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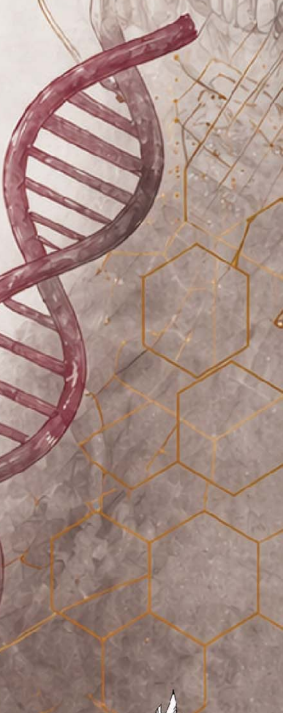
FORENSIC MEDICINE & TOXICOLOGY

(Theory, Practical and MCQs)

Includes the latest Criminal Laws-BNS, BNSS, and BSA within the text







Dekal V

As per the Revised Competency-based Medical Education Curriculum (NMC)

JAYPEE

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CHAPTER 14

Medico-Legal Aspects of Injuries

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KEY WORDS

Simple injuries, grievous hurt, dangerous injury, antemortem and postmortem injury, shock, primary neurogenic shock, hypovolemic shock, bomb blast injuries, primary, secondary and tertiary injuries, defense wound, fabricated wound, hesitation cuts, self-inflicted wounds.

COMPETENCIES

FM5.2: Define injury, assault and hurt. Describe Bharatiya Nyaya Sanhita (BNS) pertaining to injuries.
FM5.3: Describe accidental, suicidal, and homicidal injuries. Describe simple, grievous, and dangerous injuries. Describe ante-mortem and post-mortem injuries.
FM5.4: Describe healing of injury and fractures of bones with its medico-legal importance.
FM5.5: Describe factors influencing infliction of injuries and healing, examination and certification of wounds, and wounds as a cause of death: primary and secondary.
FM5.6: Describe and discuss different types of weapons including dangerous weapons and their examination.

INTRODUCTION

Legal Definition of Injury (FM5.2)

Section 2(15) BNS defines injury as "any harm whatsoever illegally caused to any person in body, mind, reputation or property".

Only bodily injuries are wounds. Hence, all wounds are injuries but all the injuries are not wounds.

Hurt (Section 114 BNS)

Any bodily pain, disease or infirmity caused to any person is called hurt.

Assault (Section 130 BNS)

Any offer of threat or attempt to apply force to the body of another in a hostile manner. Execution of such act amounts to '**battering**'.

HOW DO WE CLASSIFY INJURIES?

Injuries are classified in three ways:

1. Medical classification
2. Legal classification
3. Medico-legal classification

Medical Classification of Injuries

Mechanical injuries: Injuries caused by application of physical force.

Chemical injury: Corrosive acids and alkalis

Thermal injury:

- Due to cold: (i) Frost bite, (ii) Trench foot, (iii) Immersion foot.
- Due to heat: (i) Burns-dry heat. (ii) Scalds-wet heat.

Miscellaneous: (a) Electrical injury (b) Radiation injuries (c) Firearm injuries (d) Explosive injuries.

Legal Classification of Injuries

Legally, injuries are classified according to the severity of the injury:

- Simple injury
- Grievous hurt
- Dangerous injury—in living
- Fatal injury—in dead.

Medico-legal Classification of Injuries

For medico-legal interpretation, injuries are classified as:

- Accidental injuries.
- Suicidal injuries (self-inflicted injuries).
- Homicidal injuries.
- Defense injuries.
- Fabricated injuries.

WHAT ARE SIMPLE INJURIES, GRIEVOUS HURT, AND DANGEROUS INJURIES? (FM5.3)

Simple Injuries

Injuries that are neither serious nor dangerous to life, not causing severe pain, heals easily without leading to any complications and usually heals without leaving any scar are called as simple injuries. **Example:** Abrasions, skin deep laceration on the limbs, etc.

Grievous Hurt

Section 116 BNS enumerates eight clauses of injuries which constitute grievous hurt. All other injuries which do not fit into any of the clauses of grievous hurt are simple injuries.

Grievous Hurt (FM5.3)

Section 116 BNS defines grievous hurt as:
Emasculation
Any hurt that falls under one of these eight categories is legally "Grievous":

1. **Emasculation:** Depriving a male of his virility.
2. **Vision loss:** Permanent privation of the sight of either eye.
3. **Hearing loss:** Permanent privation of the hearing of either ear.
4. **Loss of limb/joint:** Privation of any member or joint.
5. **Impairment of limb/joint:** Destruction or permanent impairment of the powers of any member or joint.
6. **Disfigurement:** Permanent disfiguration of the head or face.
7. **Fracture or dislocation:** Fracture or dislocation of a bone or tooth.
8. **Severe pain or incapacity:** Any hurt which endangers life or which causes the sufferer to be in severe bodily pain or unable to follow his ordinary pursuits for a period of fifteen days.

Dangerous Injury (FM5.3)

Any injury which causes imminent threat to the life of the individual is a dangerous injury. An endangering injury is one for which if the individual is not admitted to the hospital for life saving treatment and surgical intervention had not been done, he could have died.

