

FIREARM INJURY

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Firearm = weapon, whose function is derived from immediate release of energy (E) of the gunshot, constructed for the required effect (damage) at a defined distance

- As missiles traverse the body it causes injury by transferring some of it's energy
 - Severity of damage is proportional to the amount of kinetic energy & the density of the involved tissue

Types of Firearms

- **fire** - function is derived from immediate release of chemical E
pistol, rifle, revolver, gun(cannon), machine gun
- **gas** - projectile, its movement is due to air or another gas pressure
airgun, air rifle
- **mechanical** - projectile, its movement is due to mechanic E *bow, crossbow*

Ammunition

- Is built to load into the gun and is composed of projectile, cartridge cases, gun powder (nitrocellulose = guncotton)

Handguns

Types of projectile (missile):

- single projectile guns (rifle, pistol) – cylindric or oval projectile
- shotguns – mass missile (a lot of small pellets)

Lenghts of barrel:

- short – one hand; *pistol, revolvers*
- long – double hand + stock on shoulder; *rifle*

Front sight



Barrel



Breech



Rear sight



Butt plate



Muzzle



Trigger



Stock



Bore: the inside of the barrel



Bullet



Cartridge

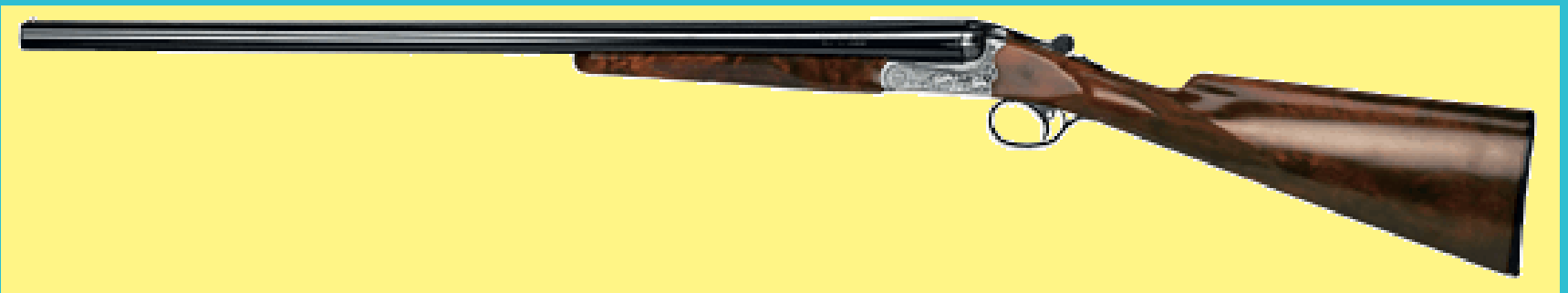
Handguns



Rifle



Shotguns



Barrel for single projectile

- **grooves** - quantity 4 – 8, depth 0,15 – 0,25 mm, right /left-handed elevation
- **fields** - are between grooves

Fields + grooves → **rotation of missile** → stable fly
→ **marks** on the missile surface – characteristic for every barrel → forensic ballistics lead to **identification of weapon**

- **calibre** – smallest inner diameter of barrel;
pistol - in mm,
revolvers – in tenths / hundredths inch
1 inch = 2,54 cm

Most frequent calibres

- **pistol** 6,35 7,65 9 mm
- **revolver** .36 .38 .357 inches
- **machine gun** 7,62 9 mm
- **rook rifle** 5,6 mm

Common characterization

- **forcibility** – ability of projectile to penetrate different materials
- **efficiency** – ability to make injury
- **stop – effect** = immediate inhibition of ability to action (move) at hurt person, injuries are hard!
 - biggest: missiles with blunt or hollow top of bullet

- **Velocity of the missile when leave barrel**
 - common approximately 600 m/s
 - high > 800 m/s

