

# Estimating Time Since Death From Post Mortem Lividity: An Autopsy Study Conducted in Government Medical College and Ssg Hospital of Central Gujarat State of India

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## Abstract

**Background:** Evaluation and estimation of time since death is a fundamental part of medico-legal investigations. Post mortem lividity or post-mortem staining is a bluish or reddish-purple discoloration due to capillo-venous distension with blood, at the under surface of the skin on the dependant parts of the body, as a result of settling of blood in those areas following pulling by gravity, after circulation of the blood in motion ceases.

A study was conducted in the department of forensic medicine, Government Medical College and SSG hospital, Vadodara to evaluate time since death by method of studying post mortem lividity.

This was prospective and observational study conducted on 256 dead bodies brought for post mortem examination from November 2021 to August 2022.

It was observed that the Post mortem Lividity starts appearing as a patchy form by 1-7 hours and well develops by 7-13 hours. Post mortem Lividity gets fixed by 8-18 hours following death.

It was concluded that compared to other methods, the post mortem lividity assessment can be used as the most conventional, easy and quicker method for estimating time since death.

**Keywords:** Post mortem changes, Death, Livor Mortis, Time Perception.

## Introduction

Postmortem hypostasis is one of the early changes in the body following death. It is considered

to be one of the surest signs of death. Apart from being a sign of death, it also carries other information along like, time since death, cause of death, position

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of body after death, etc. Post-mortem lividity is the bluish-purple or purplish-red discoloration (due to deoxyhemoglobin), which appears under the most superficial layers of the dermal part of the skin of the dependent parts of the body after death, due to capillo-venous distension. It is caused by the stoppage of circulation, the stagnation of blood in blood vessels, and its tendency to sink by the force of gravity<sup>1</sup>. When the body is left undisturbed without change of its position, the staining starts appearing in small patches at the dependent parts of the body, by the end of the first hour after death. Gradually the small patches increase in size and coalesce with each other to form uniform large areas by 5 to 26 hours. If the body is left undisturbed for an additional five to six hours after the post-mortem staining has fully formed, the staining gets fixed, meaning that the stained area stays in the same location even if the body is repositioned<sup>2</sup>. The cause of death has an impact on the staining's hue as well. The cause of death has an impact on the staining's hue as well. The purplish-blue color in hypostasis can be explained by the following reasons: (i) Oxygen dissociation between capillaries and surrounding tissues occurs in recently dead or dying tissue until equilibrium is attained (ii) The venular blood because of its blue tint<sup>3</sup>.

Considering that appearance of postmortem changes may vary in different regions globally with varying weather conditions and is dependent on varying conditions as described above, this study was aimed to study the post-mortem lividity and its determinants in the study region.

## Materials and Methods

**Ethical permission:** Medical College & SSG Hospital, Baroda IECBHR/137-2021 Dated 02/11/2021.

### Study design:

A study was conducted in the mortuary of Department of Forensic Medicine, Government Medical College, and SSG Hospital, Vadodara.

This was a prospective and observational study conducted on 256 dead bodies brought for post-mortem examination from November 2021 to August 2022.

### Inclusion Criteria:

1. Those cases were selected where the time of death was exactly known.
2. Brought dead cases where the exact time of death is known.

### Exclusion Criteria:

1. Decomposed cases.
2. The unidentified bodies, where proper history was not available.

### Sample size calculation

Based on the estimated load of the cases in our department is about 25-30 cases per month, so expected sample size over the study period has been around 250-300 cases.

### Data Collection:

A deep freezer kept the 256 medico legal cases that were gathered for the study at a temperature of 0 to 8 degrees Celsius. The test for determining if postmortem lividity was fixed involved pressing the deceased person's livid area with the thumb for 30 seconds. If blanching was observed, it was deemed that postmortem lividity was not fixed at the time of postmortem examination. The cases were divided into four groups based on the postmortem interval: 0-6, 6-12, >12-18, and >18-25.

### Data Analysis:

Data analysis has been done with the help of a computer and statistical software. All data from the proforma has been compiled in a master chart, and analyzed by calculating Mean, Standard Deviation range, and percentage. The data was also tabulated, and appropriate inferences were drawn from the data.

## Result

All the cases were classified into different age groups with a range of 10 years. The youngest victim was 9 years old while the oldest was 80 years old. The mean age was 39.89. The mean age for male victims was 40.94 years and for females was 35.68 years. ONLY 3 cases were reported from the age group 0 to 10 years.

