FIREARM INJURIES
LECTURE I

AT THE END OF THIS LECTURE THE STUDENT WILL BE ABLE TO KNOW ABOUT;

- Definition of ballistics
- Types of ballistics
- Classification of firearm weapons
- Parts of a firearm weapon
- Cartridges of various firearms
- all these will help the student in better understanding of various aspects of interpretation of firearm injuries clinically.

FIREARM INJURIES:
BALLISTICS:
The study of various physical forces acting on the projectile is known as ballistics.

TYPES OF BALISTICS:
INTERNAL BALLISTICS.
EXTERNAL BALLISTICS.
TERMINAL BALLISTICS.

1. INTERNAL BALLISTICS:
The study of various forces acting on the projectile, when it is moving inside the barrel of the firearm weapon.

EXTERNAL BALLISTICS:
The study of various forces acting on the projectile, when it leaves the barrel, i.e. when it moves in the air from the barrel to the time of reaching the target.

TERMINAL BALLISTICS:
is the study of interaction between the projectile and the target, or we can say that terminal ballistics means the fate of projectile.

FIREARM WEAPON:
a firearm weapon can be described as an instrument commonly used as a weapon of assault, with which it is possible to propel a projectile such as bullet in rifled firearms and lead shots or pellets in shotguns. This projectile force is achieved by expansive force of gases generated as a result of combustion of propellant charge i.e. gun powder in a closed space.

BASICALLY THE FIRE ARMS ARE CLASSIFIED INTO;
SMOOTH BORED FIRE ARMS
e.g. i). shot guns.
   ii). muzzle loading muskets.
GROOVED FIRE ARMS.
e.g. rifles.
    revolvers
    pistols.

AIR GUNS AND PISTOLS

CLASSIFICATION ACCORDING TO MUZZLE VELOCITY

LOW VELOCITY
(UPTO 1200 FT/SEC)

MEDIUM VELOCITY
(BETWEEN 1200-2500 FT/SEC)

HIGH VELOCITY
(MORE THAN 3000 FT/SEC)
IN GENERAL THE VARIOUS PARTS OF A FIRE ARM ARE:
1. BARREL.
2. FIRING PIN.
3. HAMMER.
4. TRIGGER.
5. BUTT.
6. MAGAZINE.

BARREL:
It consists of a cylindrical steel tube, which is closed at its proximal end known as BREECH END & DISTIL END which is always open known as MUZZLE END.
Breech end contains a chamber for accommodating cartridge and may carry an extractor to remove the cartridge case after firing.
The internal lumen of the barrel is smooth in smooth bored fire arms such as shot gun, while it contains spiral grooves running parallel to each other and are seen in Grooved fire arms such as Rifles, Revolvers, Pistols.
Usually the breech end and muzzle end have same diameter but some times to increase hitting range and decrease the spread of pellets and thus get a greater hitting range and distance, the muzzle end of Shot Gun: is narrowed as compared to breech end. This is known as CHOCKING. If both breech end and muzzle end are of same diameter the Gun is known as UNCHOCKED.

**FULL CHOCK:**
Means that muzzle end is 40/1000th of an inch less in diameter then the breech end.

**HALF CHOCK:**
Muzzle end is 20/1000th of an inch less in diameter.

**QUARTER CHOKE:**
Muzzle end is 10/1000th of an inch less in diameter.

**IMPROVED CYLINDERS OR MODIFIED CHOCK:**
Muzzle end is 2-5/1000th of an inch less in diameter.
In cases of Grooved or Rifled Fire arms, which fire a single bullet only, in side their barrels they have a number of spiral grooves which run parallel to each other but are spirally twisted their number and pattern varies with different types and makes. The function of grooves is to impart a spin movement to the bullet while passing through the barrel. The spin keeps the front end of bullet in line with the target and gives it a high velocity.

**BORE:**

Means internal diameter of the barrel, such as 12 bore Gun 20 Bore Gun. In case of 12 bore shot gun, we take 1 lb of lead and make 12 rounded balls of equal weight and diameter each weighing 1/12 lb and each ball fits exactly the internal diameter of the barrel. In case of 20 bore shot gun, 20 balls each weighing 1/20lb of lead are made, and each ball exactly fit the internal diameter of barrel. So as the bore increases the internal diameter of the barrel goes on decreasing.