When the injury leads to death of an individual, then it is called as fatal injury. **Example:** Incised wound on the wrist resulting in cut of the radial artery; if surgical intervention is done there is no threat to the life

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of the individual. This is an endangering injury. But, if not treated by surgical inter-vention, profuse bleeding would result in death of the victim in a few minutes to an hour; if death occurs, it becomes a fatal injury.

Dangerous Weapon

Any weapon used for cutting, stabbing or shooting or any weapon used as a weapon for assault of an individual is like to cause endangering injuries or death is a called as dangerous weapon.

Any routinely used objects can be used as a dangerous weapon. Like the iron chairs, wooden stools when used for assault are likely to cause death. Even the hand kerchief can be used to for choking and the "dupatta" (scarf) can be used to strangulate an individual.

Hence, basically any weapon used for cutting stabbing or shooting is always dangerous weapons and carrying any such weapons, the individual is liable for carrying dangerous weapon.

SECTIONS OF IPC RELATED TO INJURIES (FM5.2)

Homicide

Homicide is killing of a human being by another.

Justifiable Homicide

The homicide is justified under the particular circumstance. **Example:**

- In administration of justice such as execution of capital punishment.
- In the maintenance of justice as like suppression of riots or while executing an arrest of criminals.
- A woman who kills a person who attempts to rape her.

Excusable Homicide

This is homicide caused unintentionally:

- Killing in self defense
- Death by accident or misadventure
- Death following lawful operation, done in good faith, not intended or known to cause death.
- Homicide by an insane person.

Culpable Homicide (Section 100 BNS)

Culpable homicide is causing death of a person by an act done:

A person commits culpable homicide if they cause death by doing an act:

- With the **intention** of causing death; or
- With the **intention** of causing such bodily injury as is likely to cause death; or
- With the **knowledge** that they are likely by such act to cause death.

Murder (Section 101 BNS)

Culpable homicide is murder if:

The act was done with the intension of causing death.

If done with the intension of causing such bodily injuries which are likely to cause death.

With the knowledge that such bodily injuries would cause death in ordinary course of nature.'

Exceptions

The five exceptions (murder downgraded to culpable homicide)

The BNS retains the five circumstances where an act, though intended to kill, is not punished as murder:

1. Grave and sudden provocation.
2. Private defense (exceeding the right in good faith).
3. Public servant (acting in good faith for the advancement of public justice).
4. Sudden fight (without premeditation and in the heat of passion).
5. Consent (victim is above 18 years of age and consents to the risk of death).

Section 103 BNS

Punishment for murder. Death or life imprisonment, and also fine.

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Life imprisonment implies imprisonment till the end of life and/or imprisonment not <14 years.

Section 103(2) of the Bharatiya Nyaya Sanhita (BNS) introduces a landmark provision specifically targeting mob lynching and group-led murder. It stipulates that when a group of five or more persons acts in concert to commit murder motivated by factors such as race, caste, community, sex, place of birth, language, or personal belief, each member of that group shall be punished with death or life imprisonment, along with a fine. This clause distinguishes collective hate-motivated violence from individual homicide, ensuring that every participant in a mob faces the highest tier of legal accountability.

Section 105 BNS

Under Section 105 of the Bharatiya Nyaya Sanhita (BNS), the punishment for culpable homicide not amounting to murder is strictly categorized by the offender's mental state. In Part 1, where there is a clear intention to cause death or fatal bodily injury, the law prescribes a severe penalty of life imprisonment or a term ranging from five to ten years, plus a mandatory fine. In Part 2, where the act is committed with the knowledge that death is likely but without a specific intent to kill, the punishment is imprisonment for up to ten years, a fine, or both. This distinction ensures that the severity of the sentence directly reflects the level of criminal intent (mens rea) involved in the act.

Section 106(1) BNS

Section 106 of the Bharatiya Nyaya Sanhita (BNS) significantly revises the legal framework for death by negligence. Under **Section 106(1)**, the punishment for general rash or negligent acts has increased from **two years to a maximum of five years**, though a specific proviso limits the penalty for **registered medical practitioners to two years** for errors occurring during medical procedures.

Most notably, **Section 106(2)** introduces a stringent "Hit and Run" category, prescribing up to **ten years** of imprisonment and a fine for offenders who cause death by rash driving and flee the scene without reporting the incident to a police officer or Magistrate.

Section 80(1) BNS (Dowry Death)

Under Section 80 of the Bharatiya Nyaya Sanhita (BNS), a "dowry death" is legally established if a woman dies **within seven years of marriage** due to burns, bodily injury, or other unnatural causes, provided it is shown that she was subjected to cruelty or harassment by her husband or his relatives regarding dowry demands "soon before" her death. The offense carries a mandatory minimum sentence of **seven years,** extendable to **life imprisonment**. Furthermore, under **Section 118 of the Bharatiya Sakshya Adhiniyam (BSA)**, the court maintains a legal presumption of guilt against the accused once these criteria are met, shifting the burden of proof to the defense.

Sections of IPC Relating to Hurt

BNS Section 2(15): Defines injury as "any harm whatsoever illegally caused to any person in body, mind, reputation or property".
BNS Section 114: Defines hurt as "any bodily pain, disease or infirmity caused to any person".

