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Ophthalmology
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Obstetrics
Gynecology
Pediatrics
Anesthesia
Dermatology
Radiology
Orthopedics
Psychiatry



JIPMER 20 Authors

Last 10 Years' JIPMER Questions with Answers and Explanations (2006–May 2015)

Abirami
J Magendran
Rajamahendran R
Antan Uresh Kumar T

JAYPEE

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Chapter

4 Forensic Medicine

J Magendran

HISTORY, MEDICAL JURISPRUDENCE AND IDENTIFICATION

History of Forensic Medicine

Forensic or legal medicine	Application of medical knowledge to aid in the administration of justice
Medical jurisprudence	Legal responsibilities of the physician with particular reference to those arising from physician-patient relationship
Medical ethics	The moral principles which should guide members of the medical profession in their dealings with each other, their patients and the State
Medical etiquette	Conventional laws of courtesy observed between members of the medical profession
Code of Hammurabi	King of Babylon (about 2200 B.C.), is the oldest known medicolegal code
The first medicolegal autopsy done in	Bologna (Italy) in 1302
The founder of modern toxicology	Orifila

Legal Procedure

- Indian penal code (IPC) 1860: Defines offences and prescribe punishments
- Criminal procedure code (CrPC) 1973: Provides mechanism for punishment of offences, deals with police duties in arresting offenders, in production of documents, actual procedure in trials of criminal cases
- Indian Evidence Act (IEA) 1872.

Courts	Imprisonment	Fine	Location
Supreme Court	Any sentence	Any fine	National capital
High Court	Any sentence	Any fine	Capital of the state
Sessions Court	Any sentence Death sentence to be confirmed by High Court	Any fine	District
Assistant sessions	Up to ten years	Unlimited	
Chief Judicial Magistrate	Up to seven years	Unlimited	
I Class Judicial Magistrate	Up to three years	5000 rupees	
II Class Judicial Magistrate	Up to one year	1000 rupees	

- Supreme Court and High Court will hear only referrals not trials. Courts below the rank on Sessions Court cannot hear murder trials as they cannot award death sentence
- Any sentence awarded by a Court may be enhanced or decreased by a higher Court.
- The President of India has the power to grant pardons, remissions of punishments and commutation of death sentence.

INQUEST

- Police inquest
- Magistrate inquest
- Coroner's inquest (not in India)
- Medical examiners inquest (not in India).

Police inquest (S 174 CrPC)	Magistrate inquest (S 176 CrPC)
• Conducted usually by SI or Inspector, in the presence of two or more respectable persons (panchas) makes an investigation (S.175 CrPC) – The inquest report (panchanama) is then signed by the investigating police officer and by the witnesses	• Conducted by collector, Tahsildar, Deputy Commissioner, Revenue divisional officer – Death in police custody and while under police interrogation – Death due to police firing – Death in prisons, reformatories, Borstal school – Death in psychiatric hospitals – Dowry deaths – Exhumation

Coroner's Court	Cognizable offence	Conduct money
• Court of enquiry and not a court of trial, which has some judicial powers. • Type of inquest done in U.K., some States in U.S.A., and some other countries, but not in India	• Offence in which a police officer can arrest a person without warrant from the Magistrate, e.g., rape, murder	• Fee paid to a witness in civil cases, to meet the expenses towards attending the court

Dying Declaration vs Dying Deposition

Dying declaration	Dying deposition
Recorded by magistrate or doctor or Investigating officer	Recorded by magistrate
No oath is administered	Oath is administered
Inferior to dying deposition	Superior to dying declaration
Presence of accused or lawyer nor necessary	Recorded in presence of accused or lawyer
No cross examination	Cross examination is allowed
Has corroborative value if patient survives	Retains full legal value even if the person survives

- Witness
- Witnesses are of two types: (1) Common, and (2) Expert
- A doctor can be both a common and expert witness
- Hostile witness: one who purposefully makes statement contrary to facts
- Perjury: Willful utterance of falsehood by a witness under oath.

