Journal of Cardiovascular Disease Research

ISSN:0975 -3583,0976-2833 VOL14, ISSUE 10, 2023

# Estimation of Time since Death from serum liver enzymes: A Tertiary Care Centre Study.

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**Abstract:**
**Introduction-** Postmortem interval is a matter of crucial importance in any death investigation especially those involving homicide. It is found that some biochemical markers remain remarkably stable after death while others show varying degrees of change. Serum liver enzymes levels are found to follow a defined curve after death. There is orderly raise and subsequent decline in serum. These enzymatic alterations after death can be helpful in estimation of PMI. **Material & method**- Total 100 cases were studied during June 2019 till May 2023. Out of total 100 cases were enrolled of which 74 were male and 26 were female. Condition of body, presence of any injury, cause of death, history of poison intake and other relevant data were noted. Blood sample was taken earliest since time of death within 06 hours of death. Subsequent sample were taken after 06 hours, 12 hours, 18 hours and 24 hours of death. Serum Level of ALT, AST and Acid Phosphatase were measured and their correlation with various factors were studied. **Observation & Result**- Level of these biochemical enzymes are found marginally higher in male. Mean level of SGOT and SGPT was found to be 158.80 IU/L in female and 182.7 IU/L in male. Serum levels of SGPT also show rising graph like that of SGOT. Serum acid phosphatase level show steady rise in first 24 hours of death. There was decline in level of acid phosphatase thereafter. **Conclusion**- Changes in enzymatic values in serum as well as in tissues after death can be correlated with time passed since death which helps in estimation of PMI. Further more research is needed in this topic for more accuracy.
**Keywords**- PMI, SGOT, SGPT, Acid Phosphatase etc.

## Introduction:

Postmortem interval (PMI), or time since death, is a matter of crucial importance in any death investigation, but especially those involving homicide. In the investigation of deaths from any cause, the evaluation of changes in the body requires careful consideration of all variables one may encounter. A proper understanding on post-mortem changes is very important which avoid the risk of misdiagnosis at the time of necropsy [1].

ISSN:0975 -3583,0976-2833 VOL14, ISSUE 10, 2023

Time passed since death continues to be a major problem for the forensic pathologist and its determination plays an important role in medicolegal cases because forensic experts are very often required to answer questions relating to time of death in the courts of law [2].

There are numerous ways to estimate PMI, or time since death, including body temperature, rigor mortis, insect activity, and decomposition [3]. Individually, many of these indicators are prone to inaccuracy due to the influence of the external environment upon them. There is a continuous need for the development of an accurate method by which the time of death can be determined to within a few minutes [4]. Despite many decades of investigation on the topic, accuracy in determination of the time of death has not significantly improved, and no single method can be reliably used to accurately estimate the PMI [3, 4].

It is found that some biochemical markers remain remarkably stable after death while others show varying degrees of change. Studies claimed that these biochemical changes that occur are the result of three things: "the agonal period of anoxia, the continuation of biochemical changes in the early postmortem period, and the distribution of easily diffusible substances between erythrocytes and plasma as well as between interstitial fluid, tissue cells, and the blood" [5]. The nature of the enzyme released is reflected in the severity of damage. Mild conditions release cytoplasmic enzymes, whereas necrotic conditions release mitochondrial enzymes as well. Serum liver enzymes level are found to follow a defined curve after death. There is orderly raise and subsequent decline in serum. These enzymatic alterations after death can be helpful in estimation of PMI. Hence the present research work has been undertaken to evaluate serum enzymatic changes to correlate with time of death and their relation with the mechanism of death [6].

**Material and Method**:- This is a prospective study conducted in department of Forensic Medicine Index Medical College & Research Center (Malwanchal University), Indore MP. Total 100 cases were studied during June 2019 till May 2023. Out of total 100 cases were enrolled of which 74 were male and 26 were female. Only those cases were included where the time of death was known. Autopsy was performed in M.Y. Hospital, MGM Medical College Indore.

Inclusion Criterial-

- Age more than 18 years.
- Time of death is known.
- All document and requisition letters from authority.

