Respect The Cadaver!

Short Notes on Forensic Medicine

Proactive Students’ Club 2010

Ayurveda Campus,
Institute of Medicine (IOM),
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Short Notes on Forensic Medicine

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Preface:
We have made this small attempt to enable students grab the basic ideas in short before they go through classes/lectures, standard text books and do practical. This can be of use to have a recall during exam and viva.

There may be some shortcomings, let us know, which will be improved in coming days, a benefit to the coming generation. Feel free to share knowledge and ideas; the more you share, the more it is enhanced. For better understanding of forensic medicine students need to understand anatomy, physiology, pathology, toxicology, laws etc. This pocketbook is not to replace standard text books, lectures, demonstration, practical etc.

Thanks to those who helped us directly and indirectly. We would like to mention constant encouragement from Dr. Prakash Limbu. We would like to thank Dr. Vijay Bhurtel for the coordination of this innovative initiation. Further we would like to thank Dr. Pushpa Raj Poudel, Dr. Bidur Shrestha, Dr. Surya Upadhyaya, Dr. Chandra Karki, Dr. Nadan Kadel, Dr. Kenin Rai, Dr. Pravesh Srivastav, and Dr. Deepak Bhusal for their cooperation. Thanks to enthusiastic BAMS 2065 Batch.

Thank you!

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Now this is prepared in PDF format to make you use it in your computer or Smartphone or print it out.

INDEX

<table>
<thead>
<tr>
<th>S.N.</th>
<th>Topic</th>
<th>Pg. No</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Preface</td>
<td>2</td>
</tr>
<tr>
<td>2</td>
<td>Index</td>
<td>2</td>
</tr>
<tr>
<td>3</td>
<td>Introduction to Forensic Medicine</td>
<td>3</td>
</tr>
<tr>
<td>4</td>
<td>Death</td>
<td>3</td>
</tr>
<tr>
<td>5</td>
<td>Cause of Death</td>
<td>3</td>
</tr>
<tr>
<td>6</td>
<td>Diagnosis of Death</td>
<td>4</td>
</tr>
<tr>
<td>7</td>
<td>Autopsy</td>
<td>5</td>
</tr>
<tr>
<td>8</td>
<td>Post-mortem changes (Sign of Death)</td>
<td>6</td>
</tr>
<tr>
<td>9</td>
<td>Hanging and Strangulation</td>
<td>9</td>
</tr>
<tr>
<td>10</td>
<td>Drowning</td>
<td>10</td>
</tr>
<tr>
<td>11</td>
<td>Injury</td>
<td>11</td>
</tr>
<tr>
<td>12</td>
<td>RTA</td>
<td>12</td>
</tr>
<tr>
<td>13</td>
<td>Infanticide</td>
<td>13</td>
</tr>
<tr>
<td>14</td>
<td>Sexual Assault/Offense</td>
<td>13</td>
</tr>
<tr>
<td>15</td>
<td>Age Estimation</td>
<td>16</td>
</tr>
<tr>
<td>16</td>
<td>Burn</td>
<td>20</td>
</tr>
<tr>
<td>17</td>
<td>Toxicology</td>
<td>21</td>
</tr>
<tr>
<td>18</td>
<td>Autopsy Report (a format in Nepal)</td>
<td>23</td>
</tr>
</tbody>
</table>

Note: Suggestions, comments and queries are welcome. If any technical mistake exists please inform us. Email: ayurinfo11@gmail.com If you don't understand anything, ask your teacher.

----------------- ☛ ❈ ☚ -----------------
Why forensic medicine?
- 1. To investigate the crime to prevent the crime.
- 2. To save the life of innocent.
- 3. Preventive public health aspects
- 4. Property inheritance
- 5. Age estimation

Forensic Report:
- 1. Preamble (police request, consent, name, age, etc)
- 2. Examinational findings (clinical, postmortem, lab radiological etc)
- 3. Conclusion

Introduction to Forensic Medicine:
Forensic Medicine- Latin- Forum ➔ Court i.e. legal medicine/ medical aspect of law. It deals with application of medical knowledge to aid in the administration of justice.

In the ancient times, the food to be served to the kings or high officials or guests used to be tested by giving it to eat to someone of low ranking official or clerk or servant. If that person developed no signs or symptoms of poison, the kings or high ranking official or honorary people would be allowed to eat the food. The physicians used to test the food or herbs or anything new by giving it to the animals or birds. If the animal or bird developed no signs or symptoms of poison or disease, further tests of the herb or new substance would be carried out for medicinal or other sorts of uses.

Death
Def: It is the complete irreversible cessation of function of heart, lungs and brain i.e. Bishop's tripod of life.

Types- 2
1. Somatic/Systemic/Clinical:
   - Complete irreversible cessation of the circulation, respiration and brain function.
   - Person who can't survive upon withdrawal of artificial maintenance is dead somatically.
   - Harvesting of organ can be done immediate to death:
     - Cornea- within 6 hrs
     - Skin- within 24 hrs
     - Bone- within 48 hrs
     - Blood vessels- within 72 hrs

2. Molecular/Cellular Death:
   - Death of all cells and tissue individually which takes place usually 1-2 hrs after stoppage the vital functions.

Cause of Death
Def: Any injury, disease or anomalies that initiate the cessation of function of heart, lung and brain.
Type- 3
i Immediate: Directly responsible for the death. E.g. MI
ii Antecedent: indirectly contribute to death but no relation with immediate e.g. HTN
iii Contributory: has contribution to death but no relation with immediate cause E.g. DM
[Cardio-vascular arrest is not cause of Death; Death is process, Bomb blast is event]
**Manner of Death:**
Def: is the way in which the cause of death was produced

**Type – 2**

i Natural – Death occurs exclusively from disease.

ii Unnatural – Death occurs from injury or is hastened due to injury in a person suffering natural disease.

