

The scene investigation

investigation of circumstances leading to and surrounding death

- Pm injuries
- Blood stains on new part
- Biological or non biological evidences lost or dislodged
- Fresh damage in clothes
- Pm lividity and RM
- Entomological study

In autopsy room

- *is the injury caused by gunfire?*
- *How many shots hit the victim?*
- *Is the wound an entrance or an exit ?*
- *What is the course of bullet in body?*
- *What is the range of fire?*
- *What is the angle or direction of fire?*
- *What was the position of victim?*
- *How long the victim could have survived?*
- *What type of gun caused the wound?*

Photography

- Before undressing or cleaning
 - To document the condition of body when received
 - Identification photographs
 - Photographs of clothes .. After the body is unclothed
 - Photographs of external wounds
 - Photographs of internal wounds
 - Photographs of x-rays
 - Photographs of evidence removed
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- Assign number and label to holes in clothes as well wounds on the body and take photograph using ruler
 - Label is kept above or below wound and perpendicular to long axis of body

X-ray examination in autopsy room

- Before body is unclothed
 - Complete/ general body x-ray
 - AP and lateral views
- 1) Location of bullet is revealed
 - 2) Number of bullet is known
 - 3) Angle and direction of fire can be determined
 - 4) Type of firearm can be indicated
 - 5) Depth of wound can be evaluated

Recovery of bullet can be time consuming and difficult without x-ray

Effects-damage produced

- *Cavity.. Temporary and permanent by bullet*
 - *Density of tissue*
 - *Elasticity of tissue*
- *Loss of kinetic energy due to yaw--diameter, length, twist, density*
- *Bullet: blunt/tip -- expanding/jacketed*

[1] Is the wound caused by firearm?

From evidences like

- Features due to effects of bullet and components
- Circumstances of death
- X-ray examination
- Internal findings together with finding of bullet or fragments

Bullet Effects-features

- Defect in the skin [skin is most resistant]
- Abrasion ring [more in lead bullet]
- Smudge collar [dirt ring, grease ring or grease mark more in lead bullet]

Effects by components of shot

- [1] flame effect on skin / hair / cloth

Powder Burns

- [2] smoke effect .. CO, CO₂, N₂, H₂, H₂S, O₂, methane ..smoke smudging → blackish-grey film
- [3] gun powder effect.. Tattooing or stippling by powder granules with nitrites, cellulose nitrates, thiocyanate, thiosulphate, K carbonate, K sulphate and K sulphide .

Examination of clothes




general & specific

- Interposed clothing can alter the appearance of wound
- Prevent redistribution of soot and powder partly or completely -
--- better examined with dissecting microscope
- Hard contact wound appears like loose contact wound [dispersion of soot in layers of clothing or onto skin]
- Near contact wound appears like intermediate range [soot absorbed in clothing and searing either prevented or decreased]
- Intermediate range appears like distant shot [absence of tattoo]

So findings on clothing always must be correlated to findings on body by doctor

- Powder perforating clothes may mark skin: effects *depend on*
 - ✓ Nature of material
 - ✓ Number of layers
 - ✓ Powder [ball or flake]
 - ✓ Whether loose or tightly held against chest

In large and medium caliber :centre fire in contact or may in near contact wound →

- Contact wound -Cotton and cotton mix → cruciform/stellate shaped tear  
- Contact wound- Synthetic → large burn hole with scalloped margins 

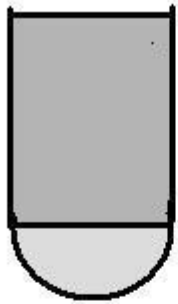
In rim fire →in contact or may in near contact small tear in cotton & small burn hole in synthetic

If pillow alike used to muffle gun → linear or L shaped black seared zone → idea of barrel length

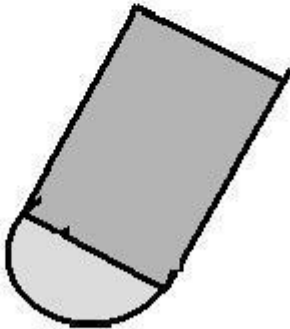
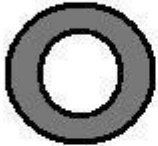
Due to melting

Abrasion ring

- Irrespective of range in majority of entrance wound abrasion collar is present
- May be absent
- Due to stretching of skin not due to spin
[fastest rotating completes one turn in 8" of horizontal path
- Width varying depending on
 - Caliber
 - Angle of entry [concentric/circular or eccentric/elliptical]
 - Site [anatomical] curves, depression etc



Circular marginal abrasion in case of perpendicular heat



Eccentric marginal abrasion with Wider zone opposite to direction Of bullet



- Smudge ring present on inner aspect of abrasion ring
- Metal fouling may be

- *Burn / ignition seen* in black powder only [due to continue burning]
- *Bullet wipe* on outer layer of cloth at entrance in both jacketed & non jacketed
- *Bending of fibers* along path
- *Tissue* on inner aspect of clothes at exit

- importance
 - Determination of range
 - Position of the deceased by correlating the holes in clothes with the entrance and exit wounds

[2] Is the wound an entrance or an exit?