Exclusion Criteria-

- Pregnant/Postpartum female
- Known case of liver disease
- Time of death is not known

Basic details and demographic were noted. Special emphasis is given on exact time of death. Condition of body, presence of any injury, cause of death, history of poison intake and other relevant data were noted. Thorough post mortem examination was done. Extent and degree of Rigor mortis, site and extent of postmortem lividity, corneal changes, skin changes and changes of decomposition were noted. Mechanism of death was noted and its relation with enzyme level was studied. Femoral blood samples were collected by aspiration with sterile needles and syringes from the femoral vein(s). Blood samples were drawn after

ISSN:0975 -3583,0976-2833 VOL14, ISSUE 10, 2023

clamping the vein(s) at the proximal end and keeping the lower limb(s) raised for several minutes

Blood sample was taken earliest since time of death within 06 hours of death. Subsequent sample were taken after 06 hours, 12 hours, 18 hours and 24 hours of death. First sample collected within 06 hours of death is considered as ante-mortem or 00 hour sample (sample just at time of death). Sample was taken and then centrifuged at 3000 RPM for 20 minutes. Serum Level of ALT, AST and Acid Phosphatase were measured using fully automated Transasia Biochemical analyser in department of Biochemistry at Index Medical College, Indore. To study correlation between postmortem interval and level of biochemical enzymes Pearson correlation coefficient was used.

Conflict of interest – None

Financial assistance- none

**Observation and Results-**

Total 100 cases were included in our study of them 74 were male and 26 were females. Age of cases varies from 19 years to 62 years. Mean age came out as 38.4 years.

Biochemical enzyme levels were studied and their relation with mechanism of death was studied. Level of these biochemical enzymes are found marginally higher in male. Mean level of SGOT and SGPT was found to be 158.80 IU/L in female and 182.7 IU/L in male. Likewise mean SGPT level was 153.6 IU/L in female and 176.20 IU/L in male. Mean level of acid phosphatase was 12.2 in female and 14.1 in male. Thus mean value of all liver enzymes studied found higher in male than female, but this finding cannot be generalised as exact ante mortem values were not known and also various other factors like cause of death affect enzyme level (Table 01).

Serum SGOT level show marked increase in first 06 hours of death, thereafter from 6-24 hours show steady rise in serum level. Mean SGOT level of first sample (0-6 hours) was 110 IU/L and mean value after 24 hours of death was 340 IU. After 24 hours level of SGOT show marked variation depending upon underlying cause of death, weather, temperature etc. Mean enzyme value between 07-12 hours is 181 IU, between 13-18 hours is 209 IU between 19-24 is 263 IU (Table 2.0).

Serum levels of SGPT also show rising graph like that of SGOT. In First 06 hours of death there was marked raise in SGPT level with average SGPT of 101 IU/L. Thereafter there was steady increase in SGPT till 24 hours of death with mean enzyme level of 351 IU. In between mean values were 172, 244, 275 respectively (Table 3.0).

Serum acid phosphatase level show steady rise in first 24 hours of death. There was decline in level of acid phosphatase thereafter with mean value around 20.6 KA unit after 24 hours. Mean values in 0-6 hours was 5.8 then 10.6, 21.8 and 24.5 KA unit in subsequent interval respectively (Table 4.0).

Out of 100 cases studied mean serum level of SGOT was found highest in death due to mechanical trauma followed by poisoning and pathological causes. Similarly mean SGOT was found least in death due to burns. Likewise mean serum SGPT was found highest in mechanical trauma and least in death due to burns. Serum acid phosphatase found highest in death due to asphyxia and least in death due to mechanical trauma (Table 5.0).