May be:

   a) Homicidal- , b) Suicidal- , c) Accidental

**Mechanism of Death:**
Def - It is the physiological or biochemical disturbance produced by the cause of death which is incompatible with life. e.g. Shock, Sepsis, respiratory paralysis, severe metabolic acidosis and alkalosis

**Mode of Death - 3**

1) **Coma** - is a state of unarousable unconsciousness as a result of illness injury.
   - involves the central portion of brain stem

**Causes:**
Compression of brain: - effusion of blood, infection, Abscess, neoplasm
Drug: - hypnotic, anesthetic etc.
Metabolic diseases: - DM, eclampsia
Other: - Embolism and thrombosis in cerebral vessels

2) **Syncope** - is sudden stoppage of action of heart.
Cause: MI, Vagal inhibition, Anemia due to sudden and excessive hemorrhage

3) **Asphyxia** – is a condition that results in interference with availability uptake and utilization of oxygen causing unconsciousness or death.
   - Cerebral cortex dies in 3 – 7 minutes of complete O₂ deprivation.
   i) Airway obstruction – smothering, shocking, gaging
   ii) Compression of neck – hanging, strangulation
   iii) Compression of chest – traumatic
   iv) Exclusion of O₂ – environmental asphyxia
   v) Drowning

Diagnosis of Death:

a) Heart: pulse absent, BP undetectable, Heart sound absent Pulse absent, ECG- flat
b) Lungs: no chest movement, no air entry from nostril etc.
c) Brain: GCS coma scale (3) , Reflexes (corneal-ve, Pupil- non reactive to light, planter- mute), sensation- absent

**GCS (Glasgow Coma Scale): 15**

4-Eye Opening: Spontaneous-4, To speech- 3, To pain- 2, None -1.
5-Verbal Response: Oriented- 5, Confused- 5, Inappropriate-3, Incomprehensible-2, None-1.
6-Motor Response: Obey command- 6, Localizing pain- 5, Flexion to pain -4, Abnormal flexion to pain -3, Extending to pain - 2, None-1.
Death Declaration: verbal
Death Certificate: written
Death Investigation
Death
↓
Police → Inquest (Prakriti Muchulka)
↓
Doctor → Postmortem examination → Autopsy report
↓
Public Prosecutor and Defense lawyer
↓
Court
↓
Judge → Verdict

<Courts in Nepal: District court, Supreme court, Appeal Court; Special Court>

Autopsy
- is the scientific and systemic examination of dead body
  a) Pathological
  b) Medico-legal

Importance:
- To know the cause of death
- To know time, manner, and mode of death
- To identify person
- To take sample for further investigation, for statistical purpose
- To write report

<Biopsy: examination of living tissue sample>

Mortuary – Temporary place where dead bodies are kept
<Cadaver has no height but length>

Medico-legal Examination
i) Preamble – Authorization
- Identification: Name, Age, Sex, Occupation, Scar mark etc.
- Consent: > 16 yrs – Self
  < 16 yrs- parents, legal guardians
    Female - attendant/ chaperon

ii) Body – Examination (external and internal)
iii) Report – conclusion

Consent: voluntary agreement, compliance or permission
i) Express – stated by patient, may be verbal or written
ii) Implied – understood from behavior
Identification: Establishing of individuality of the person

Importance:
- To know who dead person is
- To inform relatives
- To inherit property
- To claim insurance
- For statistical purpose

How to identify? (try to get whatever possible)
- Personal belonging
- hand writing
- walking
- Blood group
- fingerprints
- Tatoos, scars, moles
- Any deformity
- Dentition

In Decomposed:
- Personal belonging
- Teeth
- Scar, tattoo
- DNA sample
- Male: Prostrate
- Female: non-gravid uterus

Postmortem Changes (Sign of Death): Immediate, Early, Late.

A) Immediate- signify somatic death
- Sensibility and loss of movement
- Cessation of respiration – must be complete and continuous
  - Stoppage for > 4/5 minutes cause death
- Cessation of circulation – Stoppage for 3/5 min cause death

B) Early- signify cellular death
- Changes in skin- pallor, loses elasticity, lips becomes brownish, dry and hard
- Change in eye – loss of corneal reflex, -Tachenoir: brownish patches seen in sclera, - Truking/Shunting/Kevorkian sign – fragmentation of blood column in retinal vessels, - Pupil slightly dilates immediate to death but later constricts with onset of rigor mortis.
Algor Mortis:
- is cooling of body after death
- after 2-3 hrs of death, body temp gradually falls
- Heat is lost by conduction, convection and radiation
- cooling is affected by difference in temperature between body and medium, body built of cadaver, environment, covering on or around the body etc.

Livor Mortis / PM Staining or PM Hypostasis:
- is the purplish-bluish discoloration of dependent part of body after death due to postmortem settling of blood secondary to gravity
- **Mechanism:** Death → Cessation of circulation → Stagnation of blood with reduced Hb in toneless capillaries and venule of dependent part → stains adjacent tissue
- Appear after 3-6 hrs of death as blanched patches of 1-2 cm diameter which then unite gradually and become fixed after 8-10 hrs of death
- Clearly seen in occipital scalp, shoulder blade, buttock, posterior aspect of thigh in supine position

- Bright cherry red lividity → CO asphyxia
- Pink red lividity → cyanide poisoning

- **If suspect:** give incision → flush with water, if washable – it is PM staining, if not – it is contusion (*nil dam*)

Rigor mortis: is the stiffness of body after death and becomes complete in 6 – 12 hrs.
Order: - begins in the eyelids, neck and lower jaw → muscles of face → muscle of chest, upper limb → Abdomen → lower limb
Test: Trying to lift eye lid, depressing jaw, bending joints etc.