- Gunshot wound may be penetrating or perforating
- Despite all care in the examination, there are still instances in which interpretation is difficult, if not impossible

Example:

Multiple entry and exit

Shored exit wound

Blackening of edges at exit

chemical test and microscopic examination is required when doubt

HPE:

entry wound: distorted epidermis, with gun powder, coagulation necrosis, swelling and vacuolization of basal cell

exit wound: haemorrhage in epidermis and dermis with marginal disorganisation of cell

Positive identification of black material as powder by histological microscope up to dermis..nt restricted to epidermis

D/D

▪ Entrance wound

- i. Smaller
- ii. Inverted edges
- iii. Abrasion-contusion collar +nt
- iv. Burning/singeing/blackening/tattooing may be +nt
- v. Grease collar may be +nt
- vi. CoHb +nt [diminishing concentration of COHb along path]
- vii. Clothing may be turned in
- viii. Bleeding less

▪ Exit wound

- i. Larger
- ii. Everted edges
- iii. Abrasion-contusion collar -nt
- iv. Burning/singeing/blackening/tattooing is -nt
- v. Grease collar is -nt
- vi. CoHb -nt [diminishing concentration of COHb along path from entry to exit]
- vii. Clothing may be turned out
- viii. Bleeding more

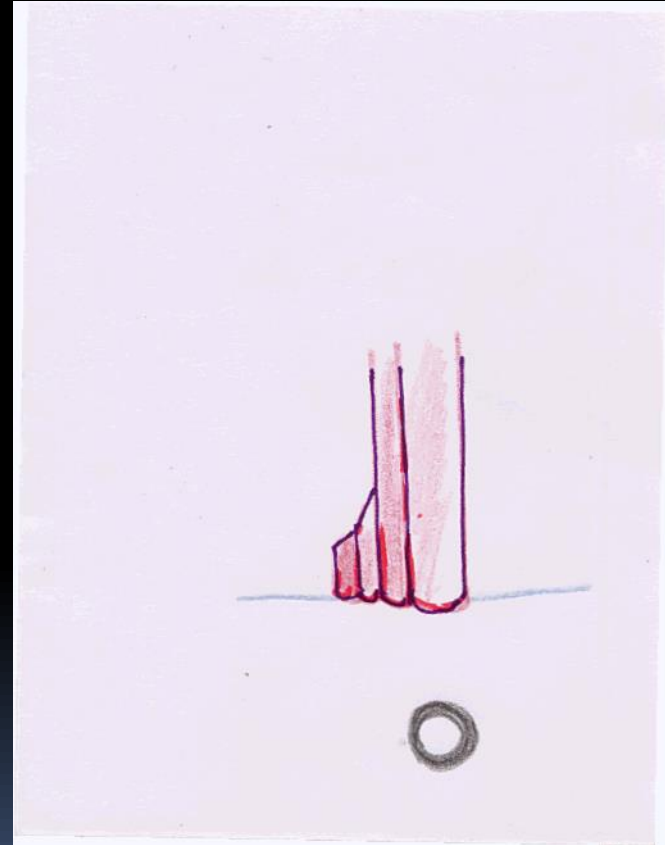
RANGE OF FIRE

Rifled gunshot entry wound

- Broadly divided in four categories depending on the distance between target and weapon
- (a) Contact :
 - [i] hard: where the muzzle of the weapon is jammed “hard” against the skin, indenting it, so that the skin envelops the muzzle.
 - [ii] Loose : where the muzzle is in complete contact with the skin, is held lightly against it.
 - [iii] Angled-Contact Wounds: In angled-contact wounds, the barrel is held at an acute angle to the skin so that the complete circumference of the muzzle is not in contact with it.
 - [iii] Incomplete-contact wounds: are a variation of angled-contact wounds. In these, the muzzle of the weapon is held against the skin, but, because the body surface is not completely flat, there is a gap between the muzzle and the skin.
- 2) Near contact
- 3) Intermediate
- 4) Distant

Contact wounds

- Hard contact wound: weapon is tight against skin with no gap: searing and blackening [of tattoo] of **immediate edges**.
- Soot deposited in **seared** area. **Can not be wiped out completely**





- High-velocity hard contact wound of head: due to large quantity of gas in confined space massive destruction- pieces of skull and brain blown away-extensive comminuted fractures : effects described as explosive: difficult to identify wounds:

- Low velocity like .22 caliber contact wound on head: small amount of powder and resultant small quantity of soot/gas → no tears and little or no soot in or around circular wound → mistaken for distant wound .. However close inspection reveals searing/blackening of edge

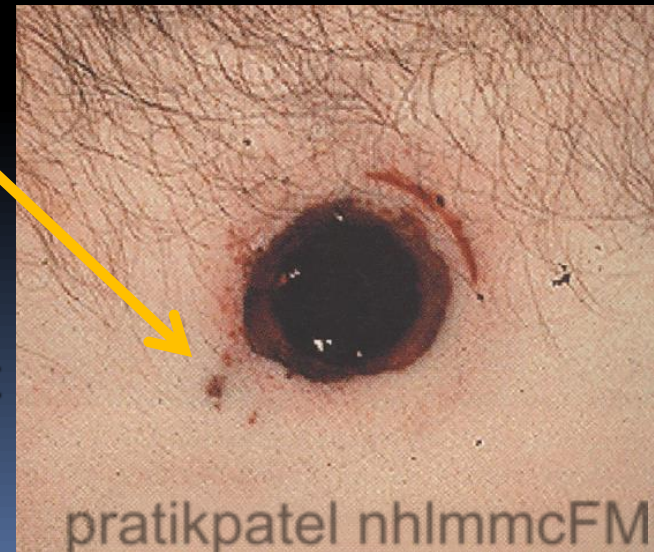
Problem can be solved by observation of muzzle imprint around suspected case of contact wound of entrance