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**Table 01**: Mean Liver Enzyme level in male and female

| | SGOT ( mean ) IU/L | SGPT (mean) IU/L | Acid Phosphatase (mean) KA unit |
|---|---|---|---|
| Male (74) | 182.70 | 176.20 | 14.10 |
| Female (26) | 158.80 | 153.60 | 12.20 |

**Table 02**- PMI and mean serum level of SGOT

| PM Interval | Range (IU/L) | Mean (IU/L) |
|---|---|---|
| 0-6 hours | 46-195 | 110 |
| 7-12 hours | 80-240 | 181 |
| 13-18 hours | 110-350 | 209 |
| 19-24 hours | 132-360 | 263 |
| >24 hours | 230-550 | 340 |

**Table 03**- PMI and mean serum level of SGPT-

| PM Interval | Range (IU/L) | Mean (IU/L) |
|---|---|---|
| 0-6 hours | 40-150 | 101 |
| 7-12 hours | 90- 280 | 172 |
| 13-18 hours | 134-360 | 244 |
| 19-24 hours | 178-440 | 275 |
| >24 hours | 220-530 | 351 |

**Table 04**- PMI and mean serum level of Acid Phosphatase

| PM Interval | Range (KA Unit) | Mean (KA Unit) |
|---|---|---|
| 0-6 hours | 3.6-13.5 | 5.8 |
| 7-12 hours | 4.9-18.0 | 10.6 |
| 13-18 hours | 9.2-29.5 | 21.8 |
| 19-24 hours | 13.8-35.1 | 24.5 |
| >24 hours | 17.4-32.2 | 20.6 |

**Table 05**- Mechanism of death and their relation with mean enzymes level-

| | Mean SGOT (IU/L) | Mean SGPT (IU/L) | Mean Acid Phosphatase. (KA Unit) |
|---|---|---|---|
| Mechanical trauma | 202.20 | 193.60 | 8.30 |
| Poisoning | 186.00 | 191.40 | 10.60 |
| Asphxia | 168.70 | 172.90 | 13.80 |
| Pathological Cause | 176.40 | 158.00 | 11.00 |
| Electrocution | 173.90 | 160.10 | 12.60 |
| Burn | 128.10 | 116.50 | 9.50 |

ISSN:0975 -3583,0976-2833 VOL14, ISSUE 10, 2023

**Discussion-**

Findings in our study were found consistent with previous studies conducted elsewhere in the world. Post-mortem rigidity and lividity are most commonly used findings to determine PMI. But since these findings are not accurate and help us only in giving wide estimation of PMI, also these are dependent of various other factors [7]. Biochemical enzymes estimation offers more accurate PMI estimation. Serum enzymatic parameters like alanine aminotransferase ie. SGOT (AST) and alanine aminotransferase ie. SGPT (ALT) concentration samples collected from 100 cases at 0-hour, 6-hours and 12 hours were evaluated.

The result showed that there was significant increase in serum SGOT, SGPT and acid phosphatase values at 6hrs, 12hrs, 18 hrs and 24hrs than 0hr. According to the previous research [8,9,10] it was reported that serum SGOT and SGPT are of clinical importance. Normally the serum transaminases levels are low but after extensive tissue damage these enzymes are liberated into serum. So SGOT and SGPT in serum rise after death due to post-mortem damage of tissues [9] There was rising trend of serum aminotransferase levels up to second to third day of death [10]. Naumann et al , Enticknap et al and Coe et al [ 7,11,12] investigated ALP levels in postmortem serum and found significantly increases of up to ten times normal ante mortem values 48 h after death. ALT concentrations were shown to progressively increase after death in peripheral blood, with a rise that was roughly linear with the postmortem interval in the first 60 hours after death [13]. We found rapid rise in serum level of SGOT and SGPT in first 06 hours of death thereafter followed by steady rise in subsequent 24 hours of death [14,15]. These findings are consistent with previous studies. Level of SGOT & SGPT was found higher in death due to mechanical trauma as these are enzymes of cytolysis and in tissue trauma there is excessive release of these enzymes due to tissue damage. possibly as a result of ALP release from leucocytes. We found gradual rise in serum acid phosphatase level in first 24 hours of death and then there is decrease in level after 24 hours.

**Conclusion:-** It can be concluded from the present study that these changes in enzymatic values in serum as well as in tissues after death can be correlated with time passed since death which helps in estimation of PMI. Further more research is needed in this topic for more accuracy. The limitations of this study must be acknowledged. The most important is the relatively small number of studied cases, which may limit the accuracy of our research.

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