

# Basic principle

- **$K.E = 1/2 mv^2$**
- dissipated as
- Heat
- Noise
- Mechanical disruption

- **Bullet design**
- **Orientation of bullet**
- **Speed of bullet**

# Mechanism of injury in slow velocity weapon

- Slow projectile cause tissue laceration, crushing of tissues.
- Secondary damage from rupture of blood vessels.
- Tertiary damage caused by displaced bone and cartilage fragment.

# Mechanism of injury in high speed bullet

- Tissue pressure increased several thousand kilo Pascal.
- Cavitation
  - Temporary
  - Permanent
- Tissue displacement depends upon loss of K.E .
  - 1500-4800feet/sec

# Mechanism of injury

- Near vacuum
- Solid organs brain and liver      less damage
- Spongy organs      more damage
- More water containing organs      more damage
  - Secondary damage
  - Vascular damage
  - **Military weapons 980 m/sec**

# Factors affecting on mechanism of injury

- Weapon
- Muzzle velocity
- Nature of projectile
- Nature of propellant
- Range of discharge
- Angle of discharge

# Ricochet

- **Critical angle of impact**
- Entrance wound tends to become larger

# Ring/collar of abrasion

- Abraded skin around entry wound due to elasticity /stretch of the skin
- Circular, oval and irregular
- Wound edges inverted
- **ABSENT IN**
- Semi jacketed/full jacketed bullets with high velocity
- Center fire rifles wound
- Wounds of palms and sole
- Under lying bone due to less skin indentation.



# Grease ring

- Inner edge of abrasion collar may be black due to wipe of bullet
- Lubricating oil,grease,metal particles and dirt
- **Under cut**
  - Tissue seen on the floor of the wound
  - Trajectory of entry will determine the site of exit.

# Back spatter

- **Tissue and blood**
- Subcutaneous expansion of gases and cavitation effect
- Emerges from the entrance wound from every possible angle
- Depends upon caliber and position of shooter

# Product of fire

- Jet of flame
- Cloud of gases
- Burnt and Unburnt grains of powder
- Carbon/soot from burnt gun powder
- Vaporized metal from bullet, cartridge case and primer
- Depends upon range between muzzle and body.

# contact

- **Hard contact**
- Seal between muzzle and skin
- Edges of wound seared
- Blackened by combination of burning from flame, soot
- Muzzle imprint
- Tearing of tissue by propulsive gases
- Presence and absence of underlying bone
- carboxy hemoglobin track
- **Collar of abrasion**

# Contact wound on the head

# Loose contact

- Gap open between muzzle and skin
- Soot deposited around the entrance hole
- This soot is washed away
- powder may be present on entry and exit wound

# Near contact

- Muzzle at short distance from the skin
- Blackened and seared margins due to flame burn
- Powder soot
- Circular hole with abrasion collar
- Small punctate burns
- Unburnt powder flakes
- Little or no monoxide in tissues

# Intermediate contact

- Powder tattooing
- only up to one meter(3 feet)
- Size and shape of marking reflects shape and size of grain

Palms and soles are resistant to powder tattooing



# Distant range

- Circular hole with abrasion ring
- Bullet wipe
- Micro tears
- No burning
- No tattooing

# Atypical wounds

- **Graze wound**
- **Tangential wound**

**Effect of intermediate target**

# Wound on the bone

- **Bevelling**
- **Gutter wound**
- **Key hole wound**

# Large entry wound

- Due to in rushing gases in contact discharge
- Tumbling bullet
- Entire bullet enters and only portion of it exit
- Tangential entry wound
- Bullet enters through folded or creased skin
- **Size should never used as determine of entry and exit wound**

# Exit wound

- No abrasion ring
- Slit like
  - Stab/incised wound
  - Stellate shape
- Shored exit wound

# Primer residue

- Present on the person who has fired the gun or who has handled the residue bearing weapon

# Test

- gun shot residue(GSRs)
  - Dermal nitrate test

## Modern methods

- Neutron activation analysis
- Atomic absorption spectrophotometry
- Scanning electron microscopy with x-rays analyzer

# Examination of injuries



- **Kennedy phenomenon**
- When gun shot cannot be evaluated as to whether it is entry or exit wound due to surgical alteration or suturing of the wounds.
  
- **Wound margins**
  - Trace metal analysis
  - Energy dispersive x-rays
  - Scanning electron microscope