Injuries caused by single projectile

- **Nastřelení** – does not penetrate, only ricochet on the skin - missile with small E
→ *abrasions, bruises*
- **Ostřel** – does not penetrate, tangential hit
→ *groove on the body surface*
- **Zástřel** – penetrates and remains in the body
→ *entrance wound + shoot canal*
- **Průstřel** – penetrates and leave the body
→ *entrance w. + shoot canal + exit w.*

Entrance wound and its surroundings

- due to angle of incidence – circular (vertically), oval (obliquely)
- Contact of missile with skin → **spray effect** → **minus effect** → completely damaged edges of skin around the entrance

Zones (rims) at entrance surroundings

- I. **greasy (dirty) z.** - gun oil, bullet lubrication, barrel and bullet debris = metallization
Sb, Ni, Cu, Fe, Pb - histochemical identification
- II. **contusion z.** - contusion, abrasion and become dry place (1-4 mm)
- III. **smoke blackening z. (carbon) and particles of unburned gun powder** (= adjacent exhaust of shot)

Discovery of I. – III. zones is dependent on distance of shooting.

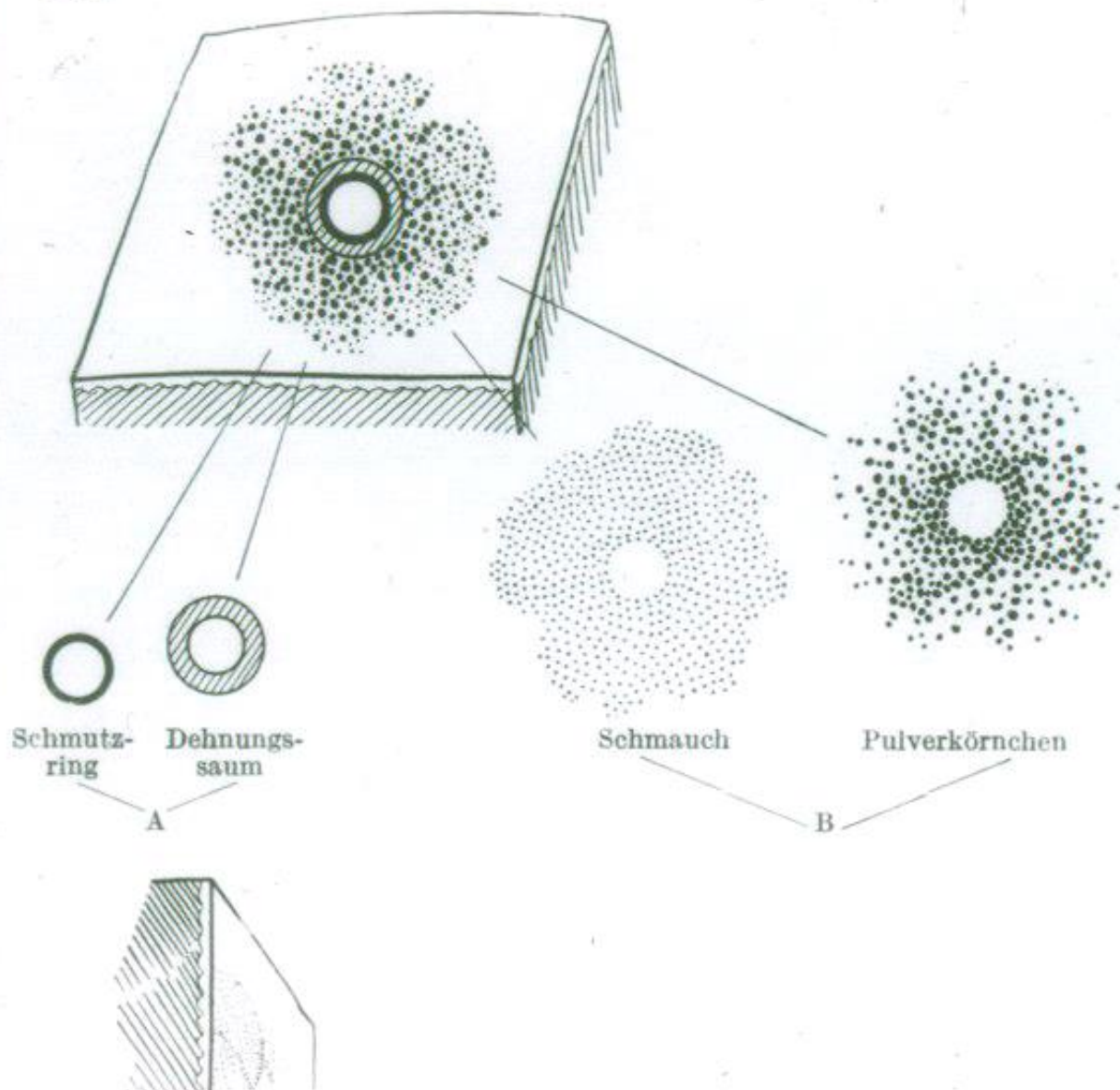


Abb. 5. Am Einschuß zu unterscheidende Schußzeichen:

A. durch das Geschöß hervorgerufene Einschußzeichen :

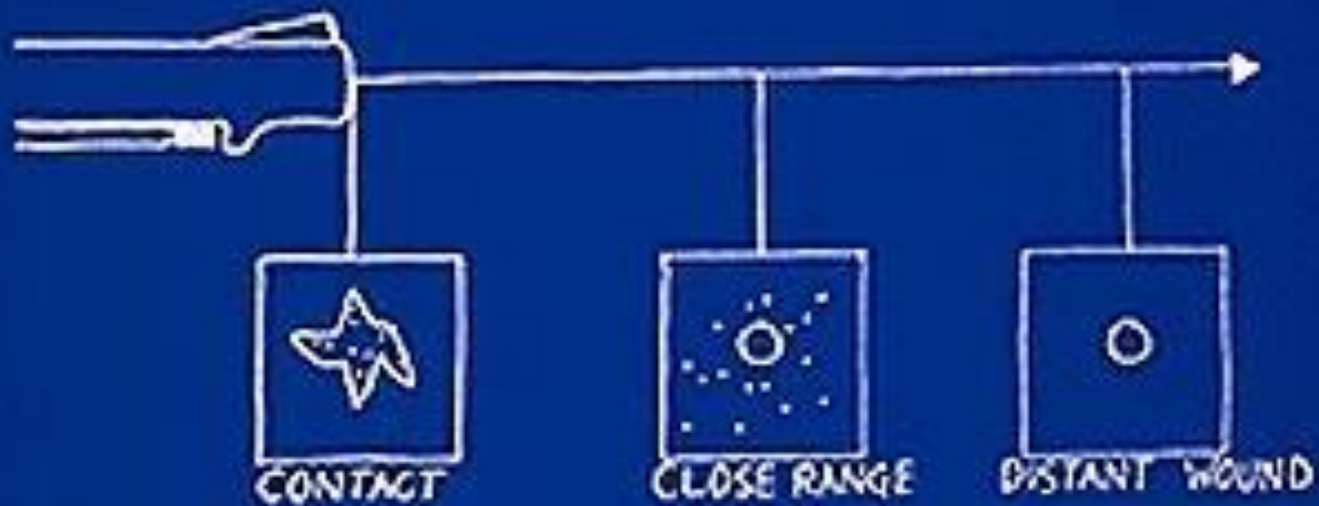
1. Schmutzring durch Abstreifen der Oberfläche des Geschößes,
2. Dehnungsraum durch Vertrocknung infolge von Dehnungsrissen in der Oberhaut (Abb. 4);

B. von der Treibmasse herrührende Nabschußzeichen:

1. Pulverschmauchablagerung,
2. Pulverkörncheneinsprengung.

Distance of shot

- contact with the **skin** - imprint of muzzle and front sight on the skin, smoke cavity – there is adjacent exhaust (soot, gases)
- **short dist.** – for orientation, same as length of barrel, picture of entrance, there are I. – III. z.
- **middle dist.** - cca 1 m, from adjacent products of shot. skin only receives particles of unburned powder
- **long dist.** - cca > 2 m, in the entrance surroundings are only I.+ II. z.