Condition altering onset and duration of Rigor mortis:
1- Age:
- foetus < 7 month: RM does not set
- Healthy adult: develops slowly and is well marked and lasts longer
- Child and old: feeble and rapid
2- Nature of diseases:
- Cholera, Typhoid, TB, cancer → early onset and short duration
- Strychnine poisoning → appears rapidly and persists longer
- OP poisoning → appears early
3- Muscular state:
- Healthy and rest muscle before death → slow and longer
- Fatigue before death → rapid and short
4- Atmospheric condition:
- Cold weather → slow and longer
- Hot → rapid and shorter
Condition simulating Rigor Mortis:

1- Cadaveric spasm:

<table>
<thead>
<tr>
<th>Rigor mortis</th>
<th>Cadaveric spasm</th>
</tr>
</thead>
<tbody>
<tr>
<td>- occurs in all muscles</td>
<td>- in a group of muscle</td>
</tr>
<tr>
<td>- seen after few hr</td>
<td>- seen instantaneous after death</td>
</tr>
<tr>
<td>- mechanism: ↓ ATP</td>
<td>- not known</td>
</tr>
<tr>
<td>- occurs in all dead bodies</td>
<td>- seen in only certain cases of death where death is unexpected and sudden</td>
</tr>
<tr>
<td>- 2° flaccidity present</td>
<td>- No 1° and 2° flaccidity</td>
</tr>
</tbody>
</table>

2- Heat stiffness:
- Heat injury (> 65° C) → coagulation of muscle protein → rigidity
- no 1° and 2° flaccidity
- sign of burn seen
- immediately seen
- knee and elbow flexed- seen like boxer (pugilistic attitude)

3- Cold stiffness:
- Temperature ≤ 0° → freezing of body fluid → stiffness
- no decomposition
- if brought to normal temperature: fluid melts → flaccidity → rigor mortis

4- Gas Stiffness:
- During body decomposition → Increased gaseous distension → stiffness

C) Late Changes:
a) Decomposition – involves two processes.
-1- Autolysis: - is a chemical process brought about by intracellular enzymes.
- proteolytic, glycolytic and lipolytic action of ferments cause autodigestion and disintegration of organs.
- is increased by heat and is stopped by freezing
-2- Putrefaction – occurs due to bacterial fermentation of the tissue
- due to intestinal bacteria: Clostridium welchii, Streptococci, Proteus, E. coli, etc.
- Cause hemolysis, liquefaction of PM clots, disintegration of tissue and gas formation

Character:
- Change in color of tissues – greenish:
  - H₂S (formed in large intestine) + Hb → Sulphamethoglobin → escape into surrounding tissue → gives greenish color
  - Network of blood vessels appears purplish red → marbling
- Evolution of gas in the tissues:
  - Proteins and carbohydrates → (splits) → amino acids, ammonia, CO, CO₂, H₂S, Methane, Mercaptans formations → distension of abdomen, eyeball, scrotum etc.
  - Increased abdominothoracic pressure → Blood stained froth exudes from mouth and nostrils called purging
    - Tongue protrudes out, eye bulge, organ soften and liquefy
    - Takes about 3 months to decompose soft tissue and ligament up to 1 year.

b) Adipocere – is modification of putrefaction in which fatty tissues of body undergo saponification and waxy coating occurs over the skin which prevent decomposition in moist and cold environment
  - Hydrolysis and Hydrogenation of fat → + Ca²⁺, NH₄⁺ → Insoluble soaps → Inhibition of putrefactive bacteria
    - Produce sweetish smell
    - Noticed max⁷ in fatty area – face, buttock, breast etc.
    - preserves face and injuries

c) Mummification – is modification of putrefaction in which body dries in hot environment
  - Fluid evaporates, muscles shrinks, and body remains preserved
  - Begins from exposed part of body then involves internal organs
  - Tissues become dry, brownish and odorless
  - They gradually break, become powdery and disintegrate

Conditions needed:
  a) Absence of moisture in air
  b) Continuous action of dry warm air

**Hanging and Strangulation**
- Hanging – is a form of asphyxia caused by suspension of the body by a ligature which encircles the neck, the constricting force being the weight of the body.
  - Type-
    A- (1) Judicial (Spinal fracture C₂-₃), (2) Non-judicial
    B- (1) Partial – body partially suspended, toe/feet touch ground, weight of head acts as constricting force
      (2) Complete – body is completely suspended without touching ground, body weight acts as constricting force
      <During Post-mortem study I shaped midline incision is given from submentum to symphysis pubis. In case of hanging Y shaped incision is made. >

Causes of Death:
  i) Asphyxia, ii) Venous congestion, iii) Cerebral anoxia, iv) Reflex vagal irritation, v) Fracture or dislocation of cervical vertebrae
  - may die within 3-5 minutes
  -ii) Strangulation- is a form of asphyxia which is caused from constriction of neck by a ligature or any other means without suspending the body.
Types:
a) Strangulation → by ligature
b) Throttling → manual strangulation
c) Bansdola → pressing neck by lathi, bamboo, iron rods etc.
d) Garroting → victim is attacked from behind and neck is grasped or tightened with ligature
e) Mugging → Strangulation is caused by holding the neck of victim in the bend of the elbow