High-velocity contact wounds of chest/abdomen:
typical and circular with **imprint of muzzle** as whole wall is flung against muzzle & powder soot in and around path of bullet

Imprint of front sight is present though front sight is half inch away

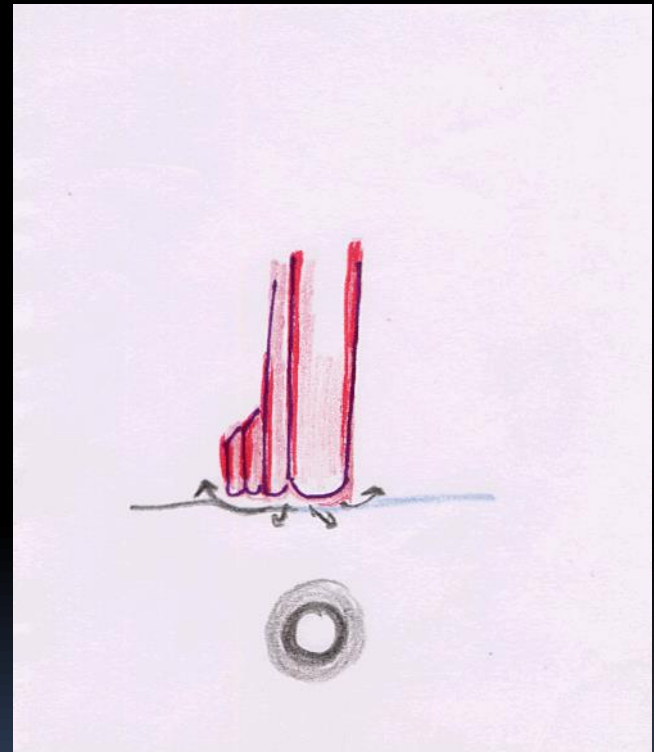
In lever action weapon with magazine under barrel, the imprint of end of magazine is produced

COHb follow the bullet and in contact shot it may be present in muscles around exit



Contact wounds

- Loose contact wound: gas preceding and bullet itself indents skin resulting into gape between skin and muzzle through which gas escapes and soot deposited in a band around seared entry wound. Can be wiped easily



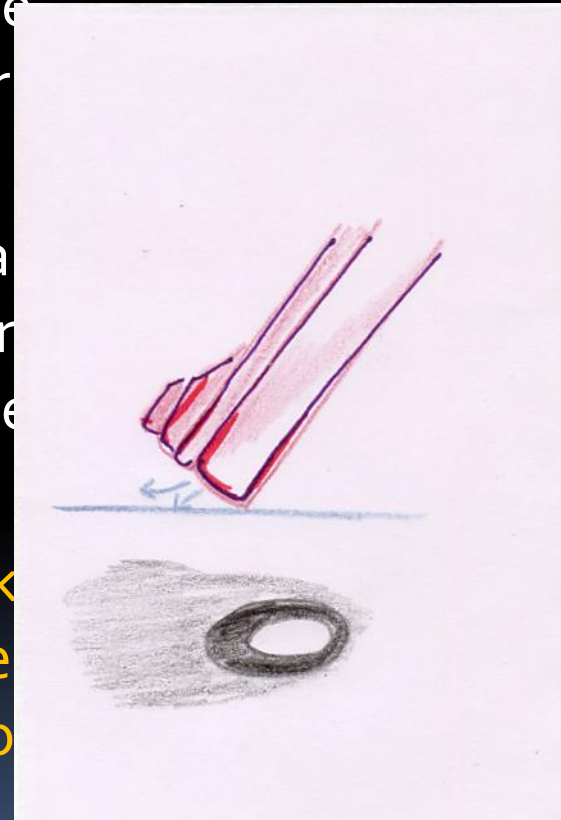
Contact wound

continue

- Angled contact wound: barrel is at acute angle i.e. entire circumference of the muzzle is not held in contact with body : gas and soot escape from gap with no complete radiation all around → eccentric pattern soot with 2 zones

[a] black seared area pear, oval or circular on skin or cloth and [b] fan shaped light gray zone of soot in direction of projectile i.e. points the way gun was directed

