing scalloped defects which are larger than the individual round or elliptical skin perforations.

ENTRANCE WOUND FROM SHOTGUN

LONG RANGE (above 4 m):

At a distance of 4 m the shots spread widely and enter the body as individual pellets producing separate openings in an area of ten to fifteen cm. in diameter. The spread of pellets from a fully choked barrel is about :

- Ten metres - 25 cm.
- Fifteen metres - 35 cm.
- Twenty metres - 45 cm.
- Thirty metres - 75 cm.

EXIT WOUNDS FROM SHOTGUNG

Usually shotgun pellets do not exit from the body except:

a) Contact wounds,
b) Tangential wounds where some of the pellets have a very short track through the body,
c) Thin part of the body, such as the neck or extremities,
d) Wounds caused by large calibre buckshot or rifled slugs.

EXIT WOUNDS FROM SHOTGUNG

At contact or near range, greater disruption of tissues occur than is seen in entrance wound.

The margins are everted as the unsupported skin is struck from within, the tissues tend to burst outward, but there is no singeing, blackening, or tattooing of the margins.

There may be small, separate wounds made by individual pellets that have become separated from the mass.

Fatalities with Blank Cartridges:

A blank cartridge is one containing primer, gunpowder and wadding, but without a bullet or pellets.

Distant shots with blank cartridge are harmless.

Wadding or gunpowder may cause laceration and may produce death from shock by pressure on nerves or by damaging large vessel, when blank cartridge is discharged close to the body

MEDICO-LEGAL QUESTIONS

1) **Is the injury caused by discharge of firearm?**

Firearm wounds are recognized by the appearance of clothing and body entrance and exit wound, the track of the bullet, and the presence of bullet or pellet and residual matter in the clothing, or around entrance wound and in the tissues.

MEDICO-LEGAL QUESTIONS

2) What kind of weapon fired the shot?

The kind of firearm can be determined by the size, shape and composition of the bullet, and examination of cartridge, shots and wad left in the body or found at the scene of the crime, and the appearances of wounds.

MEDICO-LEGAL QUESTIONS

3) From what distance and direction was the shot fired?

The range of fire is determined by the presence or absence of the marks of smoke, flame, tattooing, etc., on or in the body of the victim.

When the range is greater, it can be determined only approximately and with difficulty, from the nature of wounds and penetration.

Test fire with suspect weapon using the same ammunition is useful for estimating the range.

The direction of fire may be determined from the position of entrance and exit wounds and the track.

MEDICO-LEGAL QUESTIONS

4) When was the firearm discharged?

Tissue reaction to firearm injury is similar as for other types of injury.

MEDICO-LEGAL QUESTIONS

5) Is it a case of homicide, suicide or accident?

A) The position and direction of the wound:

For suicide, the sites of election are:

1) temple (about 60%),
2) centre of forehead,
3) roof of mouth,
4) midline behind the chin,
5) left side or front of chest.

MEDICO-LEGAL QUESTIONS

A suicide using a revolver or pistol, usually shoots himself in the right temple, the bullet passing almost horizontally or upwards and backwards through the head, and making its exit in the left parietal region.

Sometimes, the gun is put into the mouth, nose, ear, or on the face or undersurface of the chin, and fired upwards into the brain.

On the chest, the gun is fired into the cardiac region in a backward direction with a slight deviation upwards or downwards, either to the right or left.

On the abdomen, the gun is fired into the epigastric region.

MEDICO-LEGAL QUESTIONS

In homicide a great variety of wounds can occur depending upon the circumstances.

If there is a scuffle, some of the wounds may be from close range, and the bullets may strike the body in various places and at different angles.

If the victim runs, most of the entrance wounds will be on the back.

If the victim rushes at the assailant, the entrance wounds are in front of the body.

MEDICO-LEGAL QUESTIONS

B) The nature of the entrance wound:

C) The number of wounds:

D) The position of the weapon:

MEDICO-LEGAL QUESTIONS

F) The Scene:

MEDICO-LEGAL QUESTIONS

Accidental Wounds:

They are comparatively rare and usually single.

Most of the accidents are caused by carelessness or misuse.

Accidents occur when loaded weapons are handled carelessly or carried without safety catch, or when the victim slips while examining, loading or cleaning the weapon.

MEDICO-LEGAL QUESTIONS

Accidental Wounds:

The wounds are found on the front of the body and frequently directed upwards.

Sometimes, the victim is shot unintentionally by a person who is ignorant of firearms or careless in their use.

Occasionally, when the police shoot on law breakers, an innocent bystander is struck by bullets.

Hunting accidents also occur.

ECSPLOSION WOUNDS

ECSPLOSION WOUNDS

A bomb is a container filled with an explosive mixture and missiles, which is fired either by a detonator or a fuse.

When an explosion occurs, the explosive material produces a large volume of gas and releases very large amount of energy.

A person can be injured by an explosion in a number of ways:

1. Disruptive effects
2. Burns
3. Air Blast
4. Flying Missiles
5. Falling Masonry
6. Mechanical Explosion