LECTURE NOTES ON FIREARM INJURIES

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Definition of a firearm

A gun is a mechanical device which expels a projectile. It is meant to harm or kill someone. The term arm refers to a weapon that is hand held and can be transported by one person. Therefore a firearm is a gun intended to be used and supported by a single individual.

"Firearm" shall mean any portable barrelled weapon that expels, is designed to expel or may be readily converted to expel a shot, bullet or projectile by the action of an explosive, excluding antique firearms or their replicas. Antique firearms and their replicas shall be defined in accordance with domestic law. In no case, however, shall antique firearms include firearms manufactured after 1899.

Firearms and ammunition

There are different ways of classifying firearms.

1. Handguns & shoulder guns.
2. Light & heavy artillery.
3. Rifles and shotguns.
4. Rifle weapons and smooth bore weapons.

From these 3 & 4 are more appropriate for forensic purposes

Types of firearms:

1. Fully mechanical.

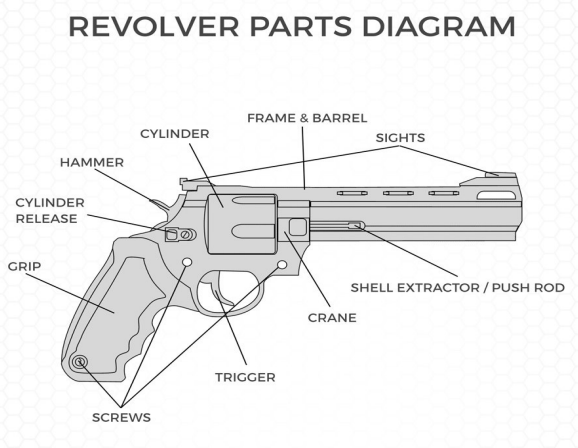
2. Semiautomatic; Automatically loaded but fires only once when the trigger is pulled. You have to release the trigger and pull once more to fire the next.

3. Fully automatic; continue to fire as long as the trigger is activated and ammunition is fed are fully automatic or machine guns.

Hand guns – use only hand and fingers to load, aim and fire the weapon

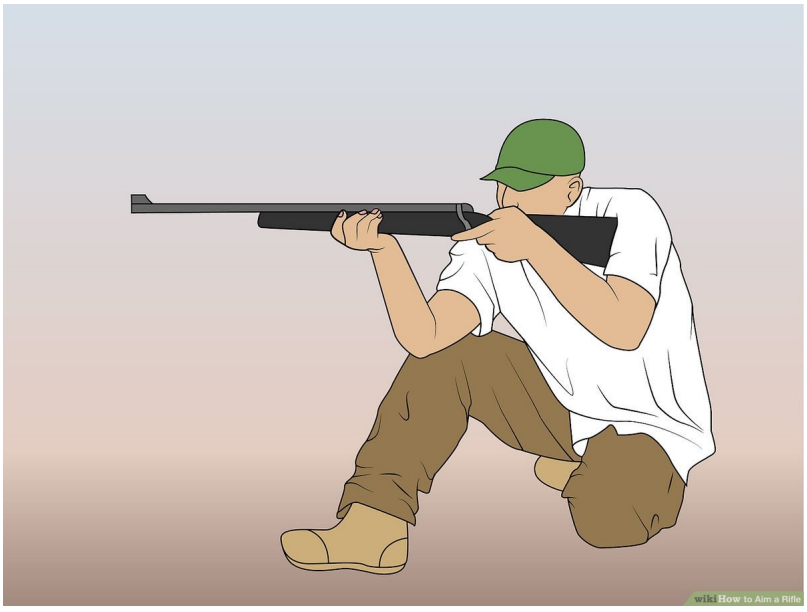
Handguns:

A handgun is a short-barreled firearm that can be held and used with one hand. The two most common handgun sub-types in use today are revolvers and semi-automatic pistols, although other handguns like machine pistols and derringers also see infrequent usage



Shoulder Gun

A firearm that is normally fired while held in the hands and braced against or upon the shoulder is called a shoulder gun.



Way to hold the shoulder gun

Parts of Firearm

ACTION: The action is really the guts of the gun. It includes all the moving parts that load, fire, and eject the firearms shells or cartridges.

STOCK: The stock (or Handle) of the gun in composed of two pieces (the Butt and the fore-end).

BARREL: A guns Barrel is the long metal tube, bored out to provide an exit path for the discharging projectile. Once the projectile is fired, it's forced down the barrel and out of the muzzle by expanding gas forces. In a rifle or a hand-gun, the bullet travels through the barrel; in Shotguns the Shot or the Slug is shot through the barrel.

Classification of Firearms:

Technically there are two types of firearms;

1. Smooth bore firearms
2. Rifle firearms

Smooth bore weapons

In a smooth bore firearm inside of the barrel is smooth. It fires a cartridge which consists of propellant and a shot. When the trigger is pulled hammer hits the primer cap, which ignites the propellant resulting in an explosion. The explosive effect push the shot and wad along the barrel and eject them from the muzzle end of the barrel. Size of the gun is given by the 'bore'. The bore is the number of equal sized lead balls made from a pound of lead which exactly fit in to the bore.

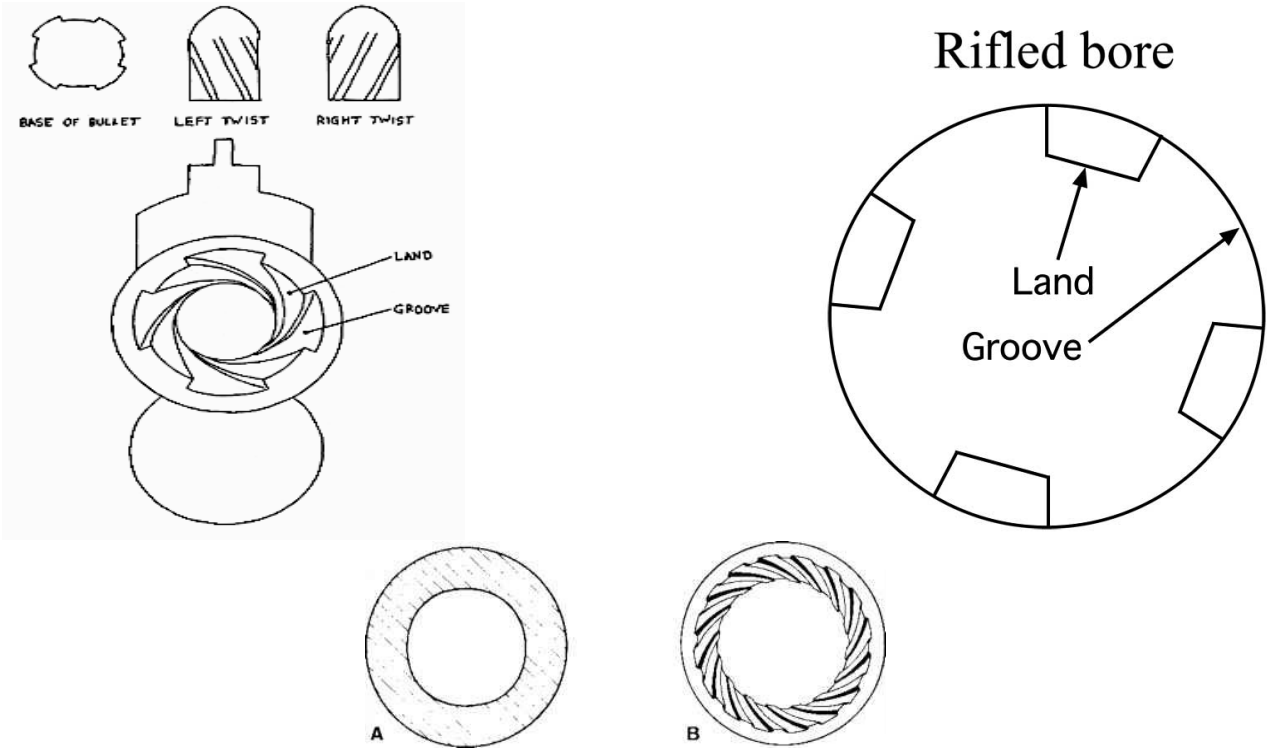
12 bore = 12 equal sized balls are made from a pound of lead