BNS Section 116: Definition of grievous hurt. Threshold for "severe pain" reduced from 20 to 15 days.

BNS Section 115(1): Voluntarily causing hurt.

BNS Section 117(1): Voluntarily causing grievous hurt.

Punishment for Hurt (Section 115(1) BNS): Formerly Section 323 IPC. Imprisonment up to 1 year, or fine up to ₹10,000 (increased from ₹1,000), or both.

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Hurt by Dangerous Weapons (Section 115(2) BNS): Formerly Section 324 IPC. Imprisonment up to 3 years, or fine up to ₹20,000, or both.

Punishment for Grievous Hurt (Section 117(2) BNS): Formerly Section 325 IPC. Imprisonment up to 7 years and fine.

Grievous Hurt by Dangerous Weapons (Section 118(2) BNS): Formerly Section 326 IPC. Imprisonment up to 10 years and fine.

Acid Attack (Section 124(1) BNS): Formerly Section 326A IPC. Imprisonment not less than 10 years to Life and fine (to be paid to the victim).

Attempted Acid Attack (Section 124(2) BNS): Formerly Section 326B IPC. Imprisonment not less than 5 years to 7 years and fine.

DIFFERENTIATE ANTEMORTEM FROM POSTMORTEM INJURIES? (FM5.3)

There is not much difficulty in finding out the nature of the injury as antemortem or postmortem in nature. A trained medical expert can easily find it out by just seeing the wound. But difficulties are encountered while examining injuries caused just before death and injuries caused just immediately after death **(Table 14.1)**.

CAUSES OF DEATH FROM WOUNDS

The causes of death from wounds could be (i) immediate causes and (ii) remote or delayed causes.

Immediate Causes

Shock

Shock is circulatory disturbance resulting in hypo-perfusion of tissues due to either reduction in the cardiac output or reduction in the volume of blood in the circulation.

Primary shock or neurogenic shock:

- Vaso-vagal shock or reflux cardiac arrest results from sudden reduction in the venous return to heart resulting from pooling of blood in the peripheral vessels by neurogenic vasodilatation caused by sudden reflex vagal inhibition.

Hypovolemic shock (hemorrhage):

- Hemorrhage is escape of blood from the cardiovascular system. The source of hemorrhage could be capillary, venous, arterial or direct trauma to the heart. The resultant hemorrhage could be external hemorrhage (due to injuries on the body surface) or internal hemorrhage (bleeding within the body, where blood escapes from the circulation but gets collected in the body cavities, as in penetrating stab wounds, gunshot wounds or internal lacerations of major organ like liver, lung or spleen, etc.) either of them results is reduced cardiac output and reduction in the circulating blood volume.
- Anyway, could be the source of hemorrhage reduction in one third of circulating blood volume causes death by irreversible hypovolemic shock.

Secondary shock (delayed shock):

- This condition is more serious and many a times fatal. There is progressive circulatory failure and resultant tissue damage. Due to diminished perfusion of the tissues intracellular metabolism is disturbed with anaerobic glucose metabolism and increased production of lactic acid which causes disruption of lysosomes. There is a decrease in production of ATP, metabolic acidosis, electrolyte disturbance and renal insufficiency.

Septic shock:

- Most of the cases of septic shock are caused by endotoxin producing gram-negative bacilli such as *E. coli*, *Klebsiella, Proteus, Pseudomonas, Pneumococci and Streptococci*.

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TABLE 14.1: Antemortem wounds vs postmortem wounds.

Features	*Antemortem wounds*	*Postmortem wounds*
Hemorrhage	Usually copious, showing signs of arterial spurting	Comparatively very less, may even be absent
Wound edges	Swollen, everted and retracted except; wound gapping present due to elasticity of the skin	Not swollen or retracted wound gapping is absent because the skin loses elasticity immediately after death
Extravasation of blood	There is extensive infiltration of blood in and around the injured areas, which cannot be washed off	No extravasation and infiltration of blood into the tissues, even if the surrounding tissues show staining it is easily washed off
Blood clot	Coagulated blood is noticed in and around the injured tissues. The clot is laminated and firmly adherent to the lining endothelium. The clot cannot be easily separated and when detached the fibrin network imprint in present of the tissues where the clot was adherent	Blood is usually not clotted. The clot, if found, is nonlaminated and weakly adherent to the lining endothelium
Consistency of the blood clot	Clot is rubbery and firm. On being pulled out from the vessel, it will come out like a horse tail because of fibrin and platelet aggregation	The clots are soft and friable. On being pulled, will invariably break due to absence of platelet aggregation
Lines of Zahn	The surface shows apparent lines of Zahn. These lines are formed by alternate areas of light-stained (aggregated platelets admixed with fibrin meshwork) and dark-stained layers (red cells)	The surface is yellow (chicken fat) in appearance. There is separation of plasma and leucocytes covering the dark red cell constituents (currant jelly) due to sedimentation of blood after death
Microscopy of the blood clot	Microscopically: composed of fibrin, platelets and RBCs	Mainly composed of fibrin and RBCs
Vital reaction	Signs of inflammation and repair are demonstrable depending upon the age of the wound/injury	No signs of inflammation and repair
Microscopy	Leucocytic emigration appreciable in the surrounding tissue as to the age (neutrophils dominating for the first 6–24 hours)	Vessels distended with postmortem clot without showing any cells outside the vessel wall
Enzyme histochemistry	➢ Adenosine triphosphatase +ve (as early as 1 hour) ➢ Aminopeptidase +ve (at about 2 hours) ➢ Acid phosphatase +ve (at about 4 hours) ➢ Alkaline phosphatase +ve (at about 8 hours)	No enzyme activity
Wound biochemistry	➢ Serotonin peak (within about 10 minutes) ➢ Free histamine peak (within about 20–30 minutes)	Nil Nil