The bore of the gun is mentioned over the base of cartridge used in it. Base is also known as head stamp.

**CALIBER OR GAUGE:**

In grooved fire arms if we take transverse section of barrel, there are depressed areas alternating with raised areas known as LANDS. Caliber indicates land to land width of the barrel and is expressed in decimals of an inch. A service Rifle is 303

Barrel may be long as in Shot Guns and rifles while barrel may be small as in pistols and revolvers.
FIRING PIN:
A firing pin is present incorporated with hammer and on loading, it is held in cocked position due to shear strain on pulling the trigger it hits the sensitive primer at the base of cartridge and firing occurs.

HAMMER:
In most of the guns a hammer is present which on loading the weapon is held in cocked position and on pressing the trigger the shear of main spring is released and hammer strikes the primer leading to fire (if hammerless than firing pin strikes).

TRIGGER:
It is a lever situated in front of butt or hand grip. As the weapon is cocked and trigger is pressed it releases firing pin or hammer which may incorporate firing pin or which in turn strikes the firing pin, resulting in the detonation of the primer in the percussion cap of a cartridge.

BUTT OR GRIP:
Is part of fire arm gripped in hand in Small barreled fire arms such as pistols, revolvers etc. while the butt is long and shaped to fit the shoulder in cases of Shot Gun and Rifles.

MAGAZINE:
It is a spring loaded box or container carrying a number of cartridges. It may be fixed in grip of pistol or attached to fore stock of a rifle in front of trigger as used in army rifles G3, where after one fire, case of cartridge automatically comes out and new cartridge from magazine is pushed to be in position off next fire.

PROJECTILE:
Any article being capable of projecting with great force from a fire arm weapon is known as projectile such as pellets in shot guns and bullet in rifled fire arms.
To understand mechanism of firing it is important to know about cartridges of various fire arms.
The case of Shot Gun cartridge is made of cardboard or plastic with metallic base, the function of the case is to keep various components of the cartridge compactly arranged in order and more over it is a water proof covering, length of Shot Gun cartridge is 2-2.5 inches. The various components of Shot Gun cartridges starting from base upwards are a metallic rim with a percussion cap in the centre outside and primer containing igniting material on its inner side, this detonating material used was Mercuric fulminate previously, but now potassium chlorate, Antimony sulphide, lead stynhate, Barium Nitrate are used. Above this lies the Propellant charge i.e. gun powder which is of three types.

BLACK POWDER:
Contain Charcoal 15%, Sulphur 10% and Potassium Nitrate 75%; only 44% of Black powder is burnt into gas. 1gm of black powder produces about 270 ml to 300 ml of gas. The Pressure built up at breach end after fire with black powder is 3-5 tons/Sq inch. This is known as breach pressure; usually Breech pressure and Muzzle pressure are same.

SMOKELESS POWDER:
Contain Nitrocellulose alone (SINGLE BASE POWDER) or with Nitroglycerine (DOUBLE BASE POWDER) or contain Nitroguanidine also (TRIPLE BASE POWDER)100% smoke less powder is burnt. Thus little or no smoke is produced 1 gm of smokeless gun powder produce 900 – 1000 ml of gases and breach pressure is 15-20 tons/Sq inch.

SEMI SMOKELESS
85% Black Gun powder.
15% Smokeless Gun powder.

Above the gun powder there is a cushion wad also known as Felt wad or under Shot wad. The various functions of under shot wad are:
- Separates the projectile from propellant.
- Seals the bore effectively.
- Prevents the gases from escaping.
- Allows optimum pressure to be developed.
- Keeps the gun powder firmly pressed against the primer.

Above the Felt wad are lead pellets and above them is a thin paper wad known as over shot wad. The over shot indicates the number of pellets used in the cartridge. e.g.
- 2 - 120 pellets.
- 4 - 240 pellets.
- 6 - 300-500 pellets
- 9 - 700 pellets.

After over shot wad, the margins of the case are turned inwards to retain over shot wad in its position, recently caseless cartridges have been introduced, the whole of cartridge is combustible and therefore does not lend itself for cartridge case identification. Inward turning of the cartridge case after over shot wad to retain it in position is known as “CRISPING” of the cartridge case.