RECORD OF EVIDENCE IN A COURT OF LAW

Oath-child below 12 years is not required to take an oath

Examination in chief (Direct examination)	Cross examination
• Witness examined by public prosecutor and accused by defense lawyer • No leading questions • Leading questions may be asked if the witness is hostile	• Witness examined by defense lawyer and accused by public prosecutor • Leading Questions allowed • No time limit

Re-examination (Redirect examination)	Questions by the judge
• Similar to direct examination • No leading questions	• Can ask questions at any time of proceedings • Oral evidence is superior to documentary evidence because it is administered under oath and cross examined

Medical Council of India: Indian Medical Council Act 1956

First schedule	Second schedule	Third schedule part A	Third schedule part B
Medical degrees offered by different Universities in India, which are recognized by the Council	Medical degrees offered by different Universities outside India, which are recognized by the Council	Medical degrees conferred by Indian Universities, which are not mentioned in the 1st schedule	Standard medical qualifications of foreign countries, which are not mentioned in 2nd schedule

PENAL ERASURE/PROFESSIONAL DEATH SENTENCE

- Removal of the name of the doctor from the medical register
- Main cause: **Serious professional misconduct/Infamous conduct (conduct of the doctor that is regarded disgraceful and dishonorable)**
- Done by the **State Medical Council**
- Other instances of removal of name
  - After death
  - Name entered by fraud, impersonation.

Medical Negligence:

- Act of omission
- Act of commission.

Types:

- Civil Negligence
- Criminal Negligence.

Components of negligence	Duty, dereliction, direct causation, damage
Doctrine of res Ipsa loquitur	The things or facts speaks for itself. Example: Amputation of a wrong limb
Doctrine of calculated risk	Inherent risk of the procedure
Novus actus interveniens	Unrelated action intervening
Medical maloccurance	Inevitable accidents
Therapeutic misadventure	Mischance or disaster a person dies due to some unintentional act of doctor or hospital
Doctrine of respondent superior (Vicarious liability)	Let the master answer
Contributary negligence	Patient also responsible and contributed to the damage suffered
Corporate negligence	Failure in part of hospital management to provide adequate facilities

CONSENT

- Free and voluntary agreement compliance or permission given for specific purpose.
- Section 90 IPC defines consent in negative form. Not valid if given under fear, misconception, intoxication, unsound mind, less than 12 years of age.

Types

- Implied
- Expressed (Oral or verbal and written)

Exceptions to consent	Consent is not required	Consent of spouse must in
• Emergency, incompetence, therapeutic privilege, waiver	• Emergency, notifiable diseases, public Interest, court order, prisoner, immigrants, postmortem	• Termination of pregnancy, sterilization, artificial insemination, donation of sperm, any procedure hampers sexual activity

MEDICOLEGAL IMPORTANCE OF AGE

Time scale	Significance
4 months IUL	Sex can be recognized
> 7 months IUL	Infanticide
> 5 years	Criminal responsibility (Railways act)
< 7 years	Not guilty of crime (Sec 82 IPC)
7–12 years	Guilty of crime if sufficient maturity present (Sec.83 IPC)
< 12 years	Parents and guardians must given consent
< 14 years	Cannot be employed in factory jobs
14–15 years	Non-hazardous jobs in factories can be given
Boys < 16 years	Taking away without the onset of the parent/guardian is kidnapping
> 18 years	Valid consent, attainment of majority, minimum age to join government service, vote, consent for sexual intercourse, marriage age for girls
21 years	Marriage age for boys
> 25 years	Minimum age for a MP
35 years	Minimum age for president, VP, Governor

Race determination from skull: Cephalic Index = Max. breadth of Skull/Max. length of skull **X** 100

Stature

Estimation of stature or height of a person is subject to variations during life due to muscular relaxation and elasticity of intervertebral discs, but still is valuable.

Formulae for Stature Estimation

- Karl Pearson's formula
- Trotter and Gleser
- Dupertuis and Hadden

As a general rule, humerus is 20%, tibia is 22%, femur is 27% and spine is 35% of individual height.

Age in intrauterine life

HASSE'S Rule	Length of the fetus (crown-heel length) up to 25 cms SQUARE ROOT gives the age of the fetus in months
Morrison's Rule	Above 25 cms DIVIDED by 5 gives the age of the fetus in months

Dactylography

- First used in India: Sir William Herschel(1858). Systematized by Sir Francis Galton (1892)
- Types: Loops (60–70%) (most common), whorls (25-35%), Arch (6–7%), Composite (1–2%)
- In practice 16–20 points of comparison are accepted as proof of identity
- Fingerprint is absolutely individualistic (No two prints are like, even in twins)
- Most reliable method of identification
- Paternity cannot be proved from finger printing, but by DNA fingerprinting
- Brain finger printing invented by Dr Lawrence Farrel.