Shoot canal

- **temporary** – the passage of missile through, and its pulse(ripple-effect)
- **definitive** (final) – width is smaller
- blood in the canal + laceration of tissue
- in surroundings **zone of contusion**
- can change direction – e.g. ricochet of missile from bone

Exit wound

- skin is disconnected (torn), but not evaporate → **no minus effect** → edges can be adapted (stitched)
- different appearance than at surrounding of entrance wound - zones are missing
- commonly bigger, than in entrance place

Contact Wounds (touching the skin)

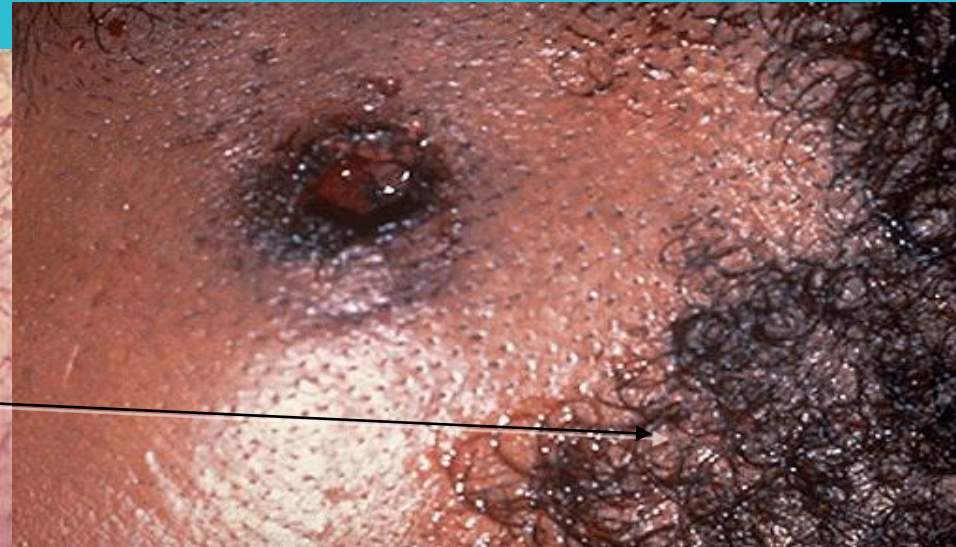
- When a weapon is fired, the bullet, hot gases from exploding gun powder & metal fragments from the bullet & the gun barrel are propelled out of the muzzle at the same time.
- The hot gases & metal fragments are blasted into the body at the same time as bullet.
 - Round or oval central defect with an 'abrasion collar' (where the bullet has abraded the skin surface as it passes through it). The size of the defect is comparable to the size of the muzzle opening or bore of the weapon.
 - "Pink/red" staining of the skin (due to presence of carbon monoxide laden gases producing carboxyhaemoglobin)
 - Gun powder blackening of the wound edges & surrounding skin (from soot & unburned propellant gases).
 - Circular bruise over the skin due to muzzle impact.