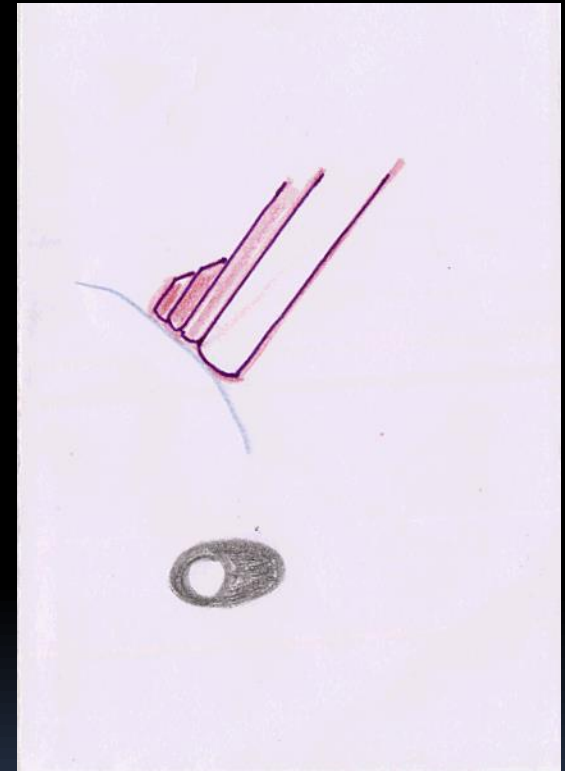
Entrance wound is at base of seared black area and as angle with body is increase hole is found more toward the center of seared blackened zone



Contact wound

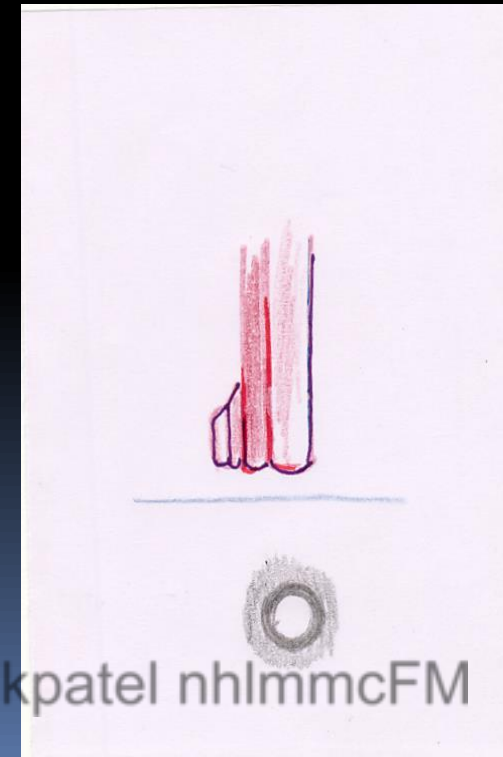
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- Incomplete contact wound: is a variation of angled contact wound... It is due to gap as body surface is not completely flat.
- Seared blackened zone can be any where in relation to muzzle circumference
- Common in head and zone is **directly opposite to the direction of bullet**

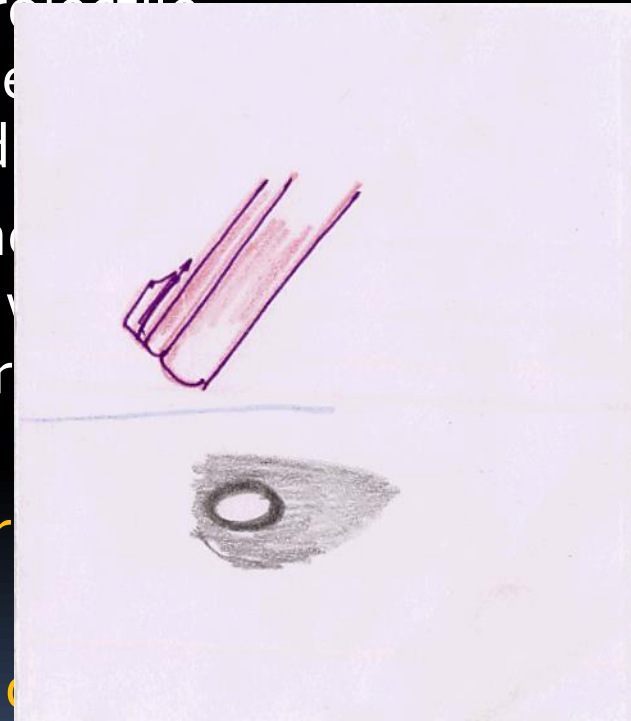


Near contact wound

- Lies between contact and intermediate wounds
- Entrance wound is surrounded by a wide zone of powder soot overlying seared blackened skin
- The distance is too small to disperse so **individual powder tattooing** not seen
- It is not possible to differentiate near and loose contact wound if weapon is perpendicular. However zone of searing is wider than what is seen in loose contact wound, can not be wiped out



- In near contact angle wound there is pear, oval or circular seared area and second fan shaped grey zone of soot
- Location of blackened seared area is different from that of angled contact wound
- Mass of blackening is on the same side of muzzle i.e. opposite to direction of projectile but towards weapon. Exactly opposite what is seen in angled contact wound
- By correlating the location of blackened seared zone with bullet track in body you can differentiate angled contact wound from angled near contact wound.
- If bullet path and zone are in same direction → angled contact wound.
- If bullet track and zone on opposite side → angled near contact



Inter mediate range wound

- Individual powder tattooing is *sine qua non* of intermediate range
- When muzzle is at an angle, skin on the same side of muzzle will have dense area than what is on opposite side
- Ante mortem phenomenon as they are punctate abrasions
- Can not be wiped out as they are intradermal
- Not seen in palms and soles
- With increased range size of zone increased but density decreased