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Remote Causes

Infection:

- Infection is the most important complication. The skin protects us from access of infection but when an injury is sustained, depending on the size of body surface involved and the severity of injury the bacteria gain easy access into the body and both local and systemic infections are the most common complication of injuries.

Embolism:

- Pulmonary air embolism (entry or air through ruptured veins) and fat embolism (from fractured long bones) are expected in extensive injuries of limbs, usually lower limb.

Gangrene and necrosis:

- When there occurs severe crush injury, the blood vessels are ruptured and the distal part usually limbs undergo gangrenous change, necrosis and putrefaction of the dead tissues.

DIC and renal failure are also expected complications of injuries.

EFFECTS OF BOMB EXPLOSIVE INJURIES

Identification of Mutilated Bodies

The effects of all explosive bomb injuries are accompanied by complex waves. There are two components of such complex waves:

i. Blast wave (dynamic overpressure) with positive and negative phase.
ii. Blast wind (Mass movement of air).

The resultant injuries are mainly due to the initial shock waves followed later and aggravated by the sub atmospheric phase.

When body is impacted by a blast pressure wave, it sets up series of stress waves injuring organs at air fluid inter-phases (ears, lungs, heart and GIT).

Blast injuries are divided into four categories: Primary, secondary, tertiary and quaternary injuries.

Primary Injuries

These injuries are unique to high explosives and are presented as over-pressurization blast waves with body surface and usually there is absence of external injuries.

These primary injuries most commonly involve air-filled organs and air-fluid interfaces, mainly middle ear, lungs and gastrointestinal tract.

Types of injuries produced are:

Blast Lung

Shock wave transit through the lungs can tear the alveolar septa and give rise to alveolar hemorrhage. Other findings in the lungs may include sub-pleural patchy hemorrhages (often in the line of ribs) and intrapulmonary hemorrhages. The air passages may be filled with bloody froth causing airway obstruction and hypoxia in addition to the primary damage. Later, neutrophilic reaction may develop around the hemorrhagic areas and those can progress onto bronchopneumonia. The pulmonary injury is a specific injury of the air blast and is sometimes called as **'blast lung'.**

Other major injuries produced are:

- Tympanic membrane (TM) rupture (acoustic barotrauma).
- Abdominal hemorrhage and perfor-ation (colon, stomach, small intestine, caecum).
- Traumatic brain injury (TBI) without physical signs of head injury.

Secondary Injuries

These secondary injuries are due to flying debris and bomb fragments which affects part of the body which results in penetrating ballistic or blunt injuries.

These are the leading causes of death in military and civilian terrorist attacks except in cases of major building collapse.

Wounds may be grossly contaminated.

Thoracic trauma (lacerations over heart and great vessel) is a common cause of death.

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Tertiary Injuries

Tertiary injuries are due to the persons being thrown onto fixed solid objects by the blast wind of explosions and are also due to structural collapse and fragmentation of building, and vehicles. This may cause extensive blunts and penetrating trauma and these injuries would show features of peppering effect with a triad of abrasion, contusion and puncture lacerations.

Bone fractures and countercoup injuries are also seen.

Children are at high risk due to their lesser body weight.

Quaternary Injuries

Quaternary injuries are also called as miscellaneous injuries and they include:

- **Injuries not included in the first three categories. Example:** Flash burns, crush injuries, fall resulting from the explosion and respiratory injuries (toxic dust, gas) or radiation exposure.
- Post-traumatic psychiatric effects are most common which could be due to neurological damage caused during the blast.
- Post-traumatic stress disorder may affect people who were otherwise uninjured.
- The sequelae of these traumatic injuries would also result in crush syndrome, acute renal failure and compartment syndrome.

Identification of the Dead in Bomb Blast Injuries

Full body X-ray for findings like pacemaker or some old fracture/bony changes that the alleged victim was known to have.

Many a times, the body could be fragmented into many pieces and thrown at some distance and are also frequently intermixed with fragmented body parts of different victims. In such cases first aligning the body parts is done using the knowledge of anatomy. Complexion, size of the body parts are all considered for segregating and aligning the body parts to fix a complete body.

Some of the body parts may not be traceable or disintegrated and may not be recovered at all in such circumstances the following data are useful in fixing the identity of the individual:

- Dentition (dental pattern) and artificial dentures may help in identification.
- Fingerprints are sometimes helpful if previous records are available.
- Blood grouping and DNA profile may also be useful in some cases for identification.
- Anthropometry may also be useful in some cases.