Conditions causing permanent impairment of finger prints

Leprosy	Radiation	Electrocution	Skin grafting

Poroscopy	Microscopic study of pores formed by mouths of ducts of subepidermal sweat glands
Cheiloscopy	Utilization of lip prints as a means of personal identification
Podogram	Study of foot prints
Bartillon system	Descriptive data, marks (moles) and body measurements for identification Useful above 21 years of age

Dentition

- Falling of temporary teeth starts at 6 years and eruption of permanent teeth starts at 6 years
- Age 6 to 12 years is the age of mixed dentition
- Superadded permanent teeth are those with do not have deciduous predecessors (*permanent molars*)
- Successional permanent teeth are those which erupt in the place of deciduous teeth.

Temporary Dentition	Age (months)
Lower central incisor 1st	6–8
Upper central incisor	7–9
Upper lateral incisor	7–9
Lower lateral incisor	10–12
Fist molar	12–14
Canine	17–19
Second molar last	20–30

Permanent dentition	Age (years)
First molar First	6–7
Central incisor	6–8
Lateral incisor	7–9
First premolar	9–11
Second premolar	10–12
Canine	11–12
Second molar	12–14
Third molar Last	17–25

Note: Premolars are absent in primary dentition.

Gustafson's Method

- Age estimation of adults > 21 years.
- Criteria used
  - Attrition
  - Paradentosis
  - Secondary dentin (2nd most reliable)
  - Cementum apposition
  - Root resorption
  - Root transparency (most reliable)—not seen up to 30 years.
- Anterior teeth are more suitable than posterior teeth, while 3rd molar is unsuitable for Gustafson's method.

Boyde Method

Most accurate age estimation method by incremental lines.

Age estimation by radiology

X-ray	Female	Male
Elbow	13–14	15–16
Wrist	16–17	18–19
Shoulder	17–18	19–20
Iliac crest	18–19	20–21
Ischial tuberosity	21–22	23–24
Clavicle medial end	21–22	23–24

Legal Sections

Some important sections of law

Sec 40 IPC	Cognizable offences
Sec 197 IPC	Punishment for issuing a false certificate
Sec 191 IPC	Perjury–willfully giving false evidence
Sec 192 IPC	Fabricating false evidence
Sec 193 IPC	Punishment for perjury–may extend to 7 years
Relevant sections of consent	
Sec 87 IPC	A person above 18 years can give a valid consent to suffer any harm, not known or intended to cause death or grievous hurt
Sec 89 IPC	A person below 12 years and an insane person cannot give a valid consent to suffer any harm
Sec 90 IPC	A consent given under fear of injury or misunderstanding or insane or intoxicated is not valid
Sec 92 IPC	Any harm caused to a person in good faith even without the consent, when it is impossible for the person to give consent is not an offence
Sec 52 IPC	Nothing is said to be done in good faith, which is done without care and attention
Relevant sections of injuries	
Sec 44 IPC	Injury–any harm what so ever caused illegally to any person in body, mind, reputation or property
Sec 299 IPC	Definition of culpable homicide
Sec 300 IPC	Definition of culpable homicide amounting to murder.
Sec 302 IPC	Punishment for murder–death or imprisonment for life
Sec 304 IPC	Culpable homicide not amounting to murder. Imprisonment for life or 10 years, and also fine
Sec 304-A IPC	Death caused by rash and negligent act–2 years
Sec 304-B IPC	Dowry death–death of a female within 7 years of marriage
Sec 306 IPC	Abetment of suicide–10 years, also fine
Sec 307 IPC	Attempt to murder–10 years
Sec 308 IPC	Attempt to commit culpable homicide– up to 10 years
Sec 319 IPC	Hurt–bodily pain, disease or infirmity
Sec 320 IPC	Grievous hurt–definition
Sec.323 IPC	Punishment for voluntarily causing hurt–1 year, with fine
Sec 324 IPC	Voluntarily causing hurt with dangerous weapon–3 years also fine
Sec 325 IPC	Voluntarily causing grievous hurt–7 years, also fine
Sec.326 I.P.C.	Voluntarily causing grievous hurt by dangerous weapon–10 years, also fine
Sec 351 IPC	Assault–offer of threat or attempt to apply force in a hostile manner
Sec 362 IPC	Abduction
Sec 498-A IPC	Punishment for harassment of dowry–3 years, also fine
Sec 82 IPC	Any act done by a child under 7 years of age is not an offence
Sec 83 IPC	Between 7 to 12 years of age, he is responsible if he understands the nature and consequences of his act
Sec 84 IPC	Mc Naughten Rule–Nothing is an offence, which is done by a person, who at the time of doing it, by reason of unsoundness of mind, is incapable of knowing the nature of the act, or that he is doing is either wrong or contrary to the law
Sec 375 IPC	Definition of Rape
Sec 376 IPC	1. Punishment for Rape 2. Custodial and Institutional Rape
Sec 377 IPC	Unnatural sexual offences

Contd...