Ball powder has greater range [30"] and markings are small, circular, hemorrhagic and in greater number

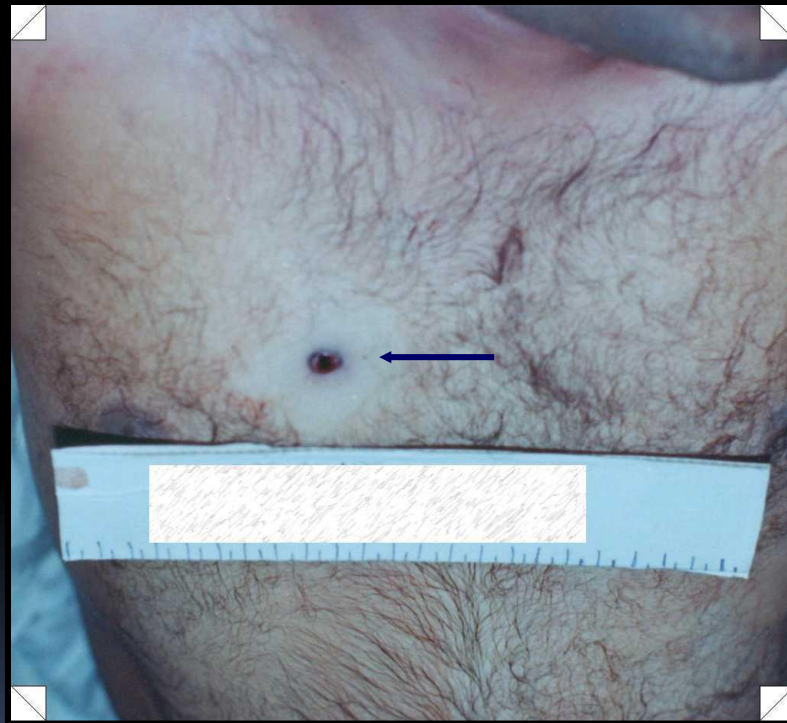
Cylindrical powder has small range [6" to 12"] but markings are larger, irregular in shape and size and relatively sparse in number may be linear

Number of tattoo at 6" with cylindrical powder is less than number of tattooing at 24" with ball powder
ante mortem phenomenon if brown red or orange red, grey or yellow indicates postmortem origin

- Distant shot with high velocity bullet on trunk wound is circular and may propel wall by temporary cavity with such force that imprint of cloth or object lying against the skin is produced on skin

← No abrasion ring

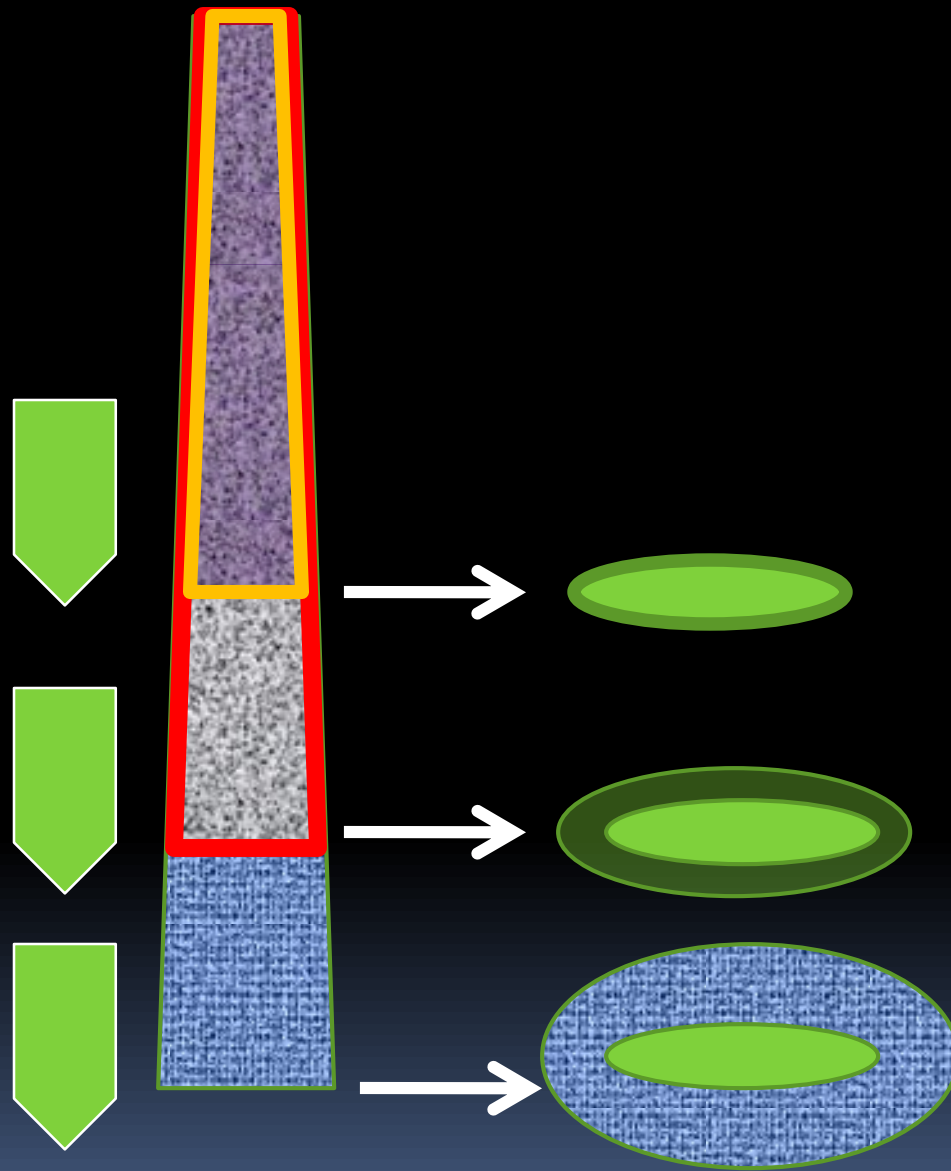
Low velocity like .22 caliber distant shot on head and trunk : circular wound and due to drying of edges may be confused for contact shot