Differences between Hanging and Strangulation:

<table>
<thead>
<tr>
<th>S.N.</th>
<th>Traits</th>
<th>Hanging</th>
<th>Strangulation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>ligature mark</td>
<td>- oblique, high up around neck, - base is pale, hard and parchment like</td>
<td>Transverse, circular and low down around neck</td>
</tr>
<tr>
<td>2</td>
<td>Abrasion and ecchymoses</td>
<td>not common</td>
<td>common</td>
</tr>
<tr>
<td>3</td>
<td>Subcutaneous tissue</td>
<td>white, hard, glistening under</td>
<td>ecchymosed under mark</td>
</tr>
<tr>
<td>4</td>
<td>Face</td>
<td>usually pale and patechial hemorrhage are not common</td>
<td>congested marked patechiae</td>
</tr>
<tr>
<td>5</td>
<td>Eye</td>
<td>usually closed</td>
<td>open and staring</td>
</tr>
<tr>
<td>6</td>
<td>Tongue</td>
<td>swelling and protrusion less marked</td>
<td>swelling and protrusion more marked</td>
</tr>
<tr>
<td>7</td>
<td>saliva</td>
<td>runs out of mouth</td>
<td>absent</td>
</tr>
<tr>
<td>8</td>
<td>signs of struggle and resistance</td>
<td>absent</td>
<td>present except in children and old</td>
</tr>
<tr>
<td>9</td>
<td>Fracture of hyoid bone and thyroid cartilage</td>
<td>not common</td>
<td>may occur</td>
</tr>
<tr>
<td>10</td>
<td>muscle of neck</td>
<td>bruising or tear not common</td>
<td>bruise with rupture of muscle are common</td>
</tr>
</tbody>
</table>

Drowning – is a form of asphyxia due to aspiration of fluid into air passage by submersion in water or other fluid.

Types – 4
1) Wet drowning/Primary drowning- water is inhaled into lungs
   - dies from cardiac arrest or ventricular fibrillation
2) Dry Drowning – Water does not enter into lungs
   - dies from laryngeal spasm due to in rush of water into nasopharynx or larynx
   - thick mucus foam and froath may develop producing a plug
3) Secondary drowning (Post-immersion syndrome)- victims resuscitated and dies from complication of drowning e.g. pulmonary oedema, pulmonary infection, electrolyte imbalance
4) **Immersion syndrome** - death results from cardiac arrest due to vagal inhibition as a result of contact with cold or fright of fall in water

**Cause of Death:**
a) Asphyxia, b) Ventricular fibrillation, c) Laryngeal spasms, d) Vagal inhibition, e) Injuries
- May die within 4-8 mins of complete submersion

**Signs and Symptoms:**

1) **External features:**
   a) Body wearing clothes → wet, stained with mud, sand, and dirt
   b) Face → pale, cyanosed
   c) Eye → Closed or partly opened, pupil dilated
   d) Tongue → swollen and protruded
   e) Shaving lather froath over mouth and nostrils
   f) Presence of goose skin or cutis anserine on the skin of extremities
   g) Cadaveric spasm with mud, plants e.g. in hands
   h) Washes man's hands and feet
   i) Injuries during falling

2) **Internal features:**
   a) Changes in lungs- voluminous, oedematous and distended and completely fill up the thoracic cavity
      - Surface show marks of indentation of ribs
      - cut section excludes copious blood stained frothy fluids
   b) Larynx and Trachea – reddish, congested
      - mud, stone, air, algae commonly found (shows ante-mortem drowning)
   c) Stomach and intestine- Presence of water containing mud, sand, algae

---

**Injury**

Injury is defined as a break of the natural continuity of any tissues of the living body. In forensic medicine, it is broadly defined as any harm illegally caused to any person in body, mind, reputation or property.

**Classification of Injury** -

a) **Mechanical:**
   -1- Due to **blunt Force** - Abrasion, Contusion, Laceration, Fracture and Dislocation
   -2-Due to **sharp force** - Incised wound, Chop wound, Stab wound, Fire arm wound

b) **Thermal injuries:**
   -1- Due to cold: Frost bite, Trench foot, Immersion foot
   -2- Due to heat: Burns, Scalds
c) **Chemical Injuries**: corrosive acids, corrosive alkalies

d) **Physical**: electricity, lightening, x-ray, radioactive substance, etc. *<Electricity: entry wound and exit wound>*

e) **Explosives**

**Abrasion** (*chithoriye ko ghau*): is a destruction of the skin which usually involves superficial layer of epidermis only.
- are simple injuries, bleed slightly, heal rapidly, and scar is not formed.
*<Abrasion: 2 dimension; Laceration: 3 dimension>*

**Contusion** (*bruis* -*Neeldam)*:
- is an effusion of blood in the tissues due to rupture of blood vessel caused by blunt trauma.
- occurs in skin as well as internal organs
- caused by blunt force like fist, stick, stone, boot etc.
- Painful swelling occur with crushing or tearing of subcutaneous tissues without destruction of skin

**Laceration** (*chyatiye ko ghau*):
- are tears or splits of skin, mucus membrane or muscle of internal organ produced by application of blunt force to the broad body are of body.