Contd...

Relevant sections of injuries	
Sec 354 IPC	Indecent offence between two males, like mutual masturbation–2 years.
Sec 509 IPC	Indecent Assault–1 year
Sec 297 IPC	Necrophilia/Necrophagia.
Relevant sections of IEA	
Sec 61 to 90 IEA	Deals with documentary evidence
Sec 32 IEA	Dying declaration
Sec 118 IEA	All persons are competent to be witnesses, unless they are prevented from doing so
Sec 45 IEA	Expert witness
Sec 142 IEA	Leading question allowed in Examination-in-chief, if the witness is declared hostile
Sec 165 IEA	Questions by the judge.
Relevant sections of CrPC	
Sec 174 CrPC	Police Inquest
Sec 174 (4) and 176 CrPC	Magistrate Inquest
Sec 2 (n) CrPC	Cognizable offences
Sec 41 CrPC	In non-cognizable offences the accused may directly go to the doctor and get himself examined
Sec 53 CrPC	A male doctor can examine a female patient only in the presence of a female attendant
Sec 54 CrPC	An arrested person at his request, may be examined by a doctor to detect evidence in his favor
Sec 328 and 329 CrPC	Deals with provisions as to accused person of unsound mind

Grievous Hurt (Sec 320 IPC)

- Emasculation
- Permanent privation of sight of either eye
- Permanent privation of hearing of either ear
- Privation of any member or joint
- Permanent destruction of power of any member or joint
- Permanent disfiguration of head or face
- Fracture or dislocation of a bone or tooth
- Any hurt which **endangers life**, or which causes the victim to be in **severe bodily pain**, or **unable to follow his ordinary pursuits for a period of twenty days.**

Dowry Death (Sec 304-b IPC)

- Death within 7 years of marriage, caused by burns or other bodily injury or anyway other than normal
- Punishment not less than 10 years but may extend to life imprisonment
- Autopsy should be carried out by two doctors
- Sec 498-A IPC; Sec 113B IEA also death with dowry death.

Rape

Sec 375 IPC defines rape	• As per Criminal Law Amendment Bill 2013, the word rape has been replaced by 'Sexual Assault' as per Sec 375 IPC. • Penile penetration, inserting finger, manipulates the body part, applying the mouth to vagina or anus without the other person's consent all constitute the offence of sexual assault or rape
Sec 376 IPC (Punishment for sexual assault)	**Subsection 1:** Rigorous imprisonment for a term which shall not be less than 7 years (which may extend to life imprisonment) and liability to fine **Subsection 2** • Police officer • Public servant

Sec 376 IPC (Punishment for sexual assault)	• Member of armed forces • Management or staff of a jail, remand home or place of institution • Management or on the staff of a hospital • Relative, guardian or teacher • Pregnant women • Under 18 years of age • Person assaulted is incapable of giving consent • Person in social or economic dominance commits sexual assault on a person under such dominance • Sexual assault on a person suffering from mental or physical disability • Person causing grievous bodily harm or endangers the life of a person • Commits persistent sexual assault • Rigorous imprisonment for a term which shall not be less than 10 years which may extend to imprisonment for life
Sec 376–A	Punishment for causing death or resulting in persistent vegetative state of the victim–Imprisonment not be less than 20 years
Sec 376-B	Sexual assault by husband upon his wife during separation–Punishment–imprisonment for 2 years which may extend to 7 years
Sec 376 C	Sexual intercourse by a person in authority • Whoever in a position of authority or in fiduciary relationship • A public servant • Superintendent or manger of a jail, remand home or other place of custody or a women's or children institution • Being on the management of a hospital Rigorous imprisonment for 5 years which may extend to 10 years with fine
Sec 376 D	Sexual assault by gang Rigorous imprisonment which shall not be less than 20 years
Sec 376 E	Punishment for repeat offenders–Imprisonment for life or with death