DESCRIBE BLAST LUNG

Shock wave transit through the lungs can tear the alveolar septa and give rise to alveolar hemorrhage. Other findings in the lungs may include sub-pleural patchy hemorrhages (often in the line of ribs) and intrapulmonary hemorrhages. The air passages may be filled with bloody froth causing airway obstruction and hypoxia in addition to the primary damage. Later, neutrophilic reaction may develop around the hemorrhagic areas and those can progress onto bronchopneumonia. The pulmonary injury is a specific injury of the air blast and is sometimes called as **'blast lung'**.

DEFENSE WOUNDS (FM5.1) (FIGS. 14.1 AND 14.2)

They are the result of immediate and instinctive reactions of the victim to save himself, either by raising the arm to prevent the attack or by grasping the weapon.

If the weapon is blunt, abrasions and bruises are produced on the back of forearms, wrist or back of the hands.

The size and shape depends upon the type and shape of the weapon.

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Fig. 14.1: Defense wound
(For color version see Plate 13).

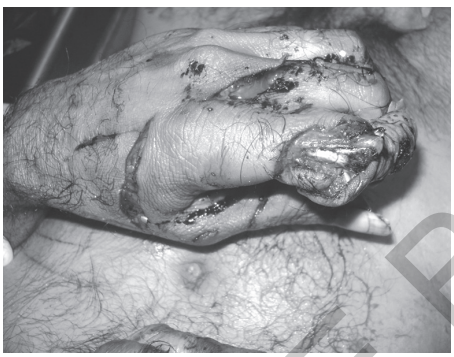


Fig. 14.2: Multiple cut wounds—defense wounds
(For color version see Plate 13).

When sharp weapons were used, the injuries produced will depend upon the mode of application of force.

In stabbing with a single edged weapon, if the weapon is grasped, a single cut is produced on the palm of the hands or on the creases of the fingers and/or thumb.

If the weapon is double edged, then cut injuries are produced both on the palmar aspect and the fingers. The cuts may be irregular and ragged, because of the gripping movement of the hand.

A typical defense wound is seen in the web between the base of the thumb and index finger, when the blade is grasped.

The presence of defense wounds indicate homicidal nature of the injuries and may be absent if the victim is incapacitated, unconscious, intoxicated or attacked by surprise.

SELF INFLICTED WOUNDS/ FABRICATED WOUND? (FM5.1)

Self-inflicted wounds are those inflicted by a person on his own body.

Fabricated wounds (**fictitious, forged or invented wounds**) are inflicted by a person on his own body or by another person with his consent.

These types of wounds are inflicted:

- To charge an enemy with assault or attempt murder.
- By the policemen and watchmen acting in collision with robbers to show that they were defending the property.
- By the prisoners to bring a false charge of torture against the officers.
- By the recruits of uniformed services to escape hard work.
- By women to bring a false charge of sexual assault or cruelty against them.

The commonest injuries fabricated are incised wounds; many a times false contusions and sometimes stab wounds and burns. Lacerated wounds and true contusions are least fabricated.

Self-inflicted incised wounds are usually multiple, superficial, shallow and parallel to each other, present on the accessible parts of the body and does not involve any vital parts like face.

The direction is from behind forwards on the top of the head; from above downwards on the outer side of upper arm; from below upwards on the front of forearms; variable on lower extremities, chest and abdomen.

Burns are superficial and usually on the left upper arm.

Clothes are not cut, and if cut are not compatible with the nature of the wounds.

The history of the assault is usually not compatible with the injuries present on the body.

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Fabricated bruises are also produced using plant juices of *Semecarpus anacardium* and *Calotropis*; which can be easily made out by an expert by examination of the margins for the presence of vital reactions, color changes, blister formation and itching.

WHAT ARE HESITATION CUTS?

Hesitation cuts are also called ***tentative cuts*** or ***feeler strokes***.

These are multiple, superficial, horizontal and linear injuries almost parallel to each other. These injuries are never deep.

The tentative cuts are always superficial because it is the basic instinct of a human to preserve his life, that he cannot inflict painful deep injuries to himself.

The presence of hesitation cuts indicates the suicidal nature of the injury.

Commonly present in cut-throat injuries on the neck around the main wound, which indicates the half-heartedness and the divided state of mind.

They are present only on the accessible parts of the body, commonly present on the front of forearm, wrist or elsewhere on the body.

These types of injuries are also inflicted to annoy or threaten the people close to them.

DISCUSS ABOUT ANESTHETIC AND SURGERY RELATED DEATHS AND ITS LEGAL IMPLICATION?

These deaths could be categorized as:

Deaths occurring during administration of anesthesia

- These could be related to:
  - The serious disease or injury for which surgery was preferred has caused death and anesthesia could have precipitated death.
  - The patient could have been suffering from undiagnosed disease which could have caused death and anesthesia could have precipitated death.

Deaths directly related to administration of anesthesia:

- These could be due to:
  - Inexperience of the doctor who administer anesthesia like failure to adopt adequate precautions and faulty techniques due to inexperience.
  - Technical mishaps like equipment failure, reduced oxygen supply, acute neurogenic cardiovascular arrest, etc.