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**RTA** - road traffic accident
**Accident**- events which are unpredictable.
*<Hematoma: swelling or mass of blood or blood clot confined to tissue/s due to seeping away of blood from ruptured vessels>*

**Causes:**
1) Man- Pedestrian, passenger, driver (unskilled, drunken), motorcyclist, pillion rider, pedal cyclists etc.
2) Machine- poor engine condition
3) Environment- difficult road, attention to opposite sex

**Pedestrians:**
- a) 1° Impact injury:- hit directly by a vehicle, if speed > 30 km/hr may fly to roof.
- b) 2° Impact injury:- injury by the same vehicle second time
- c) 2° injury:- injury due to falling on road
- d) 3° Run over injury:- injury from next vehicle?

**Driver:**
1) **Unrestrained**- driver without seatbelt
   a) sparrow feet laceration on face, head, - whiplash injury (due to hyperextension of neck)
   b) chest and abdominal injury
   c) rib fracture
2) **Restrained** - driver wearing seat belt  
   a) not ejected from bus  
   b) rib fracture  
   c) internal organ injury

**Passengers:** -  
- Front seat ➔ seat of death  
- Summering ➔ goes underneath of front seat

**Motorcyclist:** (helmet of strong type is essential)  
- most unstable vehicle  
- die due to head injury  
- Pillion rider gets more injuries

- **Tailgating** - motorcyclist collide with tail edge of heavy vehicle and gets injury in head and chest

*Elaborate the causes of RTA*

**Head Injury / Cerebral Injuries** - Coup, Contra coup

Infanticide:  
- is the deliberate killing of a child under the age of 1 year by his / her mother or caretaker.  
  a) Live birth- child shows the sign of life after birth i.e. full term baby  
  b) Still birth- who is born after 28 wks of pregnancy and is living in uterus and dies in passage during the delivery.  
  c) Dead birth- who died in uterus. It shows rigor mortis at delivery, maceration (aseptic autolysis) and mummification.

**Hydrostatic Test**  
   a) Prior to respiration ➔ whole of lung sink in water  
   b) After respiration ➔ float in water

*SIDS: Sudden Infant death Syndrome.*

**Sexual Assault/Offense:**  
Type: 2:  
- Natural – rape, incest  
- Unnatural – anal intercourse, oral intercourse, Lesbianism, Beastliest,

**Inactive partner**-  
**Un-habituated partner:** Anal sphincter is swollen, tender, lacerated, some lubricant can be found, fecal matter resent.  
**Habituated partner:** Anal sphincter looks open, healed scar, fecal matter, lubricants may be present,
Active Partner: lacerated frenulum of penis may be present
Oral Intercourse: Sudden death may occur due to sudden ejaculation of semen causing laryngeal spasm.
Oral Swab- spermatozoa in passive partner.
Penis- epithelial cells of oral mucosa

Lesbianism- sexual gratification between two females
Beastialism- sexual act with beast or animals

Natural Rape: (judge- rape; medical person- sexual assault)
Rape is illegal sexual intercourse by a man on a woman without her consent, against her will, with or without her consent if she is less than 16 years old, with putting her on threat or by impersonation.

Consent: implied, expressed- Verbal or written
Injuries can be produced by – restrain or resistance.
-1- Contusion on the arm of male.
-2- Nail marks scratches around the mouth
-3- Laceration on mouth
-4- Male may have bite marks on chest.. etc.
-5- Contusion on the body
-6- Female- defense injuries: - injuries on the vulva/genetalia, small inner circular contusion in the thigh region,

Note: in more than 70 % of the cases the females are sexually assaulted by her known friends or relatives.

Procedure of examination of victim and collection of evidences:

Preamble: These four constitute Preamble.
a) Authorization letter- must
b) Identity- Name, Age, Sex, Address, Occupation etc.
c) Consent- From victim if more than 16 years, from parents if less than 16 years, if no parents from legal guardian.
d) One female attendant

Clinical Examination
-1- History-
1) When did the incident take place? (Why she did any late if any late)
2) Where the incidents take place?

Locquard’s Principle: Every contact traces the evidences.
15

3) Who was accused? Single or multiple?
4) What really happened? Ejaculation – inside or outside vagina? Bleeding- ? Bath taken or not?
5) If she was habituated for sexual act?
6) Menstruation history? LMP
7) Married or unmarried?
8) Whether she is on any medication?
9) Assess mental status
10) Physical- walking – any pain?

<DNA, and Finger prints are useful to identify the alleged >

**Physical Examination:**
-1- Vital examination: Temperature, BP, Pulse, Respiratory Rate.
-2- Start removing the clothes one by one by herself. If there are any stain? If yes, dry them in room temperature, and store properly.

**Head to Toe Examination:**
-1- Scalp
-2- Body injury: a) Type of injury, b) Site of injury, c) size of injury, d) Exact location, e) Age of injury (fresh or old), [Injuries usually are bite marks etc, take Photograph if possible]
Bite- 1. Suck bite / hostile bite  2. Love bite

**Genitalia Examination:**
-1- Secondary sex character
-2- Comb the genitalia, suprapubic area (new comb)
   - Lithotomy position: Vulva, Hymen,
   - look for any abrasion, swelling, laceration, rupture, marks of any foreign body insertion etc.
   - Hymen: in penile insertion – rupture at 7 or 5 o’clock position.
- Take perineal swab
- Take low, high, mid vaginal swab by the help of vaginal speculum
- Take oral as well as anal swab
- Pluck pubic hair and scalp hair
   # Don’t keep the victim completely naked, give some sterile towels to cover the examined parts of the body.
   # First treat if any medical problem exists- reassure/counsel -what the patient expect and for what the doctors are meant.
- Spermatozoa may be found up to 72 hours

-No spermatozoa may be in the lab report if:
   - Vasectomy, - no ejaculation, - ejaculation outside the vagina, use of barrier method e.g. condom

**Preparation of Report:**
- Recent forceful sexual act – if there are spermatozoa present along with injuries/wounds.
- Recent Sex intercourse – if there is sperm in the lab examination but no wounds.
- No sexual intercourse – if no sperm in lab report and no injuries on the body.
Complication of Rape:
1) Unwanted pregnancy
2) STI transmission
3) Depression
4) Suicidal tendency
5) Hatred towards opposite sex
6) post traumatic distress syndrome

---

Age Estimation:
Age can only be estimated (in range) and can't be determined.

