An Observation of Cooling of Dead Body for Estimation of Time Since Death in IGIMS, Patna, Bihar

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ABSTRACT
Background: Cooling of body after death is also known as Algor Mortis. Now a days recording of temperature of a dead bodies has its medico-legal importance in connection with determination of time since death. It is variable and depends upon various factor including the atmospheric temperature of a particular region.

Aim & Objective: The main objective of this objective was to record the fall of temp in dead body as supportive data for determination of time since death at Patna (Bihar). Materials & Methods: The present study was conducted on 140 dead bodies brought for post-mortem examination at IGIMS, Patna from September 2016 to March 2018 after clearance of ethical committee.

Results: Between 3 to 6 hours after death, temperatures were recorded by 96.6˚F to 95.6˚F in 37.50% of cases and in 28.12% cases by 95.6˚F to 94.6˚F and in 34.37% cases by 94.6˚F to 92.6˚F. In the cases examined during 24 hours to 36 hours after death rectal temperatures were found to be lowered by 78.6˚F to 74.6˚F in 0.08% cases, and in 91.66% cases bodies were found to be cooled to environmental temperature.

Conclusion: The most important responsibility of the doctors performing post mortem examination to answer this point as precisely and accurately as possible. It is manifestly impossible to say the exact moment of death but a near approximation may be reached by closely recording of rectal temperature every half hourly for three hours.

Keywords: Dead Body, Algor Mortis, Rectal Temperature.

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INTRODUCTION
Cooling of body after death is also known as Algor Mortis.¹ Now a days recording of temperature of a dead bodies has its medico-legal importance in connection with determination of time since death. Cooling of body or algor mortis is due to loss of all physical, chemical and metabolic functions of the body after death.² In a living person body temperature is maintained at a level by heat gain equal to heat loss. Heat gain is obtained by metabolic activities at a cellular level whereas heat loss is obtained by catabolism. The process of metabolism and catabolism is so minutely balanced that the body temperature remains constant. After death there is no heat gain but there is constant loss of body heat until it comes to the level of environmental temperature.³ This phenomenon is completed by the help of conduction, convection, radiation and evaporation. It is variable and depends upon various factor including the atmospheric temperature of a particular region. Lot of studies are conducted in Europe, Latin America and other parts of world but few in India and other tropical countries. India itself has all type of climatic variants from North to south.

In Patna (Bihar) which is grassland of north India has four primary climate ie. Summer, winter, spring and rainy season. All have different atmospheric temperature which affect the algor mortis to a large extent. The result of algor mortis is certainly a supportive data for establishing time since death in a dead body.⁴ ⁵ It is known that whatever parameter we use, they are subjected to a wide range of variation and are affected by various factors like age, sex, built, condition of the body, personal resistance, place, environmental condition, cause of death, clothing etc. so the parameters should be graduated and treated for different place, in different season and for different individual characteristics so that time elapsed since death can be calculated in possibly narrow range in particular case.⁷ Due to these variations the findings by various foreign workers who have worked in different atmospheric condition and places and in different ethnic groups may not be of great value in solving the day-to-day problems of doctors doing post-mortem examination in IGIMS Patna.
The main objective of this objective was to record the fall of temp in dead body as supportive data for determination of time since death at Patna (Bihar).

**MATERIALS & METHODS**

The present study was conducted on 140 dead bodies brought for post-mortem examination at IGIMS, Patna from September 2016 to March 2018 after clearance of ethical committee.

**Study Design:** Prospective and Observational study

**Exclusion Criteria**

- Mutated and decomposed bodies
- Known to be suffering from HIV, Hepatitis B
- Heatstroke
- Septicaemia
- Strychnine poisoning
- Pontine Hemorrhage

**Materials**

- Laboratory thermometer (for environmental temperature)
- Clinical thermometer (for rectal temperature)

The rate of cooling was calculated by the formula evaluated as:

\[
\text{Rate of Cooling}^{10,11} = \frac{\text{Rectal temperature at the time of death} - \text{Rectal temperature after body was found}}{\text{Rate of temperature fall}}
\]

**RESULTS**

**Demographics Profile**

In the present study total 140 cases were examined in which 114 cases were male and 26 cases were female. 11% cases (15 cases) were falls in the age range between 0-18 years, 59% cases (83 cases) in between 19-40 years, 23% cases (32 cases) in between 41-60 years and 7% cases (10 cases) above 60 years of age. The total cases observed was of different type of case in which 58% RTA is highest in number, 23% Firearm injury, 10% Poisoning, 7% Hanging, 1% Acute gastroenteritis and remaining 1% were died due to Electrocution.

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Cooling of Dead Bodies

Rate of cooling of body were found to be variable depending upon the various factors. Between 3 to 6 hours after death, temperatures were recorded by 96.6˚F to 95.6˚F in 37.50% of cases and in 28.12% cases by 95.6˚F to 94.6˚F and in 34.37% cases by 94.6˚F to 92.6˚F.

In cases examined during 6 hours to 12 hours after death, temperatures were recorded by 93.6˚F to 91.6˚F in 53.84% cases, by 90.6˚F to 89.6˚F in 23.07% cases, by 88.6˚F to 86.6˚F in 17.94% cases. Whereas 0.02% cases body was found to be cooled to the level of environmental temperature.

In cases examined during 12 hours to 18 hours after death, rectal temperature were recorded by 88.6˚F to 86.6˚F in 30.30% cases, by 84.6˚F to 80.6˚F, in 12.12% cases. Where as in 57.57% Cases body was found to be cooled to the level of environmental temperature.

In the cases examined during 24 hours to 36 hours after death, rectal temperature were found to be lowered by 78.6˚F to 74.6˚F in 0.08% cases, and in 91.66% cases bodies were found to be cooled to environmental temperature.

DISCUSSION

It was observed in this study that the rate of cooling of dead bodies in Patna, Bihar was variable in different seasons. It is because of the fact the atmospheric temperature in this part of India is greatly variable in different season group as compared to other part of India. The difference between the body temperature and surrounding atmosphere is wide and naturally the dead body has to cool of the variable range of temperature. The people of Bihar are comparatively of average weight than the general population in western European countries. Consequently the amount of heat loss is moderate in Bihar. In majority of dead bodies studied in this work the cause of death was hemorrhage and shock as a result of RTA. As loss of blood causes much heat loss from body so this factor is responsible for more rapid cooling rate. The temperature difference between the atmosphere and the dead bodies was greater in winter and lesser in summer. So that time taken to cool the body were found to be very much variable.

CONCLUSION

How long has a body been dead? This is a vexing problem to the medical jurists, forensic expert and police officers in their day to day official duties in dealing with medico-legal cases. The most important responsibility of the doctors performing post mortem examination to answer this point as precisely and accurately as possible. It is manifestly impossible to say the exact moment of death but a near approximation may be reached by closely recording of rectal temperature every half hourly for three hours.

There are various factors influencing the post mortem changes displayed in dead bodies, some being personal relating to the dead bodies and others climatic, atmospheric and seasonal and depending on the surrounding medium in which the bodies lie. As such there have been wide variation in the findings of different authorities; foreign and Indian, regarding the time of appearance and duration of these changes.

From this point of view to know these temperature changes and how they develop in Bihar to find out whether these finding tally or differ in this part of the country with other authentic workers. This study on temperature changes especially rectal temperature changes of dead bodies under the local atmospheric conditions have been undertaken to estimate the time since death.
REFERENCES

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Conflict of Interest: None Declared.

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