The cartridge of Rifled fire arms consist of:
- METALLIC CASE; which may be rimmed or rimless as seen in automatic or semi automatic pistols.
- PRIMER:
- The different types of primers are:
  - RIM FIRE PRIMER:
    - With sensitive composition lies in the rim which is indented by striker.
  - CENTRAL FIRE PRIMER:
    - Where the sensitive composition lies in the centre just like Shot Gun.
  - PIN FIRE PRIMER:
    - It is uncommon. In pin fire cartridge primer composition is located just above a short pin protruding out at one side of the base or head stamp of the cartridge.
  - GUN POWDER:
    - May be black or smokeless.
  - PROJECTILE:
    - Single bullet made of lead.

A bullet may have a groove or grooves known as CANNULARE near to its base to retain it in position.
FIREARM INJURIES
LECTURE II

AT THE END OF THE LECTURE THE STUDENT WILL BE ABLE TO UNDERSTAND

- THE MECHANISM OF GUN SHOT WOUND PRODUCTION,
- DIFFERENTIATE BETWEEN WOUND OF ENTRY AND EXIT,
- DISTANCE OF FIRE,
- FABRICATED FIREARM INJURIES,
- TESTS FOR DETECTION OF GUN POWDER RESIDUE,
- POSTMORTEM EXAMINATION OF A CASE OF FIREARM INJURIES

VARIOUS TYPES OF PROJECTILES USED IN RIFLED FIRE ARMS.

BULLET

DERIVED FROM FRENCH WORD “BOULET” OR LITTLE BALL.

JACKETED CONICAL BULLETS:
Jacketted either fully or partially with copper, cupronickel, or other harder casing. Used in Rifles.

HARDENED LEAD BULLETS:
Made of lead, no covering. Used in pistols and revolvers.

DUM DUM BULLETS:
These are expanding grooved bullets. They mushroom up in to pieces when they strike the body; they are very destructive and produce extensive lacerated wounds with ragged margins.

TRACER BULLETS:
These bullets have Barium per oxide and magnesium enclosed in their base. These bullets emit light as they pass, usually used for signaling purposes.

INCENDIARY BULLETS:
These bullets contain phosphorus and burn the tissues.

TENDEM BULLETS:
When weapon is old or rusty, when fired, the bullet does not come out of the barrel but when a second bullet is fired it forcible brings out the first bullet with it. Thus two bullets come out by a single fire. Such a bullet is called tendem bullet. (PIGGY BACK BULLET)

BATON CARTRIDGE:
Rubber bullets. 25 – 50 yds.
Now bullets made of plastic i.e. Teflon bullets are used.
DUPLEX CARTRIDGE:

POISONED BULLETS- THESE BULLETS CARRY
- CURARE
- RICIN
- AFLATOXIN (Naturally occurring mycotoxin, produced by many species of Aspergillus, a fungus. (Aflatoxin is among the most carcinogenic substances known)

SOUVENIR BULLET
MAGIC BULLET

Some times in viva if red coloured cartridge of shot gun is kept we write in spotting as empty cartridge of 12 or 20 bore by seeing the base and into medico legal importance, we write it cause.

HOMICIDAL INJURIES.
SUICIDAL INJURIES.
ACCIDENTAL INJURIES.
FABRICATED INJURIES.

When metallic case of rifled fire arm is kept we write Metallic case of a fired rifled fire arm weapon most probably revolver or pistol with bullet portion missing and M.L. importance is same.

Some times when a bullet has been recovered from dead body it is fixed over empty case. Here we will say that it is fired rifled fire arm cartridge by seeing base where there will be depression over the base due to striking of hammer and secondly there will be secondary markings over the bullet portion due to grooves in the barrel while M.L. importance is same.

Some time asked in viva these Medico legal uses are in fact abuses. The real uses of cartridge are in fact when we apply for license of gun i.e. fire arm weapon 2 things are written on it. Self Defence. Shooting (Sports) purposes.

MECHANISM OF FIRING:
Loaded.
Cocked.
Fired on pulling trigger.

When the hammer or firing pin strikes the percussion cap it detonates the primer having igniting material which causes burning of Gun Powder. Depending upon type of gun powder i.e., in Black Powder 270 – 300 ml of gases and pressure of 3-5 tons per Sq. inch is generated which in that narrow space pushes the projectile forward with a great force.