Why is it necessary?
-1- for identification
-2- for punishment purpose:

Children Related Act 2048 says:
<10 years: no any criminal responsibilities
10 – 14 years: no fine is charged, if criminal act if punishment is impressionable
14 – 16 years: ⅓ of the punishment given to that of adult, fine also ⅓
> 16 years: full responsibility

International law: < 18 years old employee can't be in work

For Marriage:
- For Girl: -with her consent at 21 years
  -with the consent of parents at age 18 years
-For voting right: 18 years must be crossed in Nepal.

<Citizenship is given at the age of 16 years.>

Abortion law of Nepal:
1) < 12 wks: if the pregnant mother can't maintain the pregnancy→ can abort. Nothing is necessary
to be done except quality services of abortion and mother’s consent.
2) Up to 18 wks: if the pregnancy is due to rape or incest.
3) In any age of fetus – if the pregnancy endangers the life of mother or if the fetus is abnormal
   genetically.

# Besides these cases – any abortion is illegal.

Punishment in Criminal Abortion:
1) < 12 wks- 1 years imprisonment of mother and assistant
2) 12- 25 wks- 3 years " " "
3) > 25 wks- 5 yrs " " "

{16}
Questions:
**Foetal development**: when does cranium develop?

# Which age group usually come for Age Estimation?
1) 10 – 12 to 18 – 20 yrs → generally street child
(12 – 18 yrs) (Juvenile Delinquency)

(To begin Age Estimation letter from Women Cell is also required, in case of female.)

Report:
I. **Preamble** (passport part):
- Name, Age, Sex, Date, Time, Occupation, Place of examination etc.
- Brought by
- Exam requested by
- Identification marks: birth marks, traumatic marks, operational scars

II. **Examination/findings**:
(must be in descriptive form)

a) **Consent** – should be taken
- should be written expressed (< 16 yrs – from guardian)

b) 4 groups of developmental features should be looked:
-1- General physique- Wt., Ht.
- Features of general development- mostly muscular development
-2- Development of secondary sex character:
- Voice- hoarseness of voice in male from > 13 years
- Adam's apple- prominent and triangular in male
- Hair- must, beard in male
- Axillary/pubic hairs in both sexes
- Development of genital organs – Male- scrotum pendular in puberty
- Female- (during/after puberty) breast development, nipple dark and prominent

**Dental development:**
- 6 month- lower central incisor erupts
- up to 6 years – only temporary dentition
- 6 – 11 years – mixed dentition
- only II and III molar are helpful
- II molar – 12- 14 years – erupts
- if just erupting → at least crossed 12 years
- if both II molar → crossed 14 years
- III molar – 17-25 years
  - if 3rd molar erupted > 14 years
  - if all four 3rd molar erupted > 20 years

**Gustauson’s method of estimating age by Dental examination – 6 features related**
Radiological evidences
Most of the bone start ossifying (ossification centre) in intrauterine life and complete in early childhood (up to 2 years)

# How bone develops?
- Epiphyseal union
- epiphysis, diaphysis, metaphysic, development centre,
- (development centre may be one or more)
# variation of 1-2 years in radiological findings,
# variation of 6 months in dental finding
- if 12-14 years, elbow joint is examined, x-rayed
- if > 14-15 years to 18 years wrist joint x-rayed
- if > 18 years pelvis (AP view), iliac crest is completed at 20-21 years
- bone which fuses last is the lateral end of clavicle ≥ 25 years
- Females are 16 months to 1 year earlier in development (dental, osteological)

III- Conclusion
(simple and clear language should be used)
- The age of the XYZ is > 14 years / 14-15 years at the time of examination.

# pessiform starts to ossify in 11 years and completely ossifies in 18 years.
# Useful:
- 16-18 years: elbow joint
- 14, 15, 16, 17 years: wrist joint and phalanges
- > 18-21 years: pelvic bone x-ray

Dentition:
A. Deciduous Teeth
1. Central Incisor
   lower 6-8 months
   upper 7-9 month
2. Lateral incisor
   upper 7-9 month
   lower 10-12 month
3. First molar 12-14 month
4. Canine 17-18 month
5. Second molar 20-30 month

B. Permanent Teeth
1. First molar 6-7 years
2. Central incisor 6-8 years
3. Lateral incisor 7-9 years
4. First premolar 9-11 years
5. Second premolar 10-12 years
6. Canine 11-12 years
7. Second molar 12-14 years
8. Third molar 17-25 years
Temporary teeth - 20 in no. 2102 | 2102 X 4
Permanent teeth - 32 in no. 2123 | 2123 X 4

Mixed dentition seen upto 12 years.
Mixed age of dentition 6-12 years.