Medicolegal Aspects of Poisons

- Sec 284 IPC deals with negligent conduct with respect to poisonous substances where punishment is up to 6 months
- Sec 324 and 326 IPC deals with hurt caused by corrosive substances and punishment up to 10 years
- Sec 328 IPC Whoever administers to any person any poison, or any stupefying intoxicating, or unwholesome drugs with the intent to cause hurt to such persons, shall be punished with imprisonment up to 10 years, and shall also be liable for fine
- Suspected articles of poison to be preserved. (noncompliance–Sec 201 IPC)
- Private practitioners are bound to inform the police in case of homicidal poisoning (Sec 39 Cr PC). Non compliance to be punished (Sec 176 IPC)
- If private practitioner if summoned by the investigative police officer, he is bound to divulge all information (Sec 175 Cr PC). If he conceals information, punishment according to Sec 202 IPC. If he furnishes wrong information, punishment according to Sec 193 IPC.

Drugs and cosmetic Act	1940 1964 (Amendment)
Drugs and cosmetic Rules Schedule H and L Drugs to be sold only on the prescription of RMP	1945
Narcotic and Psychotropic Substance Act	1985

THANATOLOGY (STUDY OF DEATH)

Death is of two types:

1. Somatic, systemic or clinical.

2. Molecular or cellular.

Somatic Death: It is the complete and irreversible stoppage of the circulation, respiration and brain functions.

Brain death is of three types:

Cortical or cerebral death-intact brainstem	Brainstem death	Whole brain death
• Vegetative state with normal respiration♀. • Cerebral hypoxia, widespread brain injury.	• The cerebrum may be intact, though cut off functionally by the stem lesion. This can be produced by raised intracranial pressure, cerebral edema, intracranial hemorrhage, etc.	• Combination of 1 and 2

The signs of death appear in the following order.

Immediate (Somatic death)	Early (cellular death)	Late (decomposition and decay)
1. Insensibility and loss of voluntary power 2. Cessation of respiration 3. Cessation of circulation	4. Pallor and loss of elasticity of skin 5. Changes in the eye 6. Primary flaccidity of muscles 7. Algor mortis (Cooling of the body) 8. Livor mortis (Post-mortem lividity) 9. Rigor mortis (Cadaveric rigidity)	10. Putrefaction 11. Adipocere formation 12. Mummification

Changes in the Eyes

Changes in anterior chamber	• Tache noir de la sclerotique within 3 to 4 • Intraocular pressure: Normal intraocular tension is 14 mm mercury Hg. Becomes zero by 2 hours after death • PUPILS: Dilated and fixed (no reaction to light), later becomes constricted
Changes in retina	• Pale- 1st two hours, optic disc: hazy- 6 hours, blurred in 7–10 hours • 'TRUCKING' Sign/Kevorkian's sign: fragmentation and segmentation of blood columns in retinal vessels, viewed by an ophthalmoscope, and interpreted by an expert ophthalmologist.
Changes in vitreous chamber	• There is a steady raise in the potassium level after death

Suspended Animation

- The vital functions of the body come down to a minimum level, just compatible with life
- The person appears apparently dead; seen in:
- Voluntarily produced by yoga practitioners (death trance)
- Involuntary suspended animation is seen in
  - New born infants
  - Drowning
  - Electrocution
  - Sunstroke
  - Cholera
  - Shock
  - Insanity
  - After anesthesia.

Brainstem Death

Irreversibly unconscious and irreversibly apneic

- Tests:
  - Brainstem Reflexes
  - *Apnea Test*

Test for Brainstem functions

Reflexes	Afferents	Efferents
Papillary reflex	II	III
Corneal reflex	V	VII
Grimace	V	VII
Vestibulo oculo reflex	VIII	III and VI
Gag or Cough reflex	IX	X

Board of Doctors to Certify Brainstem Death

- RMP treating the patient
- RMP in charge of the hospital
- Neurologist/Neurosurgeon nominated from the panel of names approved by the appropriate authority
- An independent Medical Specialist nominated from the panel of names approved by the appropriate authority.

RMP certifying death should not be a part of the transplantation team

- Organs are removed when the donor Heart is still beating–beating heart donor
- Kidneys are removed within 30 to 60 minutes and generally not stored for more than 12 hours
- Cornea–6 hours, skin–24 hours, bone–48 hours, blood vessels–72 hours.