16 bore = 16 equal sized balls are made from a pound of lead.

This means that the 12 bore weapon barrel has a larger diameter than the 16 bore weapon barrel.

Rifle firearms;

There are rifling (grooves that are cut in to the bore of the barrel which have either right turns of left turns). The number of the 'rifling' depends on the manufacturer. The part between two grooves are called lands. Size of the weapon is given by the calibre of the gun which is distance between two opposing lands.



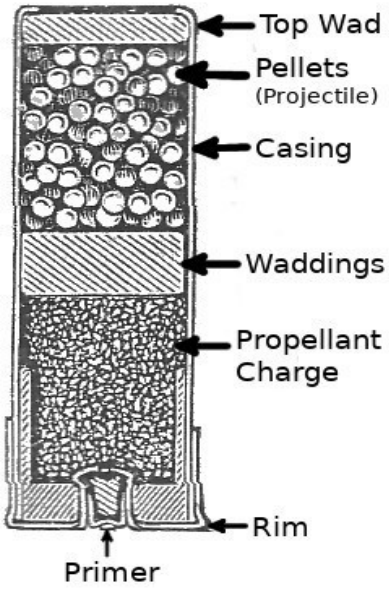
This diagram shows the difference between the smooth bore weapon (left) and rifled weapon (right)

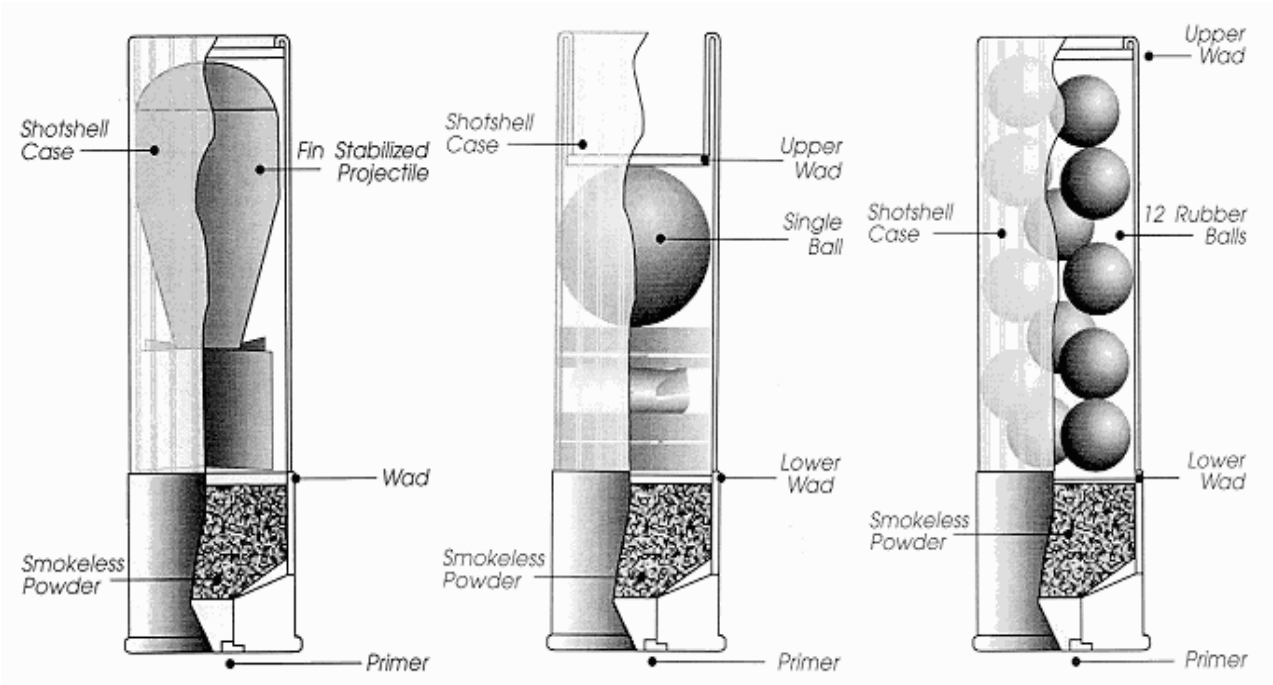
Ammunition:

Smooth Bore weapons:

Shot gun cartridge

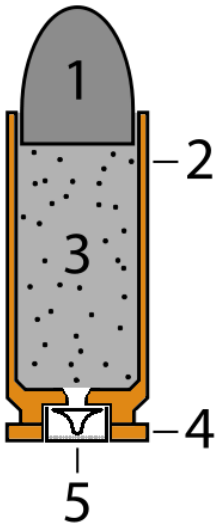
When the gun is fired or the trigger is pulled the part called 'the hammer' hits the primer cap. This will ignite the small amount of 'gun powder 'in the primer compartment. The small vent between the primer compartment and the pro-pellant charge lets the flame to pass in and which causes the propellant to explode thus pushing the parts beyond it along the barrel of the gun.