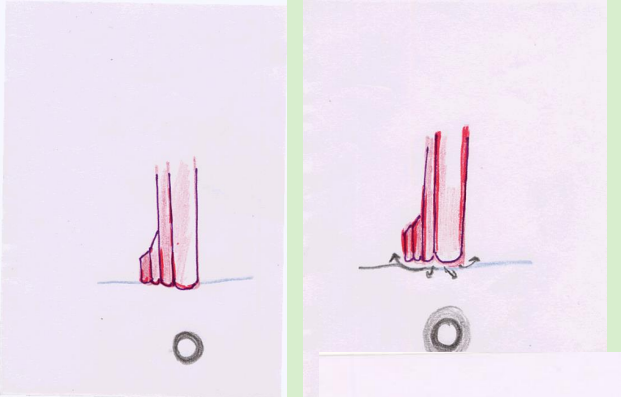
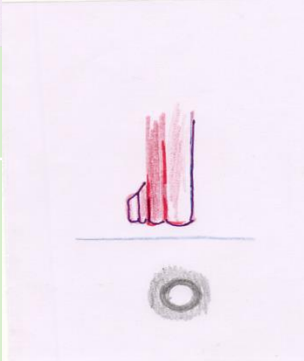

Chemical analysis and dissecting microscope is helpful or wound examination by EDX/FAAS

Low velocity
distant wounds
on front of
abdomen



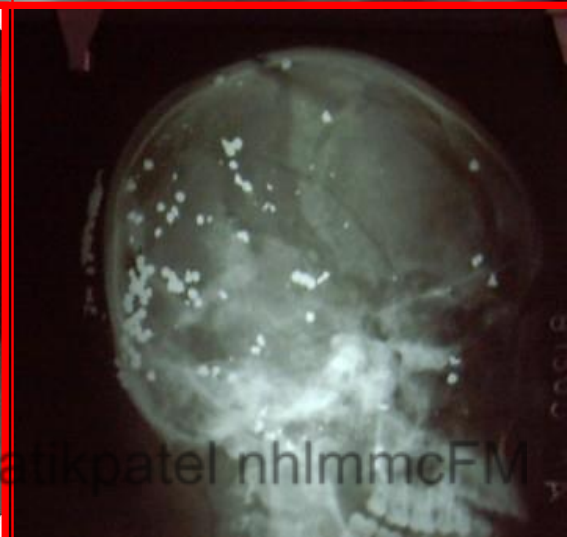
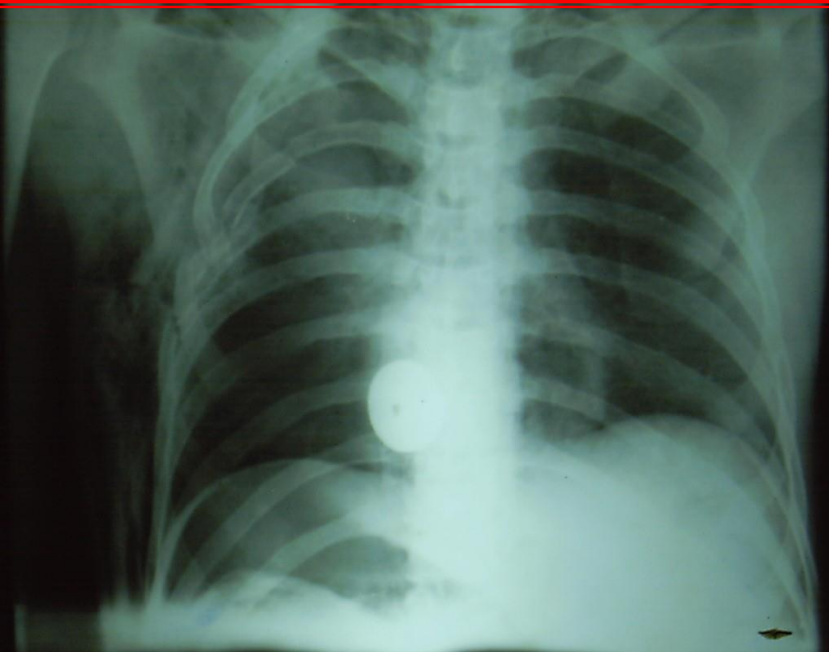


