



Full Length Research Article

“ESTIMATION OF TIME SINCE DEATH FROM HISTOLOGICAL CHANGES IN HEPATIC CORDS AND HEPATIC LOBULES OF HUMAN LIVER”

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ABSTRACT

Estimation of time since death is one of the most important object of postmortem examination. Time passed since death continues to be a major problem for the forensic pathologist and its determination plays an important and vital issue in medicolegal cases because of the fact that forensic experts are very often required to answer questions relating to time of death in the courts of law.^{1,2} Present study 30 human livers from cadaver were taken directly from the dead bodies during postmortem examination from Dr. B.R. Ambedkar Memorial Hospital Raipur (C.G.) in close association with Department of Forensic Medicine & Toxicology and Pathology. In the present study histological changes in architecture of hepatic lobule and hepatic cords and arrangement of hepatocytes of human liver were examined. Increasing expansion of hepatic lobules were seen in relation to time after death and after 44hrs Post Mortem Interval (PMI) at 23.3-30.5°C disorganization of hepatic lobules were observed. Fragmentation of hepatic cords was observed after 13.30 hrs PMI at 29.1-43.1°C adjacent to central vein and was progressive in hepatic cords adjacent to portal triad in relation to time passage. Hepatic cords in subcapsular region were observed intact till 39.40hrs PMI at 24.3-32.2°C and there was complete fragmentation of hepatic cords with scattered hepatocytes after 44hrs PMI at 23.3-30.5°C. Hepatic lobules were not identifiable after 46 hrs PMI at 23.3 to 30.5 °C. Thus Postmortem histological changes were directly dependant on not only the length of post-mortem time but also, to a bigger extent, on the temperature of environment.

Key words: Time Since Death, Hepatic Lobule, Hepatic Cords, Liver

INTRODUCTION

The traditional methods of ascertaining the time since death based on naked eye observations of the gross changes in a dead body occurring after death to provide a rough approximation of Post Mortem Interval (PMI), at best only and would appear to be still the closest approximation of the time passed since death in a given case. Estimation of time since death is one of the most important object of postmortem examination. Time passed since death continues to be a major problem for the forensic pathologist and its determination plays an important and vital issue in medicolegal cases because of the fact that forensic experts are very often required to answer questions relating to time of death in the courts of law (Kushwaha *et al.*, 2009). After death, due to deprivation of blood supply, every organ undergoes series of gross as well as histological changes. Most of the organ in human body undergoes coagulative necrosis, cell swelling, cell membrane disruption, staining changes in cytoplasm, enzymatic digestion of cellular organelles, nuclear changes like pyknosis, karyorrhexis and karyolysis *et* (Goldstein *et al.*, 2007).

Till now studies have been done on muscles, kidney, liver, RBCs WBCs etc. of various animals to estimate the time after death (Kimura and Abe, 1994; Munger and Mc Gavin, 1971; Tomita *et al.*, 1999). A few of studies also performed for same purpose on various organs of human beings (Kushwaha *et al.*, 2009). Liver is one of the most active and important organ of human body where anabolic as well as catabolic reactions take place.

The biochemical changes taking place in hepatic tissue after death are reflected in certain alterations in its histological appearance. With this important factor in view, liver has been chosen for the present study as it is liable to present certain definite microscopic changes of cell atrophy, cytoplasmic changes, sinusoidal dilatation, karyopyknosis of endothelial cells and other general cell structure. Till now the histological changes in liver after death have been studied in various animals (Kimura and Abe, 1994; Munger and Mc Gavin, 1971; Tomita *et al.*, 1999) but yet very few studies with same view which may provide keen and fruitful results for human liver have been done. That's why this present study is being carried out with this hope that it will be helpful for estimation of time after death which is very critical and one of the most important job for a forensic expert.

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MATERIALS AND METHODS

This study was performed in Department of Anatomy in close association with the Department of Forensic Medicine & Toxicology and Pathology, Pt. J.N.M. Medical College and Dr. B.R. Ambedkar Memorial Hospital Raipur (C.G.). Present study was done on human cadaver. Material for the present study was liver, taken directly from the dead bodies during postmortem examination. Human liver was obtained as and when available from cadavers at the time of autopsy. It was removed from cadavers with a known time of death where death had resulted from natural death, suffocation and trauma. The stages for which it was available were between 3.30 - 4.30, between 10- 20 hrs, 39.40, 44 and 46 hrs. In the present study 30 cases were studied.