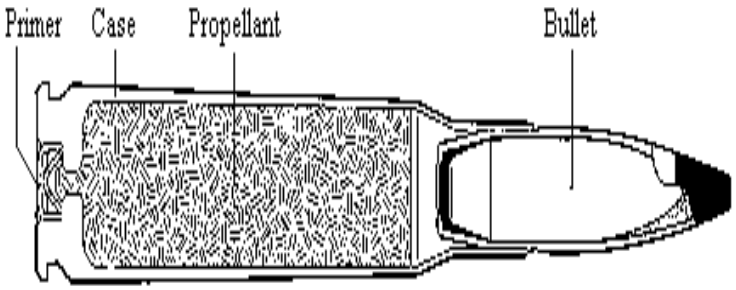




The shot can vary according to the type of the ammunition and different types of ammunition are meant to use for specific reason. Some are called birdshot and another as buckshot. In these two the name itself gives an indication of the purpose it is used.

Rifle Cartridge:





Basic mechanism is almost identical. However, there is nothing called ‘wads 'in this cartridge. There is a single lead projectile ejected on firing a rifle firearm with rifle cartridge.

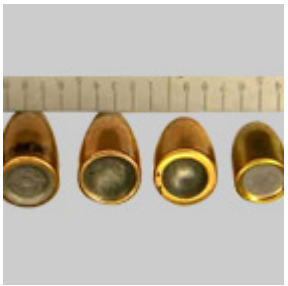
The lead is likely to get deformed easily and therefore manufacturers have introduced a protective cover called a ’jacket’ to the bullet. This casing is usually made of copper-nickel mixture and prevent deformation of the lead core.

Types of Jacketed bullets:

Full metal jacket - encloses the entire bullet, with the exception of the base. Normally used for military purposes, these bullets are also known as full jacketed, full patch, full metal case, and ball ammunition.

Semi jacketed – partially encloses the bullet with the exception of an exposed soft point or a hollow point.

Total metal jacket – fully encloses a bullet core



Full metal jacket

Semi jacketed

Total metal jacket

Firearm Ballistics

There are three areas of ballistics

1. **Internal ballistics**, - within the barrel of the gun
2. **External ballistics**, - from time of discharge until it reach the target.
3. **Terminal ballistics** – movement within the target.

Internal ballistics – how the projectile behave within the barrel of the gun

In the smooth bore weapon the shot simply traverse the length of the barrel.

In the rifles the 'rifling' imparts a rotational movement to the bullet. – ***gyroscopic movement***.

Gyroscopic movement means spinning of the bullet spins around its own axis. This stabilizes the bullet and make it more steady. Therefore in a rifle weapon the bullet traverse for a greater distance I a straight line. In certain rifle firearms the bullet may travel up to 1.5 to 2 km distant.

External ballistics: how the projectile(s) behave in the air

Shot guns - Initially the shot stay together. As the energy is lost the 'shot' starts to separate. A cone shape spread of individual pellets,

Rifles - Due to the gyroscopic spin bullet travel for a greater distance. As it reaches the end of its path it starts to wobble – called yawing. Later it tumbles and even might travel base forward along the trajectory.

Terminal ballistics (Wound ballistics)

Everything depends on the kinetic energy bullet possesses. Determined by K.E. = $WV^2/2g$ or $MV^2/2$. If the velocity is doubled the kinetic energy will be quadrupled. Amount of tissue destruction is proportionate to the amount of kinetic energy lost during the period it traverse the tissue.

As the bullet traverse through the tissue it crushes and shred the tissues around. - thus causing a formation of a **'Permanent cavity'**.

It also flings tissues outward - **'Temporary cavity'** - which lasts for 5-10 milliseconds. It extends up to 12 times the diameter of the bullet. There is alternating positive and negative pressure wave spreading out. Size of the temporary cavity depends on the consistency of the tissue.

If the bullet/pellet stops within the tissue a large amount of energy is lost to the tissue so the destruction is more.

Loss of energy also depends on;

(i) Amount of kinetic energy possessed by the bullet.

(ii) Angle of yaw.

(iii) Features of the bullet- Size of the bullet, Construction- jacketed (fully or partially) or non-jacketed, Expanding bullets, Soft nose bullets, Hollow point bullets.

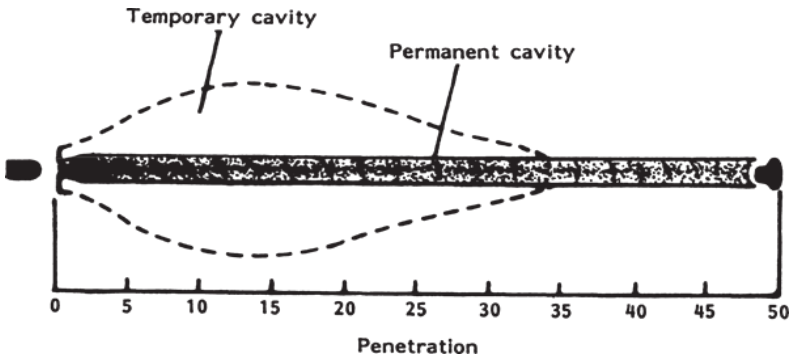
Terminal Ballistics/ Wound Ballistics

Terminal or wound ballistics deals with the mechanism of causing the physical tissue damage when a projectile discharged from a firearm enters the body. There are a number of mechanism in which the tissue is damaged.

1. Mechanical destruction of tissues due to passage of the projectile
2. Temporary cavitation effect - injuries resulting from shearing, compression and stretching forces.
3. Shock wave— which travels radially outward and sometimes even ahead of the projectile
4. Secondary injuries due to breakup of the bullet

In addition to these the nature of the tissue involved and the length of the wound track also plays a part in determining the extent and severity of the injury.

One of the most important factor which determine the severity of injuries is the formation of the temporary cavity. This effect usually last for 5-10 milli seconds. The diameter of the temporary cavity might extend up to 12 times the size of the diameter of the projectile. After the initial rapid formation of the cavity it undergoes a series of gradually smaller pulsations and contractions before it finally disappears, leaving the permanent wound track .



The dimensions of this temporary cavity are dependent upon the shape, weight, size and velocity of the missile and the elasticity of surrounding structures.

With extremely high-velocity missiles, in excess of 3000 ft/s, there is an explosive movement of the tissue away from the wound track. This results in enormous temporary cavities as well as extensive fracturing to bones and damage to veins and arteries in the immediate vicinity. In addition, there is often a back splash of tissue out of the entry hole giving the impression of an exit wound.

Types of Firearm injuries

When a gun is fired - A jet of flame up to 6", A cloud of gas, Burnt and un-burnt grains of gun-powder, Soot, Vaporized metal from bullet exit through the barrel and all of these could leave their mark on the target.

Burning, blackening and tattooing **(BBT)** – considered characteristic features of firearm injury.

Burning – due to flame

Blackening – due to deposition of burnt or partly burnt gunpowder.

Tattooing – small abrasions caused by gunpowder particles

If one or more of BBT is present it is a gunshot wound. However absence of BBT doesn't exclude gunshot wound – distant shot, intermediate object.

Classification of Gunshot Wounds:

Entrance and Exit wounds.

Contact, Near-contact, close range, intermediate and distant range wounds.