On coming out of barrel i.e., muzzle end the gases of combustion expand suddenly, which is responsible for the sound produced.

The following things come out of muzzle of a fire arm when fired.

Projectile i.e., lead pellets along with over shot wad in shot guns and bullet in cases of Rifled fire arms.
Blast of highly compressed gases (Producing sound)
Particles of unburnt or partly burnt grains of gun powder.
Smoke when black Gun Powder is used.
Flame.
Under Shot wads.
In cases of Shot Gun cartridges, these wads can travel up to 25-30 yds but can enter the body up to a distance of 2-5 yards.
Grease from weapon.
Some times Empty cartridges in shot guns if not properly fitted.

Cartridge case found at scene of crime is known as Crime or Exhibit cartridge case. So also is metallic case in Rifled fire arms.

**SPIN OF BULLETS IN RIFLED FIREARMS:**

Due to grooves in the barrel of Rifled firearms, the Projectile i.e., bullet comes out of the muzzle end with spinning movement.
The function of the spin is to:
Keep the forward end of the bullet in line with the target, so as to provide more accuracy.
Give gyroscopic stability to the bullet.
Prevents it from wobbling as it travels in the air.
Spinning movement varies in different riffled fire arms.
- Rifles 2000-3000 Rotations/Sec.
- Pistols 800 – 1300 Rotations/Sec.
- Revolver 600 – 800 rotations/Sec.

**TAIL WAG (WOBBLING):**

As the bullets comes out of rifled fire arm its front end is kept inline of the target due to spin while its posterior end or tail end tends to wobble out i.e., besides moving around its own axis (spin), it moves around the axis of the target in first few hundred yards before settling down and also in last few hundred yards with dropping of velocity. This is known as tail wag. Common example is of spin used by children for playing, where the needle remains stable, while upper wooden part moves here and there, then settle down and again when speed decreases it again moves here and there.

In cases of rifles wobbling is present in first 500 yards and then bullet becomes stable and moves in line of target up to 1500 yards. So there is no wobbling or tail wag between 500 – 1500 yards and wound of inlet and exit will be of exactly equal dimensions, but if tail wag is present, there will be extensive tearing and lacerations of the tissues due to spin.

**SINGEING**

i.e., burning of hair due to flame produced when weapon is fired.

- Pistons and Revolvers - 3 inches.
- Rifles - 6 inches.
- Shot Guns - 9 to 12 inches.

**BLACKENING:**

Deposition of Smoke.
Rifled fire arms - 1 foot.
Shot Guns - 3 feet.

TATTOOING:
Deposition of unburnt and semi burnt gun powder.
Rifled Firearms: 3 feet (1 yard)
Shot Gun: 9 feet (3 yards)

MUZZLE VELOCITY:
The maximum velocity of the projectile when it comes out of the muzzle of firearm is known as muzzle velocity.
1. Shot Guns: 1000 feet/sec.
2. Rifles: 2000-3000 feet/Sec.
3. Pistols: 1200 feet/Sec.
4. Revolvers: 600 feet/Sec.
5. Air Rifles, and Air pistols: 400-700 feet/Sec.

EFFECTIVE RANGE:
It is that range in which the firearms can cause maximum damage.

HITTING RANGE
It is that range up to which the projectile can reach the target, but will cause minimum damage.

<table>
<thead>
<tr>
<th>EFFICIENT RANGE &amp; HITTING RANGE</th>
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<tbody>
<tr>
<td>SHOT GUN</td>
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<tr>
<td>Effective Range: 30-40 YDS</td>
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<tr>
<td>Hitting Range: 100-200 YDS</td>
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<tr>
<td>RIFLES</td>
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<tr>
<td>1000-1500 YDS</td>
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<td>2000-3000 YDS</td>
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<tr>
<td>PISTOLS &amp; REVOLVERS</td>
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<tr>
<td>200 YDS</td>
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<tr>
<td>700-800 YDS</td>
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</table>

WADS:
In cases of shot guns: They can travel up to 25-30 yards.
In unchoked Guns they enter the body up to 2 yards.
In chocked Guns they enter the body up to 5 yards.

CHARACTERISTICS OF RIFLED FIRE ARMS WOUNDS:
These wounds show characteristics of lacerated wounds.
Two wounds are generally produced by the impact of a single fire i.e.
WOUND OF ENTRY.
TRACK.
WOUND OF EXIT.