**Gustauson's method**

**A Short Sample of Age Estimation:**

Name: XYZ     Sex: Male
Stated Allied age – 13 years
Address- ABC
Identification mark – small mole of 5 mm diameter in lateral end of left eye brow
Consent- taken from his brother.
Examination:
Average development (related to the normal)
  - Height: 55 inches
  - Weight: 32 kg
  - secondary sex characters:
    - voice: subjective, childish
    - Adam's apple- not very much prominent
    - mustache: fine row, not long
    - beard: - no
    - axillary hair: no
    - pubic hair: brownish, not thick, scanty, < 1 cm long

**Dentition:**
- 28 (p)

\[
\begin{array}{c|c}
  s{+}7 & s{+} 7 \\
  s+7 & s{+} 7
\end{array}
\]

Radiological examination:
- x-ray right elbow- AP, Lateral view
- right wrist – AP view

(s+: space present; P: permanent)

[Blackish bone – still there is cartilage; Whitish bone – bone formed (calcium)]

# Reference for Elbow joint: Epiphysis fusion starts – 12 years and completes at 14 years.
For wrist with hand: last carpel is distinct (i.e. pissiform) $\rightarrow$ 12 years is earlier achieved.
# Lower border of radius fusion starts – 16 years, completes at 18 years

**Conclusion:**
On the basis of General developmental, radiological findings the age of XYZ is 12-14 years esp. he is running in 13 years.
BURN

Burn is injury caused by application of heat or chemical substance to the external or internal surface of the body which causes destruction of tissues.

Types:
A. Based on type of object producing heat: flame, radiant, chemical, electric, scald with boiling fluid

B. Based on thickness of burn - shows severity
a) I° /superficial burn: Due to prolong exposure to heat, - erythamatous, no blister, heals 2-5 days
b) II° /Partial thickness burn:

1. Superficial II°: epidermis may be destroyed up to stratum granulosum, red in color, red in color and painful; blister or bulla formation; heals without scar.

2. Deep II° Burn: Epidermis is destroyed up to stratum basale; erythomatous ring seen in periphery; heals in > 21 days

c) III° /Full thickness burn: whole of dermis is destroyed; hard and lethary; heals from margin; no pain (due to nerve ending destruction); skin grafting needed.
d) IV° Burn: involves muscle; bone and deep tissues.

Area of Burn: Wallace's Rule of Nine:
(in an adult body): Whole body: 100%
  1) Front and back aspects of head - 9%
  2) Front aspect of trunk - 18%
  3) Back aspect of trunk - 18%
  4) Front and back aspect of right upper limb -9%
  5) Front and back aspect of left upper limb - 9%
  6) Front and back aspect of right lower limb - 18%
  7) Front and back aspect of left lower limb - 18%
  8) Perineum - 1%
Fluid Resuscitation:
IV fluid needed if burn > 10% TBSA in children and >15% TBSA in adult.

Parkinson's Formula: Volume of IV fluid required (ml): % TBSA burnt x weight (kg) x 4. (Half of the fluid is given in the first 8 hrs and remaining half is given over next 16 hr)

<table>
<thead>
<tr>
<th></th>
<th>Ante-mortem Burn</th>
<th>Post-mortem Burn</th>
</tr>
</thead>
<tbody>
<tr>
<td>Line of redness</td>
<td>+nt [Present]</td>
<td>-nt [Absent]</td>
</tr>
<tr>
<td>Blister</td>
<td>contains inflammatory cells</td>
<td>No</td>
</tr>
<tr>
<td>Trachea</td>
<td>contains shoot particles</td>
<td>No</td>
</tr>
</tbody>
</table>

Accelerated Burn: - with kerosene, petrol etc; - usually patches of burn seen; blackens body; eschar seen.

[Burn Management in Short- Fluid (RL, NS), Topical Hygiene (Soframycin, Silver Sulfadiazine), Systemic Antibiotics (Ceftriaxone, Metronidazole, Ampicillin, Cloxacillin), Analgesic (NSAID or Opioid ), PPI(Pantoprazole), Physiotherapy, Nursing Care etc. ]

TOXICOLOGY
General principle of Treatment of poisoning:
1. Prevention of further exposure to the poison.
2. Removal of unabsorbed poison - emesis, gastric lavage etc.
3. Use of an antidote:
4. Removal of absorbed poison- purgation, Dialysis
5. Symptomatic treatment

Principle of Management
ABCDEA-
   Airway
   Breathing
   Circulation
   Decontamination
   Elimination
   Antidote

MAJOR TOXIDROMES (next page)
ANTIDOTES (next page)

Sample of following is sent to laboratory for poisoning investigation: a)Lung -1, b) Liver- 500 gm, c) 1/2 of each kidney, d) 5-10 ml blood, e) 200 ml urine, f) 1/2 cerebral hemisphere, g) femur 10 cm in case of heavy metal poisoning, h) whole stomach with full content.