Contact Wounds cont. Summery

- Wounds are circular
- There may be muzzle mark
- There may be a slight local burning to the skin & hair
- Redness from CO gases



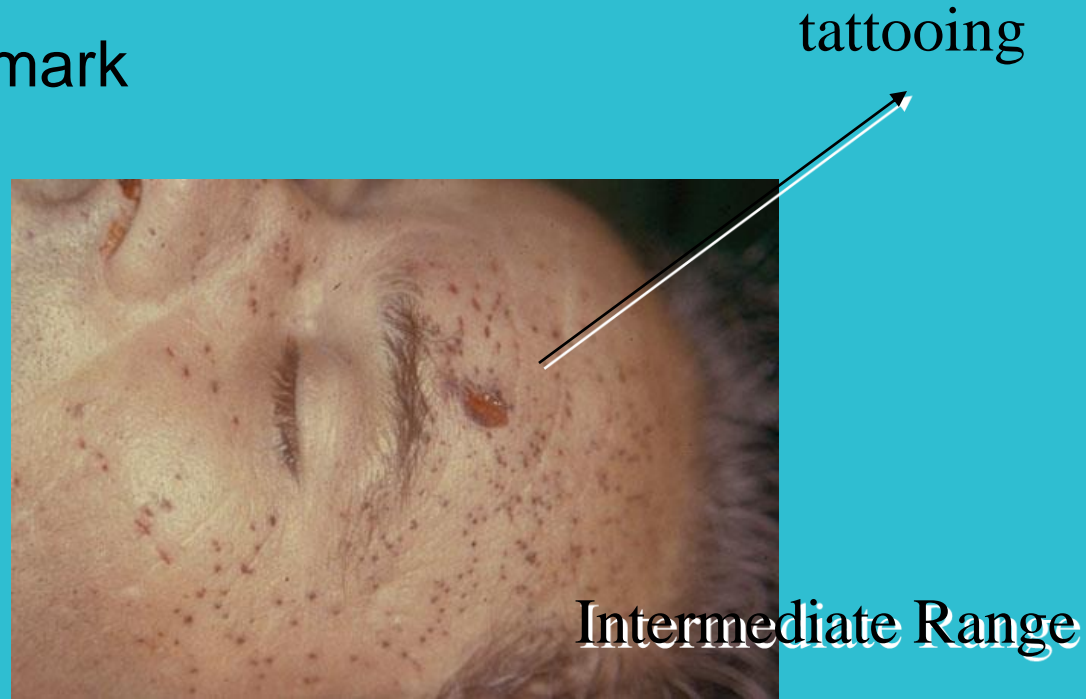
Muzzle imprint



Burning from the powder

Near Distance

- Few cm from surface
- Large central defect with 'stippling' or 'tattooing' (small, dry, reddish abrasions caused by unburned powder & small metal fragments striking the skin)
- Smoke soiling
- Lack of muzzle mark



Intermediate Range

- Within 20 cm to 1 m.
- Diminishing of the smoke soiling but powder tattooing persist
- Burning will be present
- The rim of the wound is irregular forming what is called 'rat-hole'.



Long Range (2-3m)

-Satellite pellet holes will be seen around the central wound, which diminishes in size as the range increases.

- the spread of shot in centimeters equal two to three times the range in meters.

e.g. if the wound pattern is 20 cm across the discharge was roughly 7 – 10 m so couldn't be a suicide.

Long Range (20 – 30 m)

-Abrasion collar

-No smoke soiling, burning or powder tattooing.

-Tissue displacement.