WOUND OF ENTRY.
In distant fire, the wound of entry is usually smaller than the projectile i.e. bullet due to elasticity of the skin.
It is rounded when the bullet strikes the body at right angle.
It is oval when then bullet strikes the body obliquely.
It is key hole type of wound of inlet when the bullet strikes the body side way i.e., during spinning i.e., 1st 500 yards, and wobbling due to drop of velocity after 1500 yards.

Wound of entry is smaller than wound of exit as the bullet on striking the skin, invaginates it, and pierces it and while passing out due to violent spinning action, causes laceration and a larger wound of exit. BULLET CAUSES WOUND THAT LOOKS LIKE A LACERATED WOUND.
ABRADED COLLAR / CONTUSED COLLAR OR CONTACT RING.
WHEN BULLET STRIKES THE SKIN, IT PUSHES THE SKIN SO IT IS STRETCHED TO POINT OF RUPTURE & MAKES HOLE. RIFLING IMPARTS ROTATIONAL MOTION, IT MAKES THE HOLE ROUND AS ROTATING BULLET RUBS AGAINST THE STRETCHED MARGIN OF THE HOLE, IT CAUSES AN ABRASION.

IMPORTANCE OF ABRADED COLLAR.
AS OBLIQUITY OF THE FIRE IS INCREASED THE WOUND BECOMES ELONGATED MORE & MORE.
SOME TIMES BULLETS STRIKE THE BODY AT SUCH AN ANGLE THAT THEY DO NOT ENTER THE TISSUES THEY JUST CAUSE A SUPERFICIAL ABRASION OR LACERATION THIS IS CALLED BULLET SLAP.
IF BULLET CAUSES AN OPEN DEEP TRACK THE WOUND IS CALLED GUTTER WOUND.

Wound of entry is gutter shaped if bullet hits tangentially.
The margins of wound of entry are inverted except in cases of fat people and in decomposed bodies where fat and gases of putrefaction respectively evert the edges.
Some times there is one wound of entry and multiple wounds of exit. This is especially seen in expanding grooved DUM DUM bullets which get fragmented inside the body and come out through multiple exit wounds.

Depending upon distance, there maybe singeing, blackening tattooing around the wound of inlet and gun powder in the wound.
In contact fire i.e., pressed against the target, a blast effect is produced in the skin and sub cutaneous tissues.
e.g., In cases of contact fire on skull, the underlying tissues crepitate because of expansion of gases, but there will be no evidence of singeing, blackening, tattooing, butt there will be a circular collar of abrasion due to pressure mark of muzzle. Here the wound of entry is large and cruciate and may be ragged with margins of wound everted.
As weapon is usually greased to prevent rusting. So the spin of bullet causes a collar of abrasion and
contusion which appears as a dark ring showing two zones the inner one of grease and outer
zone of abrasion.
Some times when the bullet, hits the skull due to spinning movement, there will be grooves on
the inner table of skull, known as BEVILLING OF THE BONE.

2. TRACK.
Examination of entrance wound. (collar of contusion)
Direction of bullet track within the body
Line between wound of entry & site of lodgment of projectile and exit wound as bullet usually
follows a straight line course.

WOUND OF EXIT.
It is bigger than the entry wound.
· Very irregular and torn.
· Margins are everted.
· No collar of abrasion or contusion around the margins.
· Nearer the target, more ragged and torn is the exit wound.
If the bullet hits a compact bone, it is shattered and pieces of bone come out through exit
wound, in such cases exit wound is bigger and severely lacerated.
If the bullet hits a spongy bone, it forms a clear cut punched out hole and the exit wound is also
clean and punched out.
If bullet strikes a hard bone, the bullet may rebound and come out through same wound of
entry or gets deviated and pass out from an exit wound not in line with the wound of entry.
This wound maybe near or adjacent to wound of entry. This is known as WOUND OF
RECOCHETE.
A recochete wound is often ragged since the bullet after its primary impact becomes distorted,
tilted and has lost much of its velocity.
· Recochete wound can not be fabricated. Intentional deviation of bullet is impossible, unless
fired on surface of water.
Some time there is one wound of entry but no exit wound.
The various reasons may be.
· It was ricocheted out through same wound of entry.
· Was lodged in respiratory passage and coughed out.
· Was lodged in G.I.T. and either vomited out or passed in faeces.
· Bullet is still inside the body, but if on X-ray from head to toe no
shadow of bullet is seen, then 1st 3 conditions apply only (commonly asked in viva).