Transplantation of Human Organs Act 1994

- Deals with the regulation of:
  - Removal, Storage,
  - Transplantation of Human Organs for therapeutic purposes, and
  - Prevention of commercial trade in Human Organs.
- The only organ which can be donated during life is kidney
- The donor must above 18 years of age.

Postmortem Changes-Signs of Death and Changes after Death

Algor Mortis (Cooling of the Body)

- Body loses heat by 2–3 °C in 1st hour, then 1–1.5 °C for each subsequent hour until the body reaches the environmental temperature
- When temperature is plotted against time, cooling represented by a sigmoid curve
- The body core temperature is obtained from intrahepatic/subhepatic temperature via abdominal stab (ideal site), Per rectum (except in cases of sodomy)
- Other sites—external auditory meatus, nasal cavity, peritoneal cavity
- Temperature measured using a chemical thermometer (thanatometer), graduated from 1 to 50 degrees centigrade, inserted 10 cms in to the rectum

$$\textbf{\textit{(Glaister equation)}}\ \text{Time Since Death} = \frac{\text{Normal body temp–Rectal temperature}}{\text{Rate of fall of temp/hour}}$$

Postmortem caloricity

- The temperature of the body rises for the first few hours after death
- Disturbed regulation of heat production before death-sun stroke
- Increase in heat production in the muscles due to convulsions-tetanus, strychnine poisoning
- Excessive bacterial activity, as in septicemic conditions, cholera and other fevers.

Livor Mortis (Postmortem Staining, Postmortem Lividity, Postmortem Hypostasis, Suggillations, Vibices)

- Postmortem lividity begins as mottled patches ranging from 1 to 2 cms in diameter, which increase in size and coalesce with each other to form a uniform area of staining–2 to 3 hours.

- Lividity usually becomes fixed 6 to 8 hours after death
- It indicates the position of the body after death
- After fixation, the distribution of the pattern will not change even if the body's position is altered.

'Contact pallor or pressure pallor': Parts of the body which is in actual contact with the surface do not show staining

Lividity

Present in	Absent in
• Occurs in the dependent parts of the internal organs as well • Disappears with the onset of putrefaction–merges with that of the colour change of putrefaction	• If the body is tossed and turned continuously as seen in fast flowing water in rivers • Dark coloured individuals. • Profuse bleeding before death or severe anemia

Medicolegal Importance

- Helps in estimating the time of death
- Indicates the posture of the body at the time of fixation and death
- Sometimes the color may indicate the cause of death–poisoning

Etiology	Color	Mechanism
Normal	Blue purplish	Venous blood
Carbon monoxide Burn	Cherry red Bright red	CoHb
Cyanide	Bright Red	Excess oxygenated blood due to inhibition of cytochrome oxidase
Fluroacetate	Pink	Excess oxygenated blood due to inhibition of cytochrome oxidase
Hypothermia/ Refrigeration	Pink	Oxygen retention in cutaneous blood by cold air Left shifting of Hb-O_2 dissociation curve
NaCl/Nitrite/Nitrate/ aniline Potassium chlorate Phosphorous	Chocolate Brown Dark brown	Methemoglobin (meth Hb)
Septic abortion	Grayish brown Bronze	Due to Cl. Welchii
Hydrogen sulphide	Green	Sulfhemoglobin

PM Lividity vs Bruise

Criteria	Lividity	Bruise
Site	Dependant parts	Anywhere
Cuticle	Not injured	May be injured
Appearance	Not elevated	Elevated
Margin	Sharp/Well defined	Ill defined
Colour	Reddish purple uniform	Colour change with time
Cause	Capillo venous distension	Rupture vessels extravasation
Pressure effect	Appears pale	No effect
Cut section	Blood confined with in the vessel	Hemorrhage in the tissue
Enzymatic study	No change	Change in the level
MLI	Time of Death Position of the body	Nature of injury Weapon used

Rigor Mortis (Postmortem Rigor, Postmortem Rigidity, Postmortem Stiffening, Cadaveric Rigidity)

- Appears in both skeletal and smooth muscles; voluntary or involuntary muscles
- If the glycogen stores (muscle) is low before death (exhausted and starved)-rapid rigor develop like in individuals

- Rigor mortis is totally concerned with muscles and is independent of nervous system.
- Rigor mortis passes off in the same order of appearance in, which it develops.

