

ESTIMATION OF TIME SINCE DEATH

The **time since death** or **postmortem interval** is the period of time between death and the time of postmortem examination.

- The exact time of death can rarely be estimated on the basis of autopsy findings, an approximate range can be given and is very helpful for the various changes that take place after death.
- Estimation of the time of death within a narrow range is possible only in the early period. Once putrefaction sets in, the range becomes wider, however, the toxicological study can help in narrowing the range considerably.
- The study of estimating the time since death generally falls under the following three categories:
 - **Corporal evidence** - that which is present in the dead body.
 - **Environmental evidence** - that which is present in the surroundings and general observations at the scene.
 - **Anamnestic evidence** - that which is based on the deceased's (victim) habits, movements and day-to-day activities.
- Assessing the time of death by environmental evidence and anamnestic evidence is mostly the responsibility of the investigating officer in India. The doctor is generally not concerned. Estimation of time of death in India is exclusively dependent on the evidence that can be documented during postmortem examination (Corporal evidence). Naturally, he relies upon the changes that take place after death such as postmortem cooling, post-mortem lividity, rigor mortis and putrefaction. Keep-ing in mind all those factors that alter the outcome of these individual changes. **Box 2.1** summarises the changes use-ful in computing the time since death.
- **Additional Methods**
 - **Gastric emptying time:** If the time of the last meal is known, presence or absence of food and the state of digestion in the stomach helps to a certain extent in estimating the time since death. But the rate of empty-ing of the stomach depends on many variables, includ-ing the type of food eaten, the emotional state of the person, any surgical procedure done on the stomach such as gastrojejunostomy, etc. Therefore, this method can only be used as corroborative evidence.
 - **Bladder content:** If it is known that the urinary bladder is full... [text cut off] ...in the morning of the death. If the body is found in... [text cut off] ...the urinary bladder is very... [text cut off] ...but the person has died in the early hours of the morning, it is suggestive that the death is very... [text cut off] ...occurred within the last 1 or 2 hours. On the other hand, if the body is... [text cut off] ...a certain amount of urine, hardly... [text cut off] ...to touch, and the bladder is full, it means that the person... [text cut off] ...from the previous night... [text cut off] ...before going to bed. This is, however, a corroborative evidence.
 - **Biochemical changes:** Though a lot of research work has been undertaken to estimate the time since death on the basis of chemical analysis of blood components like potassium content of the vitreous humour, pericardial fluid, synovial fluid and also chemical estimation of nitro-gen of CSF and a plethora of other chemical parameters, it is not useful in... [text cut off] ...in India. After death, the post-mortem values of these chemicals vary substantially, hence it has limited

- practical value.
- **Circumstantial evidence:**
 - If the body is lying in an open place, the state of grass underneath the body helps in the estimation of time since death. As the grass becomes deprived of sunlight, it subsequently turns pale and then yellow, due to conversion of chlorophyll to xantho-phyll. The usual time required for such a change in colour is 3-5 days.
 - Letters and mails, newspapers, recent purchases of household materials with dated bills, half-eaten food in the kitchen, etc., are other factors which can be taken into consideration in assessing the time since death.
 - **Entomology of the Cadaver:** Food-spoiling gases that emanate due to putrefaction attract various insects.
 - The study of the life cycle of these insects which helps the doctor in order to know the time of death and some other useful information, is known as **Fo-rensic Entomology**.
 - There are eight successive waves of invasion from the beginning of putrefaction right up to skeletonization.
 - Initially, four-winged flies predominate, but later there will be involvement of several other kinds of insects including beetles.
 - Two-winged flies such as blue bottles, flesh flies, house flies, etc., lay their **eggs** in about 18-36 hours (sometimes as early as 6-10 hours).

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TOPIC 2: FORENSIC PATHOLOGY

- Mostly these eggs are laid in the mucocutaneous junctions such as lips, nostrils, anus, vagina or even in open wounds.
- The eggs hatch into larvae (**maggots**) within 12-24 hours (**Fig. 2.16**). They are extremely voracious eaters and they grow in size up to 4... [text cut off] ...in a span of 4-5 days. They eat the soft tissues and hasten the process of disintegration of the body.
- The maggots then enclose themselves inside shell-like structures (**pupae**), which in another 4-5 days break open to release a new fly (**nymphs**).
- The task of the doctor while doing autopsies on such maggot-infested bodies is only to pick up these maggots, preserve them properly and send them to a qualified entomologist for species identification. Maggots immersed in boiling absolute alcohol get fixed in a straight position, which facilitates measurement of their length.
- Calculation of time since death is done as follows: **Time since death = A + B x (cd)** where **A** is the stage of invasion (in hours, days, weeks or months), **B** is the stage of life cycle (in hours or days) and **cd** represents climatic factor correction.
- Study of insect's life cycle is the job of an entomologist. The doctor should not guess the postmortem interval from his very limited knowledge of entomology.
- Usefulness of chemical analysis of maggots for... [text cut off] ...poison, etc. is controversial. If a putrefying process, should be kept in mind. ... [text cut off] ...in entomology is better to be called **Fo-rensic Entomototoxicology**.

Fig. 2.16 Maggots crawling over the face (Courtesy: Dr Rajesh V Bardale)

Box 2.1—Postmortem Changes and Postmortem Interval

Condition of the body	Time since death
Warm and flaccid, transparent cornea, no patches of lividity or rigor mortis	Within 1 hr
Patches of lividity on the dependent parts, rigor mortis just appearing in muscles of the face	2-3 hrs
PM lividity well developed and fixed, rigor mortis is fixed in the upper part of the body, body warm, cornea hazy	6-8 hrs
Rigor mortis all over the body, with or without greenish discoloration in the right iliac fossa, body cold	Around 12 hrs
Body cold and stiff, greenish discoloration in the right iliac fossa, eggs of flies	12-24 hrs
Body is cold, rigor has receded, greenish discoloration over the abdomen and chest, distension of the abdomen with gases, maggots	24-36 hrs
Marbling, distended abdomen and thorax, presence of maggots, post-mortem blisters	36-48 hrs
Whole body bloated, face unrecognisable, nails and hair easily pulled out, large maggots or pupae all over the body	3-5 days
Colliquative putrefaction where the internal organs are reduced to black unrecognisable semisolid mass	1 week (5-10 days)
Most of the soft tissues gone, organs that putrefy late like prostate and non-gravid uterus recognisable	2 weeks
Skeletonization (exposed body)	1-3 months

Pillay: Textbook of Forensic Medicine & Toxicology