VARIOUS FACTORS WHICH MODIFY THE CHARACTERSTICS OF FIRE ARM WOUNDS.
The shape size, depth and condition of the wound along with degree of internal damage are
dependent upon following factors.
· Nature of Projectile and weapon.
· Velocity and stability of the projectile at the time of impact.
· Distance between the firearm and the body.
· Angle at which the projectile hits the body.
NATURE OF PROJECTILE:
Large bullets and Dum Dum Bullet cause greater damage.
Modern conical steel jacketed bullets pass through the body with a very great velocity, without deflection and without causing much damage. Wound is punctured in appearance.
Round bullets cause greater damage than conical bullets rarely split.
Incendiary bullets may sometimes be found in wounds to be still hot and smoking in tissues after causing burning of such tissues.
Fragments of shells cause extensive wounds and even death if they strike over vital part.
Tendem bullet: 2 bullets may come out by a single fire so two wounds of entry.
Wadding or gun powder may cause frightful laceration and may produce deaths by penetrating the internal organs of the body, even if a blank cartridge is discharged close to the body.

VELOCITY AND STABILITY OF PROJECTILE AT THE TIME OF IMPACT:

Direct effect.
Remote effect.

Direct effect
High velocity causes clean circular punched in and out wounds. It perforates the body and is not deflected from its path by striking a bone, but may cause its splintering.
Low velocity bullet causes contusion and laceration of the margins of the wound of entrance. It is easily deflected from its path and deformed by striking some hard object, and often lodges in the body e.g. revolvers.
The track made by a bullet widens as it goes deeper (due to spin) P.S: this is the reverse of that seen in stab wound.

Remote effect.
A high velocity bullet with a spin of 3000 revolutions per second, imparts severe vibrations in soft tissues. These vibrations may produce concussion of the brain or spinal cord resulting in temporary or permanent paralysis, or even death by rupture of heart, lungs, big blood vessels without much destruction of soft tissues.

DISTANCE BETWEEN FIREARM AND BODY.

SHOTGUN: FELT WAD: Enters body up to 2-5 yards. 2 yards ---- if un-chocked 5 yards ---- if chocked (full) SINGEING Up to 9-12 inches. BLACKENING Up to 3 feet. TATTOOING: Upto 3 yards (9 feet). Pellets in case of shot gun enter as a mass up to 1-2 feet. In UN-CHOCKED SHOT GUNS: The pellets start separating at 2-3 feet.

Area of dispersal on body, in inches is equal to 1 ½ times the distance between the body and gun in yards.
FULL-CHOKE PROOF SHOT GUNS:
Pellets start separating from 6-9 feet.
Area of dispersion on the body, in inches, is equal to the distance between the gun and the body in yards.
IF WE WANT TO GIVE DISTANCE IN METERS, THEN 1/3 OF DISPERSION IN CMS IS EQUAL TO DISTANCE IN METERS. E.G. IF DISPERSED OVER 24 CMS THEN DISTANCE OF FIRE IS 8 METERS. (24/3 = 8)

RIFLED ARMS:
- Singeing: Rifles up to 6 inches.
- Blackening: 1 inch.
- Tattooning: Up to 3 feet.

Blackening range begins where the singing range ends.

Tattooing cannot easily be wiped off while blackening can be wiped off with a wet cloth.
The entry wound of a revolver fired very near or in contact with the skin is stellate or cruciform in shape, instead of being circular.
If the revolver is fired close to the skin, but held at an angle, the singeing, blackening and tattooing is limited only to one side of the bullet hole.
If the powder is smokeless there will be no blackening of the skin even if fired from a close range, but there may be grayish white deposit on the skin around the wound.

No blackening or singeing is found if the firearm is discharged from a distance of more than four feet.
In contact fire, burning, scorching, tattooing etc. may be absent even when the weapon is pressed tightly against the skin of the body, as the gases of the explosion and the flame, smoke and particles of gunpowder will all follow the track of the bullet in the body.
The shorter the barrel of the weapon used, the greater the tendency to the presence of unburnt or slightly burnt gun powder grains
(Usually if there are unburnt powder grains the indication is that the shot was fired from a revolver or a pistol).
Glancing or grazing shots cause burrroughs.