Preservatives: Saturated NaCl soln for specimens; For blood Pot. Oxalate, and Na fluoride.
### Major Toxidromes

<table>
<thead>
<tr>
<th>Toxidrome</th>
<th>Toxin</th>
<th>Symptoms</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Opioid/Sedative</strong></td>
<td>Opioids (heroin, morphine, codeine) Barbiturates, Benzodiazeines, ethanol</td>
<td>CNS/respiratory depression, miosis (opioids), Hypotension, Bradycardia, Hypothermia, Decreased GI motility</td>
</tr>
<tr>
<td><strong>Sympathomimetics</strong></td>
<td>Cocaine, Amphetamines, Decongestants (Phenylpropanolamine, ephedrine, pseudoephedrine), theophylline</td>
<td>Tachycardia, Hypertension, hyperpyrexia, diaphoresis, mydriasis, Delirium, seizures, tachyarrhythmia</td>
</tr>
<tr>
<td><strong>Cholinergic</strong></td>
<td>Insecticides, Sain nerve gas, physostigmine, endophonium, acetylcholine</td>
<td>&quot;SLUDGE&quot; (salivation, lacrimation, urination, diarrhea, GI cramping, emesis); also diaphoresis, miosis, bradycardia, seizure</td>
</tr>
<tr>
<td><strong>Anticholinergic</strong></td>
<td>Antihistamines, Tricyclic antidepressants, phenothiazines, belladonna alkaloids (atropine, scopolamine), anti parkinsonian agents</td>
<td>Delirium, tachycardia, dry flushed skin, mydriasis, hyperpyrexia, decreased GI motility, urinary retention, seizure, dysrhythmias</td>
</tr>
</tbody>
</table>

### Antidotes

<table>
<thead>
<tr>
<th>S.N.</th>
<th>Poisoning</th>
<th>Antidote</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Atropine</td>
<td>Neostigmine/Physostigmine</td>
</tr>
<tr>
<td>2</td>
<td>Benzodiazeines</td>
<td>Flumazenil</td>
</tr>
<tr>
<td>3</td>
<td>Carbon monoxide</td>
<td>100% O₂</td>
</tr>
<tr>
<td>4</td>
<td>Copper</td>
<td>Penicillamine</td>
</tr>
<tr>
<td>5</td>
<td>Cyanide</td>
<td>Sodium thiosulphate, Sodium nitrite</td>
</tr>
<tr>
<td>6</td>
<td>Heparin</td>
<td>Protamine sulphate</td>
</tr>
<tr>
<td>7</td>
<td>Iron</td>
<td>Desferroxamine</td>
</tr>
<tr>
<td>8</td>
<td>Isoniazid</td>
<td>Pyridoxine</td>
</tr>
<tr>
<td>9</td>
<td>Lead</td>
<td>CaNa₂ EDTA, Dimercaprol (BAL), D-penicillamine</td>
</tr>
<tr>
<td>10</td>
<td>Mercury/Arsenic</td>
<td>Dimercaprol</td>
</tr>
<tr>
<td>11</td>
<td>Methanol, Ethylene glycol</td>
<td>Ethanol, Fomepizole, Dialysis</td>
</tr>
<tr>
<td>12</td>
<td>Mushroom</td>
<td>Atropine</td>
</tr>
<tr>
<td>13</td>
<td>Opioid analgesics</td>
<td>Naloxone</td>
</tr>
<tr>
<td>14</td>
<td>Oral anticoagulant</td>
<td>Vitamin K</td>
</tr>
<tr>
<td>15</td>
<td>Insecticides (Organophosphate)</td>
<td>Atropine/Pralidoxime</td>
</tr>
<tr>
<td>16</td>
<td>Paracetamol (acetaminophen)</td>
<td>N-acetylcystine</td>
</tr>
<tr>
<td>17</td>
<td>Salicylate</td>
<td>Bicarbonate, Dialysis</td>
</tr>
<tr>
<td>18</td>
<td>Anticholinergics</td>
<td>Physostigmine</td>
</tr>
<tr>
<td>19</td>
<td>Tricyclic antidepressants</td>
<td>Bicarbonate</td>
</tr>
<tr>
<td>20</td>
<td>B-blocker</td>
<td>Glucagon</td>
</tr>
<tr>
<td>21</td>
<td>Ca²⁺ Channel blocker</td>
<td>CaCl₂, Glucagon</td>
</tr>
<tr>
<td>22</td>
<td>Digoxin</td>
<td>Digoxin-specific fab fragments (Digibind)</td>
</tr>
<tr>
<td>23</td>
<td>Universal antidote</td>
<td>Activated charcoal [N.B.- In fact, there is no such universal antidote.]</td>
</tr>
</tbody>
</table>

---

[N.B.- In fact, there is no such universal antidote.]
(AUTOPSY REPORT)

RELEVANT DETAILS:

EXTERNAL EXAMINATION:

FULL BODY - ANTERIOR AND POSTERIOR VIEWS (VENTRAL AND DORSAL)
(figures of body: anterior, posterior, left lateral, right lateral)

GUIDELINES:
RELEVANT DETAILS:
Mention short history of circumstances of death.
EXTERNAL EXAMINATION:

WITH CLOTHES ON: -
List & describe clothing and ornaments etc. (Note if mud, grass present)

AFTER CLOTHES ARE REMOVED: Take height, estimate weight, describe stature, hair, and estimate age. See the body from all sides.
- Appearance of cornea, rigor mortis, PM staining, if anything found on natural orifices, findings related to decomposition.
  Record old scars, tattoo, deformity in unidentified body.
  Record details of injury type, size, site.
  Record blessing, semen, faces, urine if present.

INTERNAL EXAMINATION: -
LARYNX, TRACHEA, PHARYNX, LUNGS: -
Note any injury abnormality or change in physical character

STOMACH:-
See what is inside, describe smell if present.
OTHER ORGANS:
Describe injuries, if present.
Note abnormality or change in physical character.

SKETCHES:
Fill in appropriate in the blanks provided in cases of injury/wounds

INTERNAL EXAMINATION:

SPECIAL EXAMINATION:

CAUSE OF DEATH:

(SEAL OF HOSPITAL)

Full Name of M.O.:
Signature of M.O.:
Date:
Hospital:

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{25}