Deaths due to hypovolemia:

- This may occur during the surgical procedure which are directly related to failure to recognize or replace blood/fluid volume as necessary by calculating the amount of blood loss.

Deaths and complications related to administration of anesthesia:

- A large number of unexpected complications of anesthesia vary from minor to fatal events.

Malignant hyperthermia:

- Even though fatal complication is rare due to drugs using in general anesthesia like halothane and succinylcholine.

Postmortem examination and investigation of such deaths:

- Chemical analysis to detect the anesthetic drug administered and incidence of over dosage if any.
- Brain should be fixed and sent for histopathological examination.
- All deaths/complications may not be due to errors, most of the time it is the disease process in the patient and/or the response of the individual to the anesthetic drug administered.
- To fix the liability and find out where the sequence went wrong and how death has resulted is a difficult task for the autopsy surgeon. He should consider the following

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aspects when conducting autopsy on such death:

- Complete history of the patient's disease condition before surgery.
- Details of anesthesia administration: The expected adverse effects of the drugs administered.
- Details of surgical procedure and the level of risk involved in that particular surgical procedure should be considered.
- Preanesthetic drugs used.
- Details of blood transfusion before, during and after surgery.
- Details of resuscitation attempted
- Equipments used and whether the correct qualified person handled it.

Medico-legal issues relating to operational deaths:

Whether the surgery is a life saving surgery or an optional surgery:

- If it is a life saving surgery that is, if the patient dies directly due to the effects of the disease problem or condition for which surgery was done, then there lies no liability on the part of the surgical team because even if surgery is not opted then also the patient would have died directly due to disease or the condition, he was suffering from. **Example:** Cardiac surgeries like valvular replacement, coronary artery bypass, severe traumatic injury, etc.
- If it is an optional surgery then there lies more liability on the part of the surgical team because if surgery is not done he could have been very well living as the disease, problem he was suffering from was not dangerous enough to cause death. **Example:** Surgeries done for deviated nasal septum, squint, cosmetic surgeries, etc.
- Even in an important surgery like cardiac or brain surgery, if death is due to any gross negligent act on the part of the anesthetist or surgeon or anyone of the team then they are liable for compensation.

HEALING OF SOFT TISSUE INJURIES (WOUNDS) (FM5.4)

Healing is the body's natural response to restore tissue integrity after a mechanical injury, serving as a "biological clock" to estimate the age of the injury. In forensic medicine, soft tissue healing progresses through inflammation, granulation, and scar formation, while bone healing involves callus production. Under the Bharatiya Nyaya Sanhita (BNS), the healing process has legal implications: bone fracture healing classifies the injury as grievous hurt, and permanent scars can influence charges related to disfigurement.

The body repairs itself through a predictable sequence of stages, which help estimate the Time Since Injury (TSI). In the immediate haemostasis stage, blood clots form to seal broken vessels. During inflammation (1–3 days), the area becomes red, swollen, and painful, while white blood cells clear infection and debris. In the proliferation/granulation phase (3 days—3 weeks), new capillaries and soft, pink granulation tissue form, with fibroblasts producing collagen. Finally, in the remodeling/scarring stage (3 weeks—months), the wound contracts, and the granulation tissue transforms into a firm, white, and relatively bloodless scar.

Healing of bone fractures: The healing of a bone (ossification) is more complex and involves the formation of a "callus" (new bone).

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Stage	*Timeline (Approx.)*	*Description*
Hematoma	0–48 hours	A large blood clot forms around the fracture site
Soft callus	1–2 weeks	Inflammation subsides; fibrous tissue and cartilage bridge the bone ends
Hard callus	3–6 weeks	Cartilage is replaced by woven bone (visible on X-ray). The bone becomes stable
Remodeling	Months–Years	The "bulge" of the callus is shaved down by cells (osteoclasts) to restore the bone's original shape

Estimation of age: The primary goal of a forensic expert in estimating the age of an injury is to determine the exact time of occurrence of injury. For example, if a victim claims to have been hit yesterday but the wound shows thick white scarring, it suggests the claim may be fabricated. Similarly, the presence of a hard callus on an X-ray indicates that a fracture is at least three weeks old, providing crucial evidence for the timing of the injury.

Under the Bharatiya Nyaya Sanhita (BNS), injuries are classified as either Simple Hurt or Grievous Hurt. Simple Hurt applies when the injury heals without permanent disfigurement or long-term disability. **Grievous Hurt (Section 115 BNS)** includes fractures or dislocations of any bone, regardless of its size, and carries much harsher penalties. In terms of cause of death, fat embolism can occur in long bone fractures (like the femur), leading to sudden death. Medical malpractice may be implicated if a fracture heals with significant deformity due to poor treatment, potentially leading to litigation. Old, healed fractures found in skeletal remains can aid in identification, particularly in "cold cases," by comparing them with past medical records. It's important to note that factors such as age, nutrition, diabetes, and infection can delay healing, and a forensic expert must consider these modifiers before providing a final opinion on the age of the wound.