Mechanism: (ATP depletion*) after death there is no synthesis of ATP. As long as there is ATP stores in the muscles the fibers remains relaxed; once the stores get exhausted then the muscle fibers goes in a for a permanent state of contraction*–called Rigor mortis. The level of ATP falls below a critical level (85% of the normal).

Order of appearance	• Occurs in proximodistal spread • Internally: Myocardium • Externally: First in the eyelids, muscles of the face, jaw, neck, upper limbs, chest, abdomen and lastly the lower limbs
Time of appearance	• (Rule of 12Q) • Starts in 3 to 6 hours, takes 12 hours to complete, stays for another 12 hours, disappears in next 12 hours, in the same order of appearance

Conditions altering the onset and duration of rigor mortis

Age	• Does not occur in a fetus of less than 7 months old
Muscular stage	• Onset is slow and duration is long in cases where muscles are healthy and at rest before death
Nature of death	• In deaths from diseases causing great exhaustion and wasting, the onset is early and duration is short
Atmospheric condition	• Onset is slow and duration is long in cold weather • Onset is fast and duration is short in hot weather

Conditions simulating rigor mortis

- Cadaveric spasm
- Heat stiffening: Due to coagulation of muscle protein
- Cold stiffening: Due to solidification of subcutaneous fat
- Gas stiffening: Due to gas accumulation under the skin and subcutaneous tissues, evolved from putrefaction.

Cadaveric spasm or instantaneous rigor

- The group of muscles which were at strenuous work during life (just before death) goes into a sudden state of stiffening, instead of passing to primary flaccidity after death
- Occurs especially in cases of sudden death, due to exhaustion and fear, etc.
- Reflects the last action of the individual at the time of death: firearm in the hands of victims in suicidal gunshot injuries, plants and weeds in the hands of victims in drowning, the weapon in the hands of victims in cut throat injuries, etc
- Cadaveric spasm cannot be mimicked.

Decomposition (Putrefaction)

It takes place in 2 steps-1) Autolysis 2) Putrefaction.

Autolysis: Aseptic process (maceration of dead fetus in the uterusQ).

Putrefaction

- The chief destructive agent of putrefaction is Clostridium welchiiQ
- LecithinaseQ is the most important enzyme causing hemolysis, liquefaction of clots, gas formation and disintegration of tissue.

Stages of Putrefaction

Color changes	• 1st sign of decomposition -Greenish discolouration in the right lilac fossaQ; 12–24 hours in summer and 1 to 3 days in winter. • The superficial veins of the limbs, chest, abdomen and neck are stained greenish blue due to hemolysis of red cells and stain the walls of the vessels–MARBLING

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Salient Features

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Abirami MBBS MD is a young and budding physiologist who believes that 'to teach is to touch a life forever'. Her love and passion towards the subject made her teach the students in the most interesting and the easiest possible way. As a teacher, she has always won the love and respect of her students. She has been involved in several research projects and has presented her work in the National-level conferences. She has also contributed to several other PG entrance books. All this has gone a long way in enabling her to bring out this book with great success along with her co-authors.

J Magendran MBBS MD Gold Medalist is currently working as an Associate Professor, Department of Forensic Medicine, Saveetha Medical College, Chennai, Tamil Nadu, India. With keen interest in forensic medicine, he chose the subject in his very first attempt in the PG entrance examination. He completed his MD Forensic Medicine at the Institute of Forensic Medicine, Madras Medical College, Chennai, Tamil Nadu, India – one of the premier institutes for forensic medicine in India. With consistent academic records during his career, he had been the Gold Medalist and University topper in the PG examinations. Having extensive background in various medicolegal cases, he presented many papers in various conferences. He completed special training in analytical toxicology recognized by the World Health Organization. He has many research publications in various International and National journals to his credit.

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Antan Uresh Kumar T MS FMAS MCh (Urology) is the best motivator for the PG aspirants. Those who follow his words will surely become achievers in anything. He is a charismatic person. He is the founder of KONCPT PG Medical Coaching Centre, Chennai, Tamil Nadu, India. He is a Gold Medalist in General Surgery. He is among the top laparoscopic, endoscopic and transplant surgeons. He did his postgraduation from Stanley Medical College, Chennai, Tamil Nadu, India. He achieved his MCh degree from Madras Medical College, Chennai, Tamil Nadu, India. He is an all-rounder in the teaching field and is the best in guiding the simplest way of reading. His mantra for success are the three Ps—Pray, Play and Prepare.

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