Rifle firearm and smooth bore weapon injuries.

Features of Entrance Wounds - General

Inverted margins

Abraded margins ('abrasion collar') – usually not in shotgun wounds

Dirt ring or bullet wipe

Fibres may be found in the wound

Smaller defect than the diameter of the bullet

Burning, Blackening, Tattooing

Internal beveling,

Muzzle imprint

High CO amount

Features of Exit Wounds

Usually everted

No abrasion collars (unless 'shored')

A larger wound than the entrance wound,

Bony fragments being forced out through the skin

No BBT

When a suspected case of gunshot injuries is found;

Firstly try to determine whether they are gunshot injuries,

If they are then try to distinguish entrance wounds from exit wounds.

This will give you the 'baseline' to investigate further.

When you find circular perforating/penetrating wound in a body what are the possibilities - Stabs by a weapon with a circular cross section – uncommon, Considering the incidence gunshot injury is much commoner. Then look for other characteristic features of firearm injuries.

Range of fire

Range could be described as the distance from muzzle end of the firearm to the target. It can be divided in t o following types.

(i) Contact (ii) Near contact (iii) Close (iv) Intermediate range (v) Distant wounds

Contact range:

Hard or loose contact. In 'hard' contact all the material exiting the gun goes beneath the skin. Margin is seared and blackened. Circular perforating injury. Gas going in to the tissue causes bulging of tissue. Muzzle imprint is present. Over the head it might be of stellate shape.

Back spatter on to the gun./ or even on to hand or arm. Important in determining the assailant, gun used or in a case of suicide confirming it.

In loose contact; Muzzle is in contact with the skin but due to the recoiling effect it moves away from the skin at the moment of discharge. Muzzle imprint may not be there. Soot deposition around the entrance.

Near contact; near contact is almost in contact - < 10mm. (This is mostly a technical classification and can be included under close range shot.)

Close range;

BBT around the wound. Seared margin. Examination of the clothes may reveal these in some cases. Seared margins;

Intermediate range;

No burning is seen. Blackening and tattooing both or only tattooing is seen.

In the absence of these features clothes should be examined for these features.

Distant shot;

BBT absent.

In rifle firearm wounds abrasion collar and grease ring present.

Shotgun Wounds

Features of shotgun injuries differ according to the type of ammunition used. As described in page… shotgun cartridge usually contains lead shot and wads. Both these parts exit from the muzzle end on firing the gun.

Shotgun wounds differ from those of other missiles. The spectrum of severity of wounds is large, the amount of damage varying mainly with the weapon-victim range and the type of weapon and shot used. Pellets tend to scatter as they travel, which accounts for a wide spectrum of wounds. Although shotguns are low-velocity weapons (less than 2,500 feet/second), at close range the entire charge strikes the target as a single missile with a kinetic energy similar to that of a high-velocity military rifle. At longer ranges, with pellet scatter, the charge acts as multiple individual missiles, with the kinetic energy imparted separately by each pellet which strikes the target.

The type of shotgun, ammunition, and range of the weapon are all important in determining the wounding potential. Shotgun pellets are usually round, and therefore have poor ballistic characteristics. Ideal ballistic characteristics have been sacrificed in order to obtain target area saturation with multiple missiles, making it possible to hit a small, fast-moving target.

Pellet Spread.

The velocity of the shot falls off rapidly with distance, and so the kinetic energy and wound potential. Because the shot depends on a bolus blast effect to maintain velocity, spread of the pellets (may be measured by the diameter of all of the shot in flight, or the average distance between pellets) results in less velocity.

Increased spread of the pellets may be caused by:

1. Range or distance from the shotgun,
2. Lack of choke or constriction in the end of the shotgun barrel,
3. A shortened barrel as in a "sawed-off' shotgun or scattergun, or
4. Pressure developed in the cartridge.

Barrel lengths of shotguns range from 18 to 36 in. with 26 and 28 in. the most common.

Choke:

The muzzle constriction in the bore of a shotgun barrel that serves to condense the shot pattern (i.e., prevents spread of the pellets). Choke varies as to degree and length.

The archaic term “gauge” is used to describe the caliber of the shotgun. This term refers to the number of lead balls of a given bore diameter that make up a pound. In 12 gauge, for example, it would take 12 of the lead balls to make 1 lb.

Most shotgun barrels have some degree of choke that controls the size of the shot patterns. The choke is a partial constriction of the bore of a shotgun barrel at its muzzle. The choke may be permanent and built into the barrel or the barrel may accept choke tubes that when screwed in the muzzle determine the choke of the barrel. Choke constricts the diameter of the shot column, increasing its overall length. The outer layers of shot are given inward acceleration as they pass through the area of constriction (the choke). This holds the shot column together for a greater distance as it moves away from the muzzle.

The following table gives the percentage of shot that can be expected in the various choke borings:

Choke	**Percentage of Shot at 40 yard in 30 in. Circle**
Full choke	65–75
Improved Modified (3/4 choke)	55-65
Modified choke (1/2 choke)	45–55
Improved cylinder (1/4 choke)	35–45
Cylinder (No choke)	25–35

Different degrees of choke will give different spreads for a particular shotgun charge and range. The tighter the choke, the smaller the pattern of pellets is. The usual degrees of choke in descending order are full, Improved modified, modified, improved cylinder, and cylinder. The degree of choke is based on the **percentage of pellets that will stay inside a 30 in. circle at 40 yard**.

Range of Fire in a Shotgun

The most accurate way to determine the distance from which someone has been shot with a shotgun is to do a test-firing with the actual weapon and ammunition from the same batch. However this is not possible I most instances.

It may be assumed for clinical purposes that if the diameter of the entrance wound is an inch or less, then the distance of the shot was 18 inches or under, irrespective of the gauge or the degree of choke. *Up to 2 feet there is very little difference in the spread from guns of various gauges and chokes, with the hole being slightly over an inch in diameter.*

Beyond 3 feet the difference between the two extremes of boring and choke become evident. At 6 feet the hole from a true cylinder has twice the diameter of that produced with full choke.

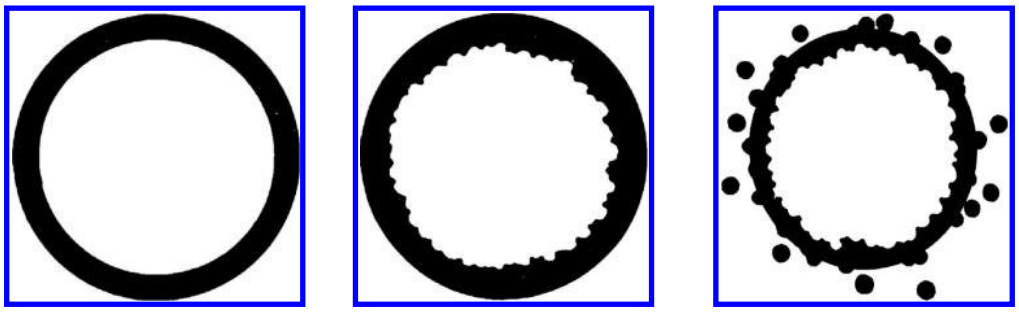
There are 3 methods to calculate the range in a shotgun injury.