FACTORS INFLUENCING INFLICTION OF INJURIES AND HEALING, EXAMINATION AND CERTIFICATION OF WOUNDS, AND WOUNDS AS A CAUSE OF DEATH: PRIMARY AND SECONDARY (FM5.5)

In forensic medicine, the transition from an injury to a legal "charge" depends on how the wound was inflicted, how it heals, and whether it ultimately leads to death. Under the BNS, these factors determine the severity of the offense.

1. Factors influencing infliction and healing: The "nature" of an injury is determined by the balance between the force applied and the body's response. Several factors influence the infliction of injury, including the characteristics of the weapon (such as weight, sharpness, and velocity), the target area (with soft areas like the abdomen being more susceptible than hard areas like the skull), and the force and velocity of the impact.

Healing is influenced by various factors. Local factors such as infection, lack of blood supply, or foreign bodies (e.g., dirt or glass) in the wound can hinder healing. Systemic factors like old age, malnutrition (especially Vitamin C or protein deficiency), and diseases like diabetes or anemia can significantly delay the process. Medical interventions, including proper suturing and the use of antibiotics, can accelerate healing.

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2. Examination and certification of wounds: A Medico-Legal Certificate (MLC) is a legal document that requires careful examination and documentation. Before starting, always obtain informed consent, unless it's a court-ordered emergency. The examination should be conducted in bright, natural light. Documentation must include the type of injury (e.g., abrasion, laceration), its size (length × breadth × depth in cm), shape (spindle, linear, or irregular), and precise location (measured from fixed anatomical landmarks). The age of the injury is determined by color changes (in bruises) or scab/scar formation. The certification should include an opinion on the nature of the injury (simple vs. grievous under Section 115 BNS), the weapon used (blunt, sharp, or firearm), and the manner of injury (suicidal, homicidal, or accidental).

A. Primary causes (immediate/direct): These occur shortly after the injury and can lead to death or severe complications. Hemorrhage, or excessive blood loss (internal or external), can cause shock. Injury to vital organs such as the brain, heart, or lungs can be fatal. Shock, either neurogenic (due to sudden pain or fright) or hypovolemic (from fluid loss), can also result in death. Asphyxia, caused by obstruction of the air passages (e.g., throat injury), is another immediate threat.

B. Secondary causes (delayed/indirect): These occur days or weeks after the injury and may complicate recovery. Infection or sepsis, originating from the wound, can lead to generalized blood poisoning. Embolism, such as air embolism (air entering cut neck veins) or fat embolism (fat from fractured long bones blocking lung vessels), may cause severe complications. Organ failure, such as acute tubular necrosis in the kidneys, can develop due to prolonged shock. Post-traumatic complications, like pneumonia in bedridden patients with spinal injuries, may also arise.

DIFFERENT TYPES OF WEAPONS (DANGEROUS WEAPONS) AND THEIR EXAMINATION (FM5.6)

A weapon is any instrument used to cause bodily harm. BNS, the classification of a weapon as "dangerous" significantly impacts the legal charges, often elevating an offense from simple hurt to a more severe category.

Classification of weapons: Weapons are classified based on their physical characteristics and the type of injury they cause.

1. **Blunt weapons**, such as lathis, stones, hammers, and baseball bats, cause injuries by crushing or tearing tissues, leading to abrasions, bruises, and lacerations.
2. **Sharp weapons** are designed to cut or pierce the skin, including incised/cutting weapons (e.g., razor, knife).
3. **Piercing/stabbing weapons** (e.g., needle, ice pick), and chapping weapons (e.g., axe, meat cleaver).
4. **Firearm weapons**, like rifles, revolvers, pistols, and shotguns, use explosive charges to propel projectiles.
5. **Miscellaneous weapons** include corrosives (strong acids or alkalis, like vitriolage) and thermal weapons (heated objects or fire).

Dangerous weapons under BNS: A dangerous weapon is specifically defined by its potential to cause death. Under Section 118 of BNS, voluntarily causing hurt by dangerous weapons or means is a non-bailable offense with enhanced punishment. This includes: (i) Any instrument for shooting (firearms), stabbing, or cutting. (ii) Any instrument which, used as a weapon of offense, is likely to cause death. (iii) Fire or any heated substance. (iv) Poison or corrosive substances. (v) Explosives.

Examination of a weapon: During weapon examination, the first step is a physical description, which includes noting the type of weapon, any unique serial numbers or markings,

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and taking measurements of the total length, blade/handle length, width, and thickness. The weight is particularly important for "chop" weapons like axes. The second step involves a surface examination, where the examiner looks for foreign matter such as bloodstains, hair, skin tissue, fibers, or soil, and assesses the condition of the weapon, checking for sharp or blunt edges, rust marks, or "nicks" on the blade.

Trace evidence should be preserved for DNA or serology, and the weapon should not be washed. In the third step, forensic correlation, the examiner must answer three critical questions: 1) Could the injury have been caused by this weapon? 2) What was the degree of force used? 3) Was the weapon "dangerous" in the context of the specific assault? Medico-legal parameters include matching the weapon's dimensions to the injury, determining the direction of force based on the wound and weapon design, and assessing intent, as the choice of weapon helps determine homicidal intent. Additionally, finding the victim's DNA or hair on a weapon in the suspect's possession is crucial evidence for linking the suspect to the crime.