In each case liver was studied histologically. Following parameters were taken

- Architecture of hepatic lobules
- Arrangement of hepatocytes in hepatic cords

Inclusion Criteria

- Deceased with average health and without any history or evidence of any liver disorder
- The exact time of death of individual must be known

Exclusion Criteria

- Deceased of unknown time of death and diseased liver.
- Deceased individual suffering from amoebic hepatitis, infective hepatitis, cirrhosis of liver, congestive heart failure, bleeding disorders, hemolytic anaemia, etc.

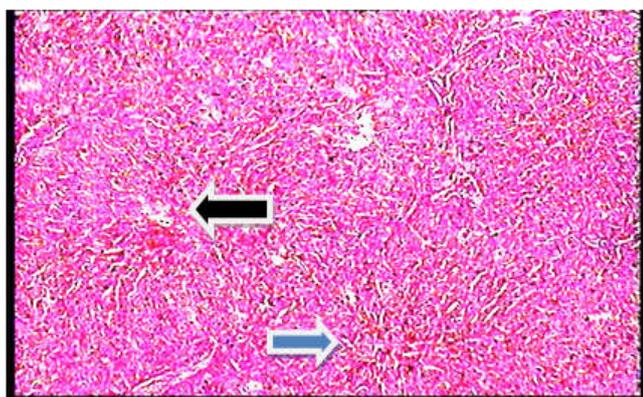


Fig. 1. [4.10hrs, 11/25.8°C, H & E stain, 4X]. Photomicrograph showing hepatic lobule with intact hepatic cords & brown pigments [blue arrow] in hepatocytes adjacent to central vein [Black arrow]

RESULTS AND DISCUSSION

Study no-1. PMI - 3.30hrs, Temperature- 27.5/ 42.2°C, Humidity- 14/41%

Study no-2. PMI - 4.10 hrs, Temp - 11/25.8° C, Humidity- 42/82% [Fig. 1]

Study no-3. PMI- 4.30 hrs, temp- 11/ 25.8° C, humidity- 42/44%

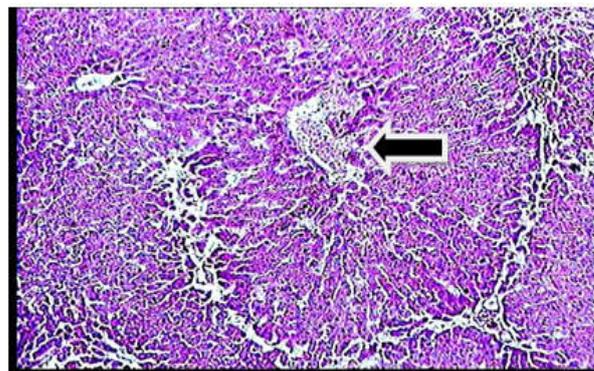


Fig. 2. [12.50 hrs, 23.8/39.3°C , H & E stain, 4X]. Photomicrograph showing expansion of hepatic lobule with intact hepatic cords, dilated sinusoids & blood in central vein

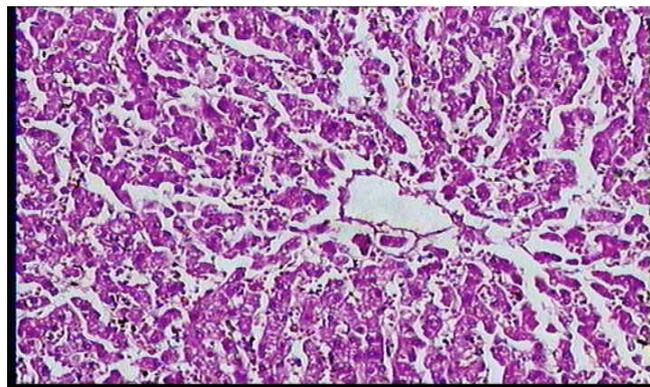


Fig. 3. [13.30 hrs, 29.1/43.1°C , H & E stain, 10X]. Photomicrograph showing fragmentation of hepatic cords [13.30 hrs] adjacent to central vein