It is concluded that 205 (80.08 %) were males and 51 (19.92 %) were females. The ratio of male to female cases was 4:1 (Table 1).

The maximum no. of cases belonged to the age group 21-30 years (n= 66, 25.78 %) followed by the age group 31-40 years (n= 47, 18.36 %) whereas the Minimum no. of cases belonged to age group 0-10 years (n=3, 1.17 %) followed by age group 70-80 years (n=9, 3.52 %)(Table 1).

The cases were categorized by age group in view of the fact that handling bodies during the day changes the way post-mortem staining forms and becomes fixed. The cause of death also determines the occurrence, area of distribution, color, and fixation of post-mortem staining hence the cases were categorized according to the cause of death. Maximum death occurred due to Road traffic accidents (n=119, 46.48%), followed by sudden death (n=50, 19.53%) and hanging (n=35, 13.67%) respectively. (Table 2)

There were 49 cases out of a total of 256 cases that died due to hemorrhage and shock including road traffic accidents and railway injuries, in these 19.14% of cases the homogenous development of post mortem staining area could not be appreciated even after 6 hours following death.

In most cases (97.65%, 250 out of 256 cases) the lividity appreciated at the posterior surface and dependent areas of the body. Among 6 cases of death due to hanging, the typical glove and stocking distribution of staining.

In all 256 cases, the color of post-mortem staining was purple, and the post mortem staining was well appreciated in persons with fair complexion. It was recognized that the development of lividity does not

happen in the body's pressure points, such as the areas where the body rests on a table or the ground, or along areas where clothing is too tight.

In all cases, the exact time of death was available as they were documented in hospital case sheets and also the time since death was considered based on history and inquest report. The earliest time the post mortem staining started to develop as small patches was by 1 hour following death and late development as small patches was observed to be 12 hours following death in a case of road traffic accident. The earliest time the post mortem staining developed homogeneously as big patches was 3.5 hours following death and late development was observed to be 23 hours following death. (Figure 1 & 2)

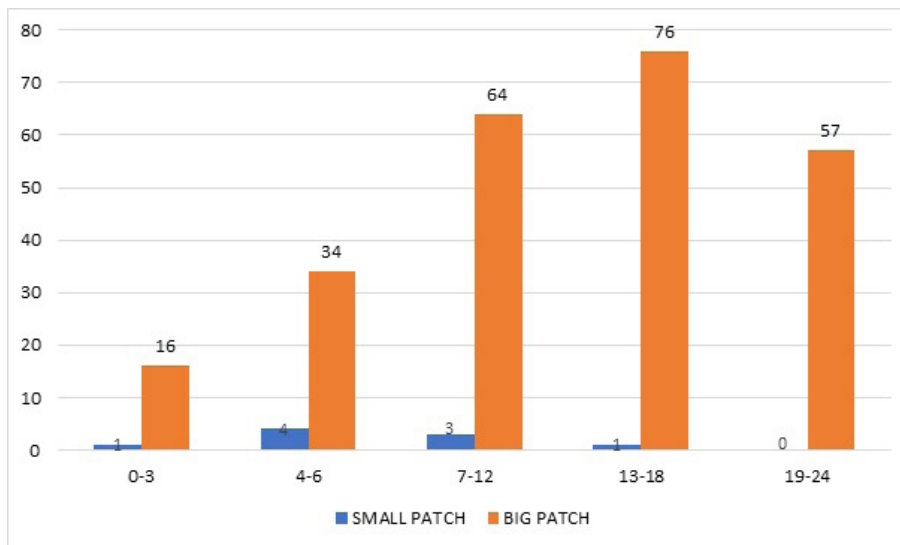
In the majority of cases, well-developed Post-mortem Lividity was seen in 86.33 % followed by diffuse form in 10.16%, Uniform in 2.73%, and patchy in 0.78%. the cases examined between 0-6 hours after death, post mortem lividity was developed but not fixed in the majority of the cases [n= 40 (93.02 %)]. In the examined cases between 6 -18 hours after death post mortem lividity was developed well and fixed in [n=198 (92.96 %)] cases. Post-mortem lividity starts to develop early in 55 minutes as a patchy form in most dependent areas while well development of PML was observed in 7 hours 15 minutes. The average time of development of the lividity is 4 hours 19 minutes  $\pm$  4 hours 13 minutes SD. In the present study, PML starts to be fixed at 3 hours and 5 minutes, and later on, it is fixed so on. The average time of fixation of the lividity is 13 hours 17 min  $\pm$  5 hours 29 minutes SD.