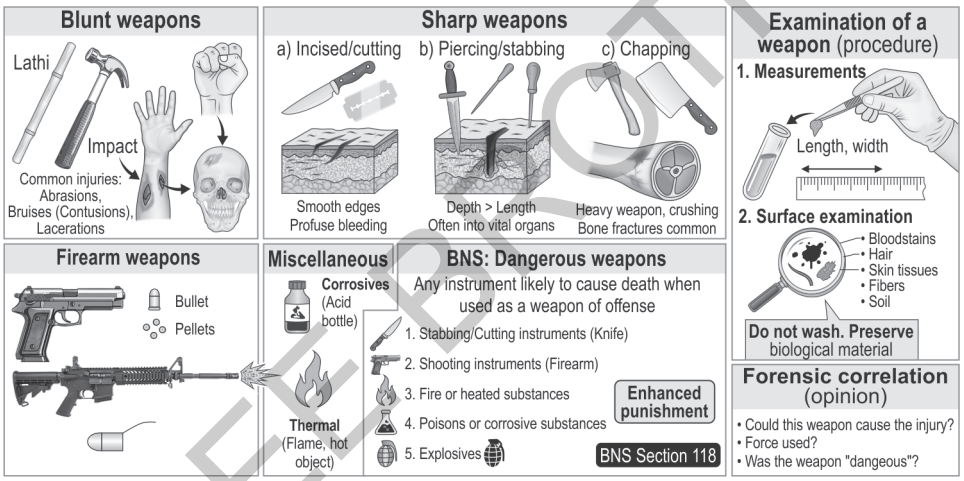


Fig. 14.3: Classification and forensic examination of weapons.

MULTIPLE CHOICE QUESTIONS

1. The similarity between legal and medical definition of injury is:
a. Injury to the body
b. Injury to the mind
c. Damage to property
d. Damage of reputation

2. A 25-year-old person sustained injury in right eye. He developed right corneal opacity following the injury. Left eye was already having poor vision. Corneoplasty of right eye was done and vision was restored medico-legally such injury is labeled as:
a. Grievous
b. Simple
c. Dangerous
d. Serious

3. Killing in self defense comes under:
a. Murder
b. Justifiable homicide
c. Excusable homicide
d. Culpable homicide

4. A person has been brought in casualty with history of road accident. He had lost consciousness transiently and then gained consciousness but again became unconscious. Most likely, he is having brain hemorrhage of:
a. Intracerebral
b. Subarachnoid

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c. Subdural
d. Extradural

5. Self-inflected artificial bruises are characterized by all of the following, *except*:
a. Small in number
b. Not extensive
c. Only on accessible parts
d. Typical color changes

6. Causing death under the following conditions does not amount to murder, *except*:
a. Premedication
b. Provocation
c. Private defense
d. Public justice

7. The following are medico-legal significance of defense wounds, *except*:
a. Sign of instinctive reaction of the victim
b. Mandatory in all homicides
c. Nature of weapon can be identified
d. Relative position of the victim and assailant can be presumed

8. The following grievous wounds can be certified without consultation of an expert, *except:*
a. Simple fracture of tibia
b. Erectile dysfunction
c. Partially broken central incisor
d. Nasal bone fracture

9. Tentative cut is a feature of:
a. Fall from the height
b. Homicidal assault
c. Accidental injury
d. Suicidal attempt

10. Punishment for culpable homicide not amounting to murder is dealt under:
a. BNS Section 100
b. BNS Section 101
c. BNS Section 103
d. BNS Section 105

11. IPC section dealing with dowry death:
a. BNS Section 109
b. BNS Section 105
c. BNS Section 106
d. BNS Section 80

12. As per the Dowry Prohibition Act 1961, penalty awarded in case of death is imprisonment for:
a. More than 5 years
b. Up to 7 years
c. 7 years to life imprisonment
d. Up to 10 years

13. If a woman is assaulted by her husband, then he is charged under:
a. BNS Section 85
b. BNS Section 106
c. BNS Section 80
d. BNS Section 352

14. Which one of the following is not a grievous hurt:
a. Loss of left little finger
b. Loss of hearing in one ear
c. Loss of vision of one eye
d. A large abrasion on the face

15. Neurogenic shock is characterized by:
a. Cool and moist skin
b. Increased cardiac output
c. Decreased peripheral vascular resistance
d. Bradycardia and hypotension

16. Not a manifestation of anaphylactic shock:
a. Hypotension
b. Vasoconstriction
c. Bronchospasm
d. Laryngeal edema

17. Risk of thromboembolism is highest with:
a. Deep femoral vein thrombus
b. Anterior tibial vein thrombus
c. Posterior tibial vein thrombus
d. Popliteal vein thrombus

18. Fat embolism commonly occurs in:
a. Scurvy
b. Fracture of long bones (femur)
c. Paget's disease
d. Psoriasis

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ANSWERS

1. a	2. a	3. b	4. d	5. d	6. a	7. b	8. b	9. d	10. d	11. d
12. c	13. a	14. d	15. c	16. b	17. d	18. b				

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