1. Between 2 and 100 meters the pellets spread out approximately 1 inch for each meter travelled.

2. Range (meters) = 2 X $\sqrt{\frac{\text{Pellets:load x radius (inches)}^2}{\text{Pellets:counted}}}$

3. Range (meters) = 2 X pellets:load X Distance:pellets (inches)^2

Shape of the Shotgun wound:



(a) (b) (c)

Shotgun pellet patterns: (a) contact to 2 ft, (b) 3 ft, and (c) 4 ft. (This is a rough guide and the pellet spread can vary depending on multiple factors. By 6–7 ft, there is a definite cuff of satellite pellet holes around a slightly irregular wound of entrance for a shotgun even with a modified barrel.

Direction of Fire

Determining the direction of fire is another important aspect in firearm injury investigation. The first step in this is identifying the entry and exit wounds. By doing this we can get a basic idea about the direction of fire - relative to the position of the victim from which direction the shot was fired. Determining this would also help the investigator to formulate an opinion about;

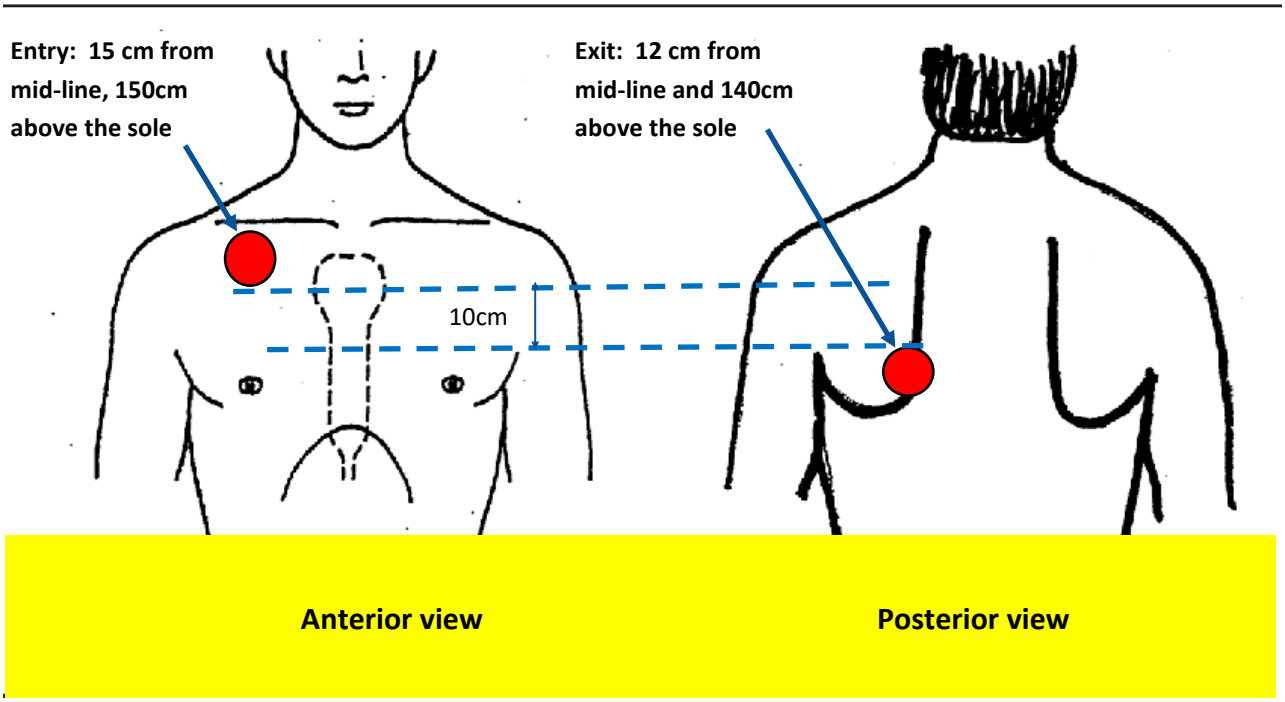
1. Circumstance of injury/death - Suicidal, accidental or homicidal.
2. Number of assailant involved - if there are multiple shots from different directions. However, this has to be done cautiously considering the movement of both the victim and assailant.

Finding the corresponding exit wound for a particular entry wound will make it easy to determine the direction.

For an example if the entry wound is located right chest in front, 150 cm above the sole and the exit wound on left side of the chest at the back 140 cm above the sole one can arrive at the following conclusion: (Figure)

Direction of the shot within the body is to the left , downward and backward.

Therefore the direction of fire should be from right, front and above in relation to the victim.

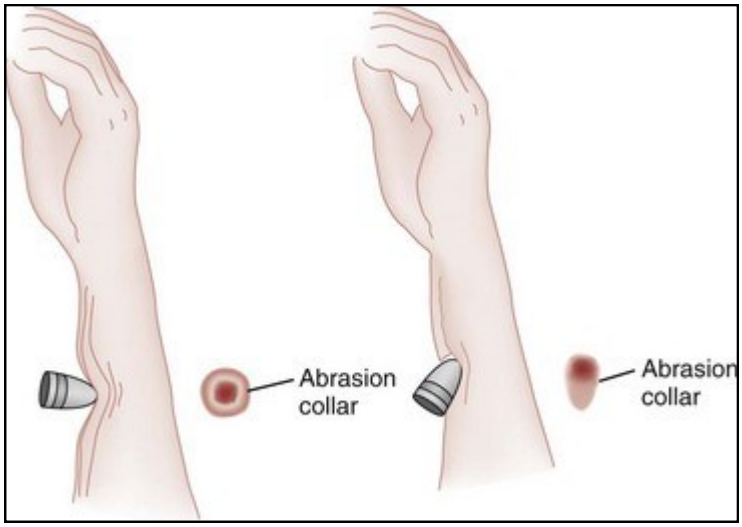


Abrasion Collar

This is a feature seen at the entrance wound. It appears like a reddish brown area adjacent to the entry of the projectile. In the early days it was thought to be due to burning of the skin due to contact with the heated projectile - bullet. Lately this explanation as found to be incorrect and it was thought due to the wrapping of skin bullet at the time of the entry. However the most recent studies have shown it to be due to overstretching of skin rather than contact abrasion.

Shape of the abrasion collar is useful in determining the direction of the bullet.

1. Circular shape abrasion collar indicates a perpendicular entry of the projectile - bullet.
2. Oval shape abrasion collar - angled entry.