BACK SPLATTER PHENOMENON
CONTACT WOUNDS MAY CAUSE BLOOD AND TISSUE FRAGMENTS TO ENTER THE MUZZLE FOR SEVERAL CENTIMETERS CALLED “BACK SPLATTER”. THIS IS DUE TO MOMENTARY SUCTION EFFECT AFTER THE PRESSURE OF GAS BLAST SUBSIDES DUE TO RAPID COOLING OF BARREL. THIS SEEMS TO ASPIRATE MATERIAL SUCH AS PIECE OF SKIN, HAIR, ADIPOSE TISSUE AND BLOOD IN TO THE MUZZLE. SOME TIMES BLOOD AND TISSUE MAY SOIL THE HANDS AND ARMS OF THE PERSON FIRING THE GUN. THIS IS OF CONSIDERABLE FORENSIC IMPORTANCE

ANGLE AT WHICH PROJECTILE HITS BODY.
- If perpendicular .... Rounded wound of entry.
- If oblique .... Oval.
- If tangent hitting .... Wound is gutter shaped and projectile does
not enter the body at all.

If side ways .... Key hole type of wound of inlet.
The direction of the firing is difficult to be correctly found out as the bullet does not always follow the course of a straight line. It changes its course after hitting a bone (may change) however, in case of a straight line course, by the joining of the entry and exit wound, and prolonging this imaginary line outside, the body the position of the firing person can be determined.

IDENTITY ESTABLISHMENT FROM A FLASH.
There is a comparatively little flash with modern smokeless powder, though with black powder some amount of light is produced. It is controversial if identity can be fixed with that amount of in a dark night. With a distance of 5-20 feet, one can see and recognize a person firing it he has seen the person before.

GUN SHOT WOUND MAY BE SUICIDAL HOMICIDAL OR ACCIDENTAL.

<table>
<thead>
<tr>
<th>S. NO</th>
<th>SUICIDAL</th>
<th>HOMICIDAL</th>
<th>ACCIDENTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Victim</td>
<td>Generally adult male</td>
<td>Any</td>
<td>Any</td>
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</table>

<table>
<thead>
<tr>
<th>Site</th>
<th>Where hands can reach easily i.e. middle of forehead, side of head, mouth, under the chin &amp; heart. With shot gun, it may be fired into the abdomen, by using the toes for triggering.</th>
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</thead>
</table>

<table>
<thead>
<tr>
<th>Distance</th>
<th>Contact or close fire.</th>
<th>Any distance but usually distant fire.</th>
<th>Usually close fire.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Direction</td>
<td>Consistent with self fire.</td>
<td>Any Direction</td>
<td>Any Direction</td>
</tr>
<tr>
<td>Number of shots</td>
<td>Usually one.</td>
<td>Any Number</td>
<td>Any Number</td>
</tr>
<tr>
<td>Weapon</td>
<td>Weapon is near this Person.</td>
<td>Keep on not near the person.</td>
<td></td>
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</table>
FABRICATED (FAKE) FIRE ARM WOUNDS: Purpose:

To implicate and enemy falsely.

For blackmailing.

Murderer inflicts on himself to show self defence.

To make an injury cognizable.

How to find out fake gun shot wounds.

A.1. Fake wounds are usually under clothings.

2. Signs of near fire. Singeing blackening tattooing, etc. present.

3. Wound is on non vital parts.

4. Sometimes the person pulls away the clothes and fire in and carbon only, none gun powder will be present particles may be present on the skin clothes.

5. Sometimes a gutter shaped wound produced near calf, shoulder, or thigh.

TESTS FOR DETECTION OF GUN POWDER ON THE HAND.

-DERMAL NITRATE TEST, GONZALE’S TEST OR
DIPHENYLAMINE TEST (PARAFFIN TEST) (NOT USED NOW)
-HARRISON AND GILROY METHOD

LATEST TESTS ARE.

-NEUTRON ACTIVATION ANALYSIS.

-FLAME LESS ATOMIC ABSORPTION
SPECTROPHOTOMETRY (FAAS).