**Table 1: DISTRIBUTION OF CASES ACCORDING TO AGE AND GENDER**

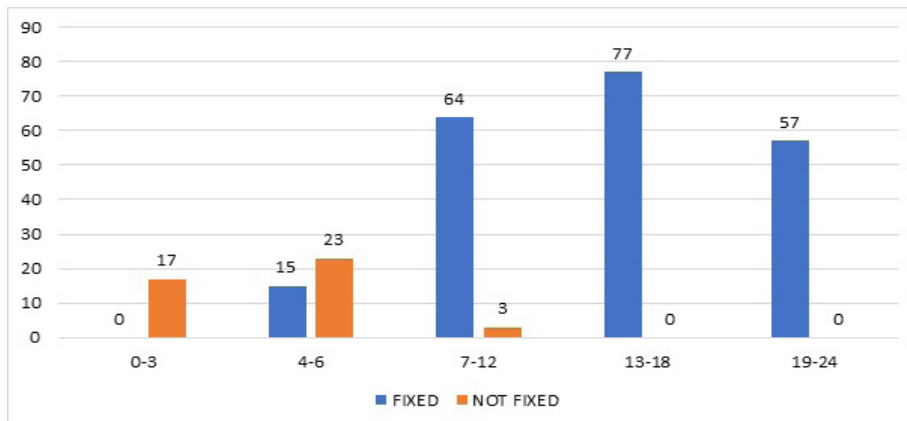
AGE GROUP	MALE	FEMALE	TOTAL	PERCENTAGE
0-10	2	1	3	1.17%
11-20	20	8	28	10.94%
21-30	48	18	66	25.78%
31-40	40	7	47	18.36%
41-50	29	5	34	13.28%
51-60	37	4	41	16.02%
61-70	22	6	28	10.94%
71-80	7	2	9	3.52%
TOTAL	205 (80.08%)	51 (19.92%)	256	100%

**Table 2: DISTRIBUTION OF CASES ACCORDING TO CAUSE OF DEATH**

CASES	NO. OF CASES	PERCENTAGE
ROAD TRAFFIC ACCIDENT	119	46.48%
SUDDEN DEATH	50	19.53%
HANGING	35	13.67%
POISONING	19	7.42%
FALL FROM HEIGHT	16	6.25%
HOMICIDE	8	3.13%
DROWNING	5	1.95%
ELECTROCUTION	3	1.17%
RAILWAY ACCIDENTS	1	0.39%
TOTAL	256	100%



**Figure 1: Time Since death and area of development of staining**



**Figure 2: Time since death and fixation of staining area**

**Discussion**

The post-mortem staining appears as small mottled patches of 1-2 cm. These small patches

gradually coalesce together to form homogenous big patches. The same was concluded in a similar study by Raymane et al.<sup>4</sup> In our study, the earliest

documentation of post-mortem staining was within 1 hour following death and the staining developed as big patches by 3.5 hours, while maximum cases showing big patches were by 12-18 hours (30%) following death and it was found to be statistically significant. In a similar study by Gradwohl et al<sup>5</sup>, it was learned that the staining appears as small patches in 0.5 hours and is well appreciated as big patches in 6-10 hours. Vander at et<sup>6</sup> in his study on postmortem staining documented the earliest formation of small patches by 1 hour and big patches by 8-12 hours. From a study done by Sharanagouda M Arikeri et al<sup>7</sup>, it was learned that the post-mortem staining starts appearing as small patches by 2 hours and coalesce into big patches by 9-12 hours. In a maximum number of cases (95.94%) lividity is appreciated at the posterior surface and dependent areas of the body.

The study done by Shailendra G. Dhawaneet al<sup>8</sup> showed male-female ratio was 3:1 and most of the study population belongs to the 21-50 years of age group (67.64%) and concluded that PM lividity developed within 7 hrs was not fixed & PM lividity developed after 7 hrs was fixed, while in this study, we found 4:1 male to female ratio and 57.42% study population belong to 21-50 years of age group and concluded that PM lividity developed within 6 hrs was not fixed & PM lividity developed after 6 hrs was fixed.

### Conclusion

Post mortem Lividity starts appearing as a patchy form by 1-7 hours and well develops by 7-13 hours. Post mortem Lividity gets fixed by 8-18 hours following death. Post mortem Lividity prolongs in case of shock and hemorrhage i.e., Road Traffic

Accident, Fall from height, homicide. As compared to poisoning, hanging, and sudden death.

**Conflict of interest:** None to declare

**Source of Funding:** None to declare

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