Perpendicular entry (left) and angled entry (right)

Perpendicular entry

Angled entry

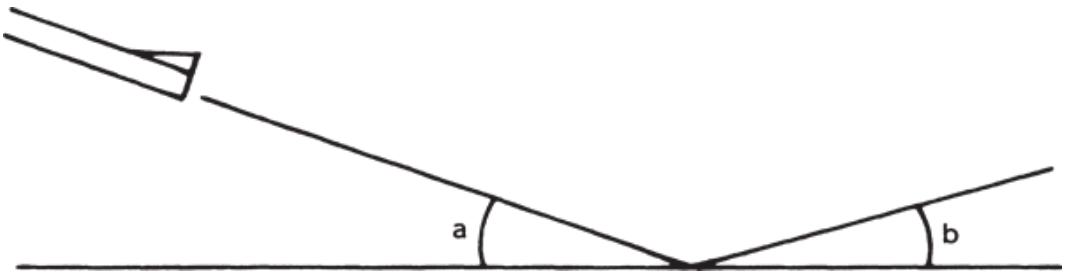
Special Situations

In this section special situations that could occur in relation to firearm injuries will be described.

Ricochet Bullets:

Projectile ricochet is defined as ‘‘the continued flight of a rebounded projectile and/or major projectile fragments after a low-angle impact with a surface or object”

When a bullet strikes any surface, there is a critical angle at which the bullet will bounce off or ricochet from the surface rather than penetrate. After ricocheting from the surface, the missile will lose a considerable amount of its velocity (anything up to 35% in test firings) and, invariably, lose its stability.



Ricochet nomenclature: a = incident angle; b = ricochet angle.

There are two types of ricocheting; External and Internal.

External Ricochet: A projectile fired from firearm could hit a hard surface and ricochet off it. In most cases of bullets ricocheting from a hard surface, the angle of ricochet is considerably less than the angle of incidence. In most instances the projectile will get deformed on striking the hard surface. Therefore it inadvertently loses some of it’s kinetic energy and penetrating power. However the ability to penetrate tissue and cause serious or fatal injury will depend on the features of the target tissue. Bullets which have ricocheted from glass, steel, concrete or wood have a very distinctive flat spot which is characteristic of the material where the contact has been made.

Most commonly, ricochet entrance wounds are described as being atypical: large, irregular, elliptical or keyhole or D-shaped, having ragged edges and wide, eccentric, abraded margins. Some have a large stellate appearance.

Internal Ricochet:

A projectile entering the body could strike hard surface like bone and ricochet off it.

It can ricochet 1. Intra cranially, 2. off vertebral bodies, 3. orbital cavity or any bony surface.

Intracranial ricochets fall into three types:

(1) After ricocheting off the inner table of the skull, the bullet re-enters the brain and produces another wound path.

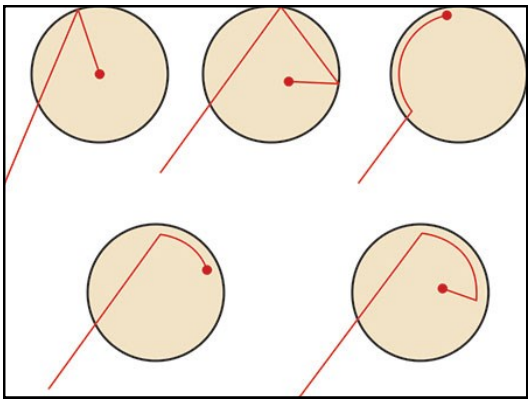
(2) When the bullet enters the skull obliquely, it may travel a curved course along the inner table of the skull after ricocheting off it, producing a gutter-like wound path on the surface of the brain.

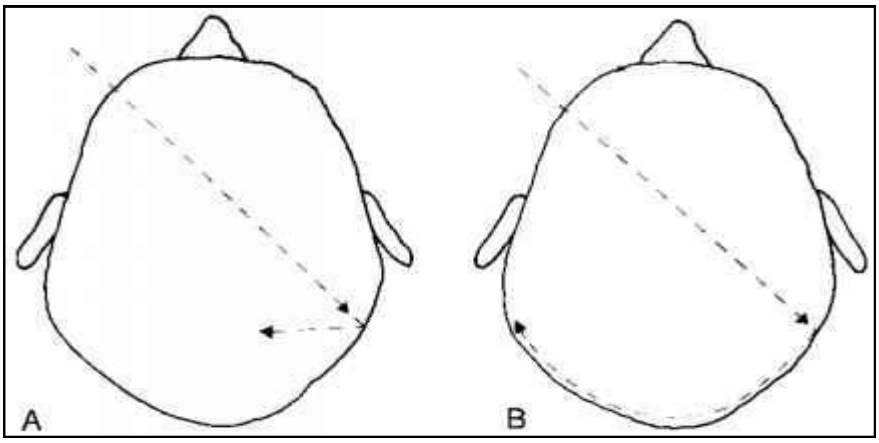
(3) The bullet exits through its entrance wound after ricocheting off the inner table of the skull

A bullet may also ricochet off the vertebral body to produce a wound path in the spinal canal that is not in line with the shooting direction.

There are instances reported where projectile enters the orbital cavity and ricocheting off the roof and changing the direction.

When this happens within a limited space and where a vital organ lies it will cause extensive injuries as the projectile traverse through the same organ twice or more.





These two diagrams shows different types of intra-cranial ricochet

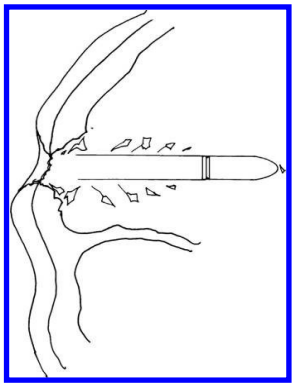
Beveling

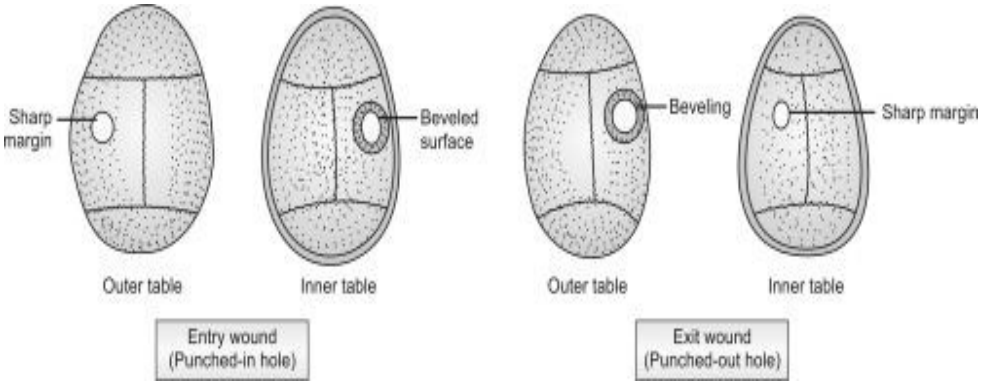
Beveling is a feature seen in bone on penetration by a firearm projectile usually a bullet. Whether a projectile perforates the bone id dependent on various factors. These factors include;