Serial number	Ranges	Effects
1	Contact	Hard : seared edges Soot and gun powder over edges and in tract
		Loose : seared and tattooed edges and smoke around seared area
2	Near contact	Seared and tattooed edges, smoke zone around seared area, but smoke zone is wider
3	Intermediate	tattoo
4	distant	Nothing

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3	Intermediate 	tattoo
4	distant	Nothing pratikpatel nhImmcFM

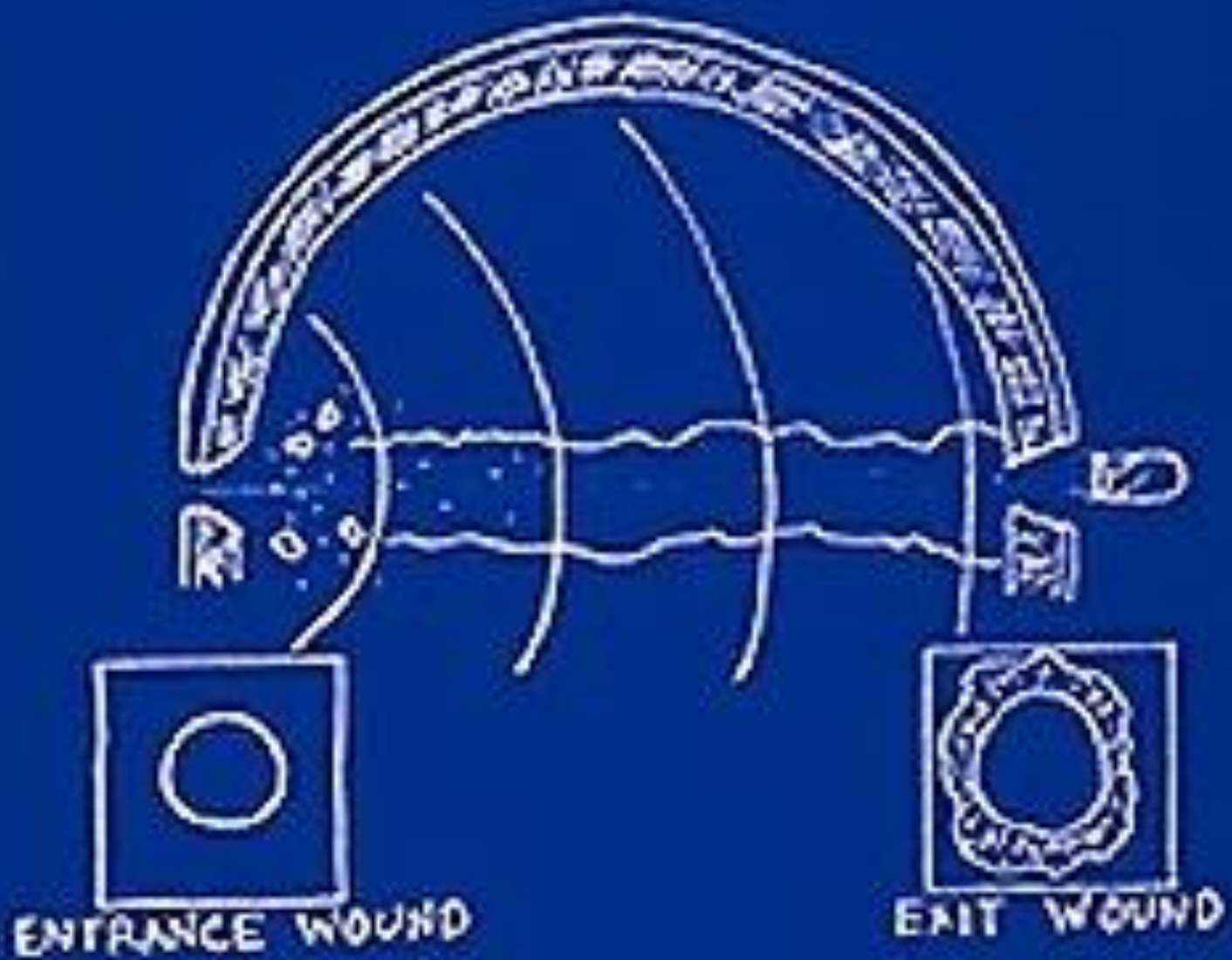


Bullet graze



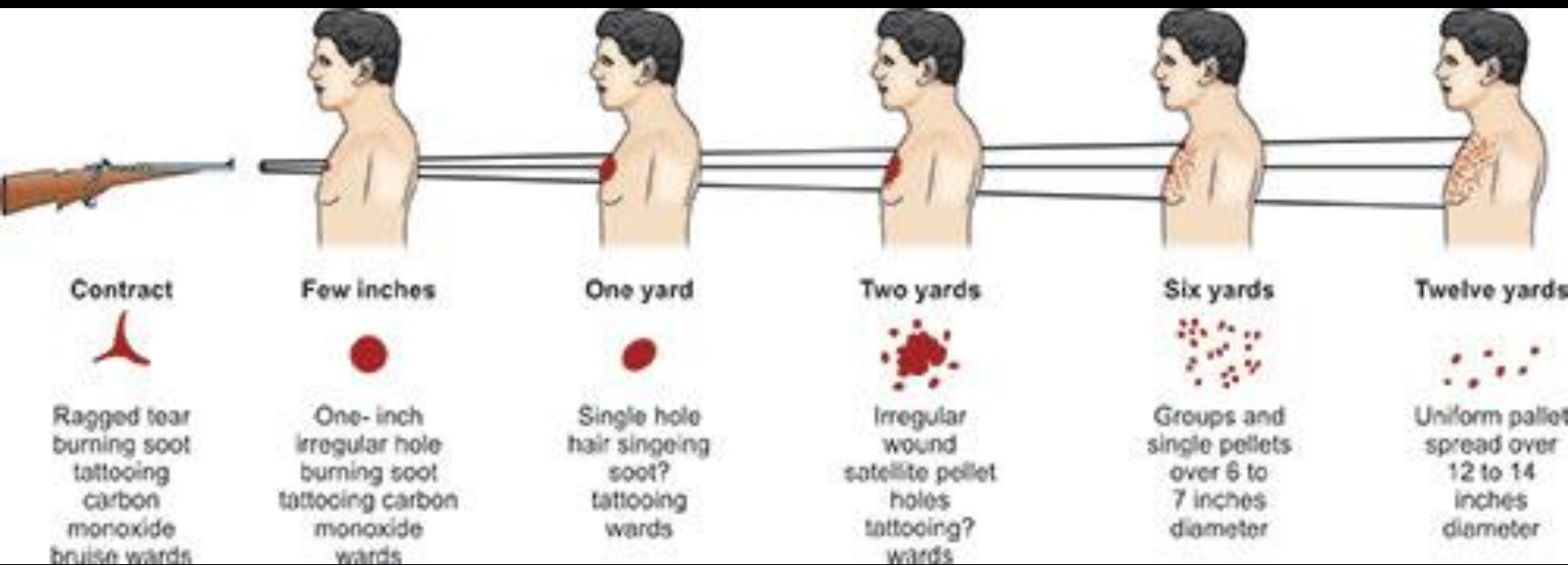
Intermediate target

- Velocity lost: high velocity → hand gun feature
- Multiple fragment with main wound in close range
- Entry wound large irregular

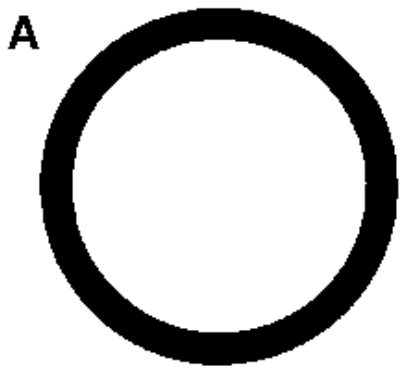


DIRECTION OF FIRE AND RELATIVE POSITION OF THE GUN AND THE VICTIM

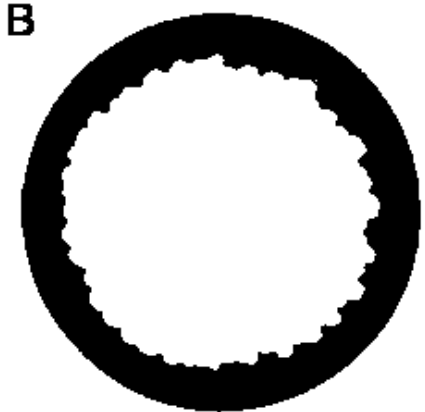
- abrasion ring