-SEM/EDX, SCANNING ELECTRON MICROSCOPY/
ENERGY DISPERSE X-RAY ANALYZER

-CHROMATOGRAPHY

-ELECTROPHORESIS

L.G. & S.G. CARTRIDGES.

L.G. Stands for Large Globules.

S.G. Stands for Small Globules.

In cases of shot guns the terms S.G. & L.G. are used which indicate greater
effective and hitting range. If big shots are used they usually vary in number from 6 to 8, but some times only one lead shot is used known as LETHAL shot.
The effective range is increased upto 100-200 yds, where as in ordinary guns, the number of shot made from 1 ¼ oz of lead in weight. As the number increases size of lead shots or pellets decrease so ordinary cartridge contains about,

<table>
<thead>
<tr>
<th>Size</th>
<th>Pellets</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>120</td>
</tr>
<tr>
<td>4</td>
<td>240</td>
</tr>
<tr>
<td>6</td>
<td>300 – 500</td>
</tr>
<tr>
<td>9</td>
<td>700</td>
</tr>
</tbody>
</table>

So if large number off pellets are present they are known as DUST SHOTS, but if only 6-8 pellets are used seen in S.G. & L.G. they are known as BUCK SHOTS and their effective range is greater i.e. about 100-200 yards, instead of ordinary 30 – 40 yards.

**POSTMORTEM EXAMINATION:**
In addition to the routine examination, the following points require special consideration:
- Scene of crime.
- Description of clothing – No of holes, tattooing or blackening of clothes etc.
- Findings regarding firearm injuries.
- Cause of death.
- Chemical analysis – Analysis for gun powder on tissues around the site of entrance, Test clothes for blood stains, seminal stains, faecal matter.

Wounds should be numbered and described fully.
Skin around the wound of entrance is sent for chemical examination for gunpowder (indicating near fire).
Muscles and tissues are examined for Carboxy haemoglobin. Close fire gives a positive test. This is useful for telling range. Bullet path should be traced by dissection and not by probing. (Path is not always straight).
If the wound of entrance is oval, with beveling only on one side than direction of slanting fire is from the beveled side towards the other.
If any metallic fragment is found, preserve it and hand it over to Police, duly sealed, for showing it in the court.
If the bullet cannot be traced within the body, X-Ray should be taken.
Look for fragments of bullets which may be lodged in subcutaneous tissues, scalp etc, if the bullet gets fragmented inside the body. It is even possible for some fragments to remain lodged in the body even if the main bullet has passed out.
If there is one wound of entry but two wounds of exit, then suspect.
   i. Fragmented bullet.
   ii. So close a fire that entrance is one of two different bullets.

**Bullet Embolism:** If the bullet enters the aorta, it may get lodged anywhere in the body due to circulation of blood, this is called “bullet embolism”.
If the bullet is lodged in the bone, try to remove the bullet for sending to the Forensic Laboratory if it cannot be removed, then remove a piece of bone with the bullet, and send for examination. The following should be sent for examination:- Blood stains (if found) for blood Grouping. Blood and urine for alcohol content. Skin & tissues for stains of gunpowder, and tissues and muscles for Carboxyhaemoglobin.

D. Clothes for other stains e.g., seminal, faecal etc.

CAUSE OF DEATH:
Usually the cause of death is shock, haemorrhage or injury to the vital organs. Infection is also common. Peritonitis may result. Pneumonia may complicate head injuries due to prolonged unconsciousness.

TIME WHEN A WEAPON WAS FIRED:-
After recent discharge a black deposit of potassium sulphide mixed with carbon is found in the barrel of the fire arm, if black gunpowder was used. For the first five of six hours this deposit form a strong alkaline solution with distilled water and emits an offensive odour of sulphurated hydrogen. If the solution is filtered and the filtrate is treated with a solution of lead acetate a black precipitate of lead sulphide is formed.

After exposure to air and moisture for a few days potassium sulphide becomes converted into thiosulphate, and finally into potassium sulphate which forms a neutral solution with distilled water and gives a white precipitate with lead acetate. At later periods Oxides of iron with traces of iron sulphate are formed in the barrel.

In case of smokeless powders a dark grey deposit is formed in the barrel of a recently discharged firearm. If does not change with the passage of time.
FOR ANY SUGGESTIONS/PROBLEMS RELATED TO THE DEPARTMENT -
E MAIL ON captdrmirza@hotmail.com
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