1. The velocity of the bullet at impact.
2. Construction of the bullet.
3. Shape of the projectile.
4. Type of bone - long flat bone.
5. Thickness of bone and it's configuration

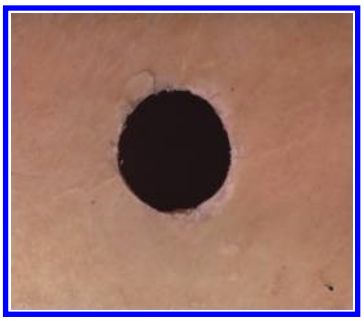
The direction in which a bullet was traveling when it perforates a bone can be deter- mined by the appearance of the wound in the bone. When a bullet perforates bone, it bevels out the bone in the direction in which it is traveling. The entrance has a round to oval, sharp-edged, punched-out appearance. The opposite surface of the bone, i.e., the exit side, is excavated in a cone-like manner.

This feature is very useful in determining the entry wound and hence determining the direction of





fire as well. Apart from the skull where we commonly see the this phenomenon it might also be seen in other bones like, hip bone, scapula and even ribs.



Smooth outer surface

Beveled inner surface

Back Spatter

Back spatter is another important phenomena which might help in forensic investigation in cases of firearm injuries and deaths.

Occasionally there is ejection of blood and tissues from the entry site. When this happens bood and tissue usually are thrown towards the weapon or towards the direction from which the projectile came. Amount of back spatter depends on various factors like;

1. Anatomical location
2. The range - usually at contact range
3. Calibre of the weapon - Large calibre weapons are more likely to cause back spatter.

Back spatter is important because the resultant back spatter stains may be found on the weapon, the shooter, and objects in the vicinity.

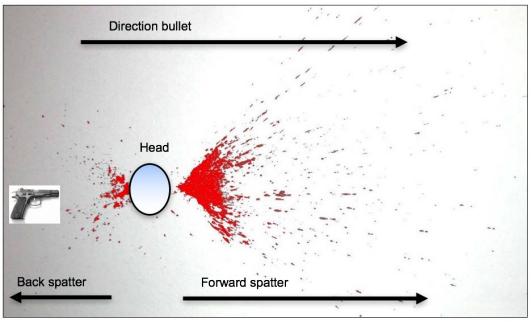
Mechanism of back spatter:

There are three possible mechanisms.

a. Subcutaneous collection of gas and subsequent rupture of the gas bubble— particularly with contact wounds of the head

b. Raised intracranial pressure produced by temporary cavitation effect.

c. Tail splashing - backward streaming of blood and tissue along the lateral surfaces of the bullet.



Presence of back spatter is useful in determining the circumstances of injuries. In suicidal injuries blood and tissue deposition may be seen in victims hands or any body part—particularly the hand.

Even in homicidal cases presence of back spatter and staining of body parts and others depend on proximity of the assailant to the victim.

In some instances feet or foot ware worn by the assailant might show blood staining or tissue deposition. Blood grouping and DNA finger printing of blood and tissue sample found could be use to ascertain the origin of them and on some instances could be used to trace the weapon. It also produce valuable evidence in establishing the circumstances of death.

Bullet Wipe

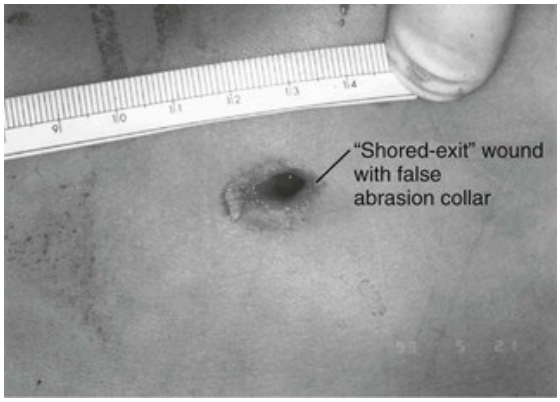
It is a grey to black discolouration around the entry wound of a bullet. It is principally due to deposition of soot. However it also include lubricant and small amounts of metallic elements from the primer, cartridge case and inside of the gun barrel.

As a bullet moves down the barrel of a gun, it is coated with soot, lubricant, and the previously mentioned metallic elements. In addition, the bullet may pick up debris left in the barrel by prior discharge of the weapon.

As it passes through the clothing or skin it wipes off these substances producing the bullet wipe.

Shored exit wound

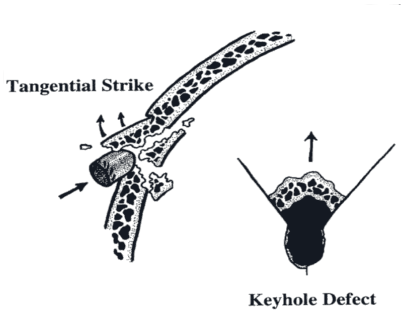
Shored gunshot wound of exit is produced when the outstretched skin is impaled, sandwiched, and crushed between the outgoing bullet and the unyielding object over the exit site, thus leaving an abrasion collar on the wound margin.

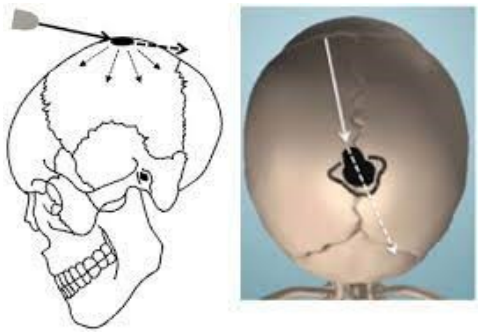


As the tissues flung outward at the time bullet exit skin edges strike the surface against which the victim leans on. Usually it has to be a firm/hard unyielding surface like a wall, door, floor etc. however on some instances even firmly attached clothes may also produce the same effect. This feature if seen will be useful in determining and reconstructing the scene.

Keyhole defect

Keyhole wound of a firearm injury shows features of both entry and exit wounds. This phenomena occurs when bullet hits the bone at an angle. It is relatively commonly seen in cranial injuries. Probably the shape of the skull bone favours this phenomenon.

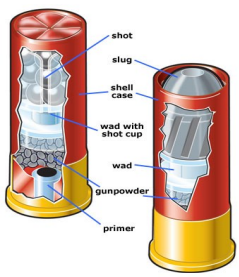




When bullets strike the bone at an angle it starts to punch out an entry hole. However, the bullet start to exit as soon as it enters passing just below the bone. Piece of bone between the entry and exit points which lies close to each other is blown away resulting a continuous defect of bone. Towards the entry point inner beveling will be seen and at the opposite end outer beveling will be seen. Thus the appearance of this elongated bone defect mimics the appearance of a keyhole.