- Line joining entrance and exit wounds
- Line joining entrance wound and site of the lodgment of bullet vividly explains the posture of victim



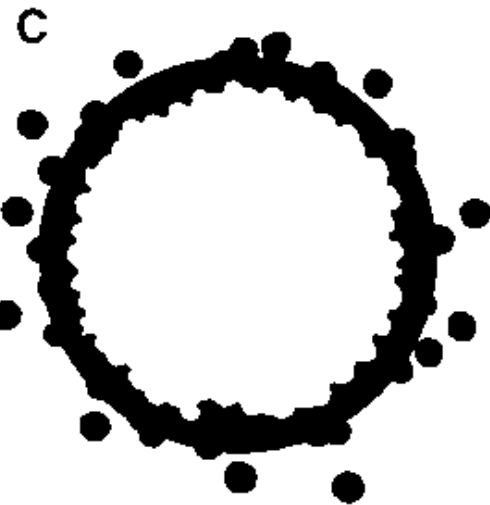
Ref: Textbook of Forensic Medicine and Toxicology by Rao Nageshkumar G, 2nd edition 2010



Contact to 2 Ft



3 Ft



4 Ft

Chemical test

clothing should be air dried and

- ~~preserved: in paper bag [not in plastic]~~
Walker test: [with alpha naphthylamine] presence of nitrites [orange], size and configuration of pattern and replication by same weapon, ammunition at known distance ... For range
- Watson: [with alpha naphthol] **yellow**
- None of above interfere **lead** for test to be carried subsequently with Na rhodizonate
- EDX ..for antimony, lead, copper and barium as it is rapid, non destructive and no preparation required