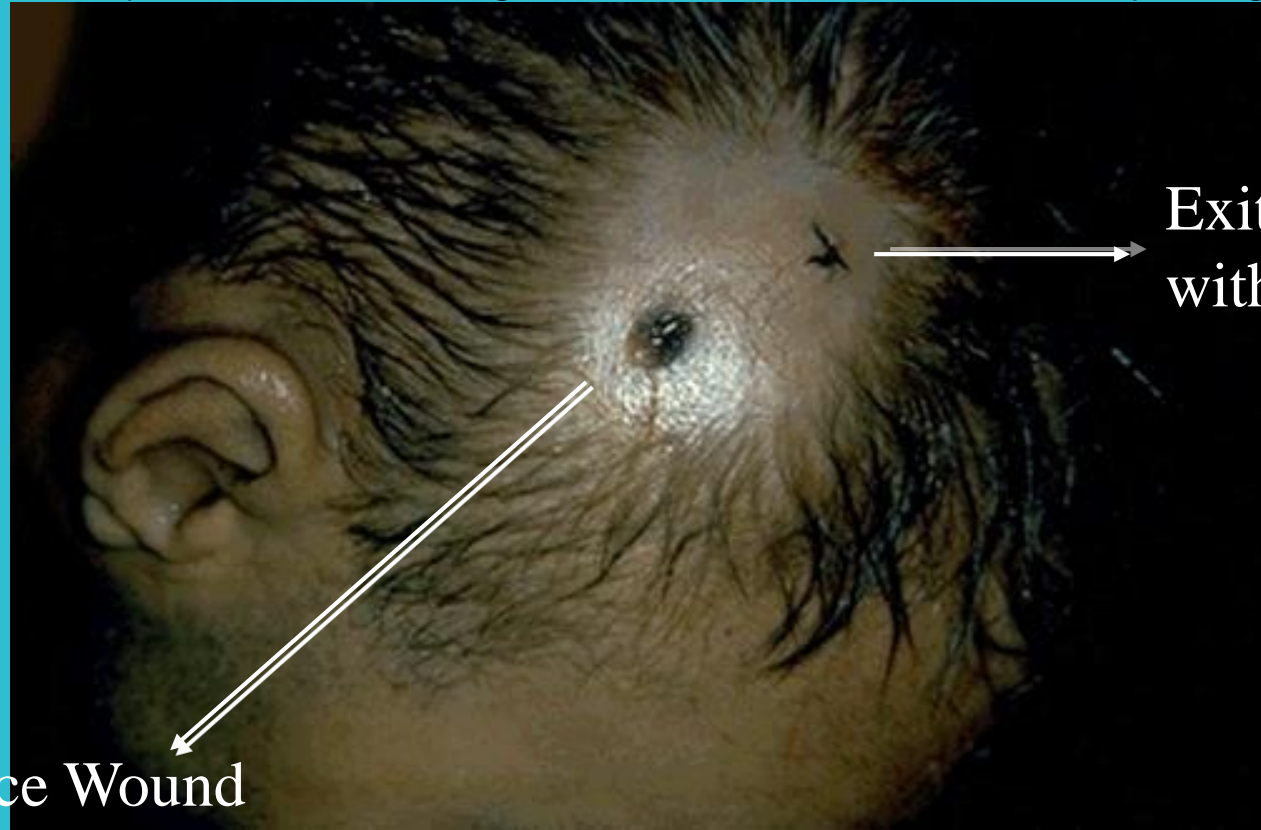
Exit wound

-Rifled weapons:

--Exit wound is usually everted with split flaps.

--No burning, smoke or powder soiling.

--if the bullet flattened or has destruct some bone internally, exit wound may be more irregular and sometimes very large in size.



Exit Wound
with split flaps

Entrance Wound

Hunting arms with small round balls

- **barrel on the skin** – entrance circular or irregular, in surroundings strong black soiling (smoke blackening), both muzzle marks on the skin; shoot canal – there are small round balls (pelets); more devastate injury
- **bigger distance** – bigger disperse of small round balls
 - **smaller dist.** – little disperse (homogeneous) → homogenous entrance
 - **increasing dist.** → whole in the entrance of the main beam + separate pelets in surrounding
 - cca > 10 m → only separate pelets

Less commonly findings

- **embolism of projectile** – mainly at shotgun - embolism of small round balls
- **falling projectile**
 - shoot up (to the sky) – less of risk (smaller impact E)
 - shoot tangential – can lead to death

Homicide - suicide - accident

- **suicide** - frequent, injury on the places, which are available for self-murderer hands
 - commonly 1 shot
 - shooting on short distance (length of arms !)
 - droplets of blood on the hands
 - no another injury or marks of fight
- **homicide** – frequently more wounds, in not available places for victim hands, more directions, from longer distance
- **accident** – gun cleaning, careless manipulation