Wad marks/injuries

This is a sub-set of injuries caused by the was present in shotgun cartridge. Wads are usually made of plastic or cardboard. There are four types of wads in a shotgun cartridge:



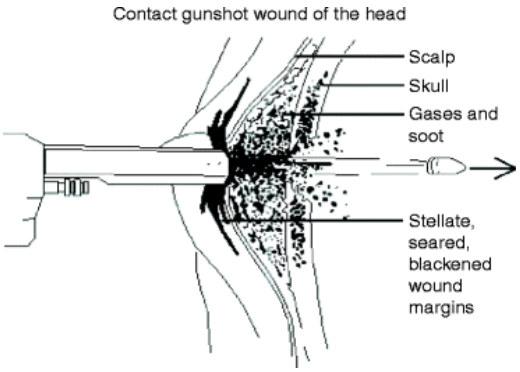
1. Base wad
2. Over powder wad
3. Filler wad
4. Over the shot wad

Depending on the type of the weapon and cartridge number of wads present may vary. On firing the gun all wads except the base wad will be ejected. These wads travel up to few meters and occasionally cause markings or injuries on the victim.

Characteristic injury seen due to a wad - wad classified as a power piston.

Contact wound over head

Contacts wounds of the head takes a characteristic stellate shape. This is said to be due to collection of gas between the scalp and bone. Since the muzzle is tightly pressed against the skin gas coming out of the gun on discharge of the bullet is directly pushed in to the wound momentarily forming a gas bubble which ruptures almost immediately. This phenomena gives rise to both back spatter and formation of a stellate shaped wound.



Muzzle imprint

Tight contact wound usually gives rise to imprint mark of the muzzle around the entry wound. Presence of muzzle imprint confirms it to be contact firearm entry. Features of the muzzle imprint could also give information about the weapon used.

Sawn off Shotguns (Sawed off Shotguns)

Sawed off or Sawn off shotgun is a weapon where the barrel of the firearm is cut short. This would effectively reduces the range of fire. Another reason to cut off the barrel is that it makes the weapon to be easily concealed.

In Sri Lanka there are home made guns as well' and most of them a known by the popular name 'Gal katas'. These are usually crude weapons and muzzle loading guns. Sometimes even shot gun cartridges or rifle firearm cartridges are used.

Investigating a firearm injury – clinical/autopsy

Scene visit should be done whenever possible. The correct handling of firearm deaths begins at the scene. If not done properly valuable evidence on the body can be lost. On the other hand spurious evidence may inadvertently introduced to the scene due to mishandling. This can result in wrong conclusions and interpretations.

Before a body is touched, let alone examined, its position and appearance should be documented photographically and diagrammatically.

The scene examination has to be done methodically according to accepted principles of scene investigation. Full photographic documentation of the scene is important. Spent cartridges and bullets/pellets are specially looked for during the scene investigation. Service of a forensic ballistic expert is important for a proper comprehensive examination of the scene. Presence of the offending weapon at the scene of crime indicates the probable circumstances - Commonly the weapon is found with the victim or at the scene when it is due to either accident or suicide. However, it must be remembered that presence of the weapon does not exclude homicide.

Before transporting the body to the morgue, paper bags should be placed over the hands to prevent loss of trace evidence. Paper bags should be used rather than plastic, because condensation will form in the plastic bags if the body is refrigerated. This can wash away primer residues and make fingerprinting more difficult.

If the deceased did not die immediately after being shot and was transported to a hospital, a number of surgical and medical procedures may have been carried out. Because of this, complete medical records of the deceased from the time of admission to the death should be obtained before the autopsy.

Pre-autopsy procedures:

a. Obtaining samples for gunshot residue

b. Finger prints

c. Pre-autopsy X-Ray

Procedures (a) and (b) should be done by the relevant experts.

However it is mandatory (Practical difficulties may arise) to obtain full body X-Ray antero-posterior and lateral to find any lodged bullets/pellets or any other metallic objects within the victim's body. X-ray in two perpendicular direction will help to ascertain the location of the bullet accurately.

Detail history should be obtained from all available parties for a better initial assessment of the event. Depending on the event different people might give different explanations or descriptions. Therefore it is important to obtain all information related to the injury/death.

Examination of clothes when available is very important. It can reveal defects caused by firearm projectiles, presence of burning and blackening which may be absent on the victim's body. (Acting as intervening object.)

On examination of the injuries the first thing to determine is whether they are gunshot injuries or not. Once they are confirmed to be gunshot wounds it is easy if entry and exit wounds are identified. Advantages of doing this are;

It helps to get an idea about the number of shots fired.

Helpful in determining the direction of fire.

From the locations of entry and exit wounds one could also get a basic idea about possible internal injuries or organs involved.

Determine the number of shots - usually equal to the number of entry wounds. Re-entry wounds and entry of tandem bullets should also be considered before determining the exact number of shots.

Try to determine the range and direction of fire as described earlier.

Determine the manner/circumstances of injury/death.

Try to determine whether injury/death is due to accidental, suicidal or homicidal in nature. Factors considered are same as for most of other injuries.

Accidental wounds could occur anywhere in the body but usually there will be single fatal wound unless the weapon is an automatic one like T56 in burst mode. Suicidal wounds usually have a single fatal injury, in an accessible site. Sometimes the side of the suicidal wound depends on the handedness. In some cases the weapon is held in hand in cadaveric spasm or found near by. However if a special mechanism is employed to fire the weapon these features would be absent but still the weapon will be found in the scene. The presence of gunshot residue on the victim's hand is useful in determining the circumstances.

The presence of suicidal notes helps in determining the circumstance of death.

Homicidal wounds will show the same features of any other homicidal wounds. Absence of the weapon in the scene suggests homicidal intention/action.

Investigating a firearm injury – clinical/autopsy

Steps of investigation;

1. Scene visit whenever possible.
2. Detail history.
3. Determine the number of shots.
4. Differentiate entry and exit wounds.
5. Determine the range of fire.
6. Determine the direction of fire.
7. Determine the manner/circumstances of death.
8. Determine the cause of death and mechanism.
9. Identifying the weapon and assailant.
10. Interpreting atypical wounds or findings.

Determining whether any type of volitional activity is possible or not may help the outcome of the investigation or the trial.

Cause of Death

Write the most apparent injury as the immediate cause of death;

e.g. Cerebral laceration,

Laceration of the heart etc.

Underlying cause is firearm injury/gunshot injury etc.. You may choose the proper term according to the case.

Do not comment much about the type of fire arm.

If you find a bullet inside better mentioned as bullet injury rather than saying rifle firearm because home made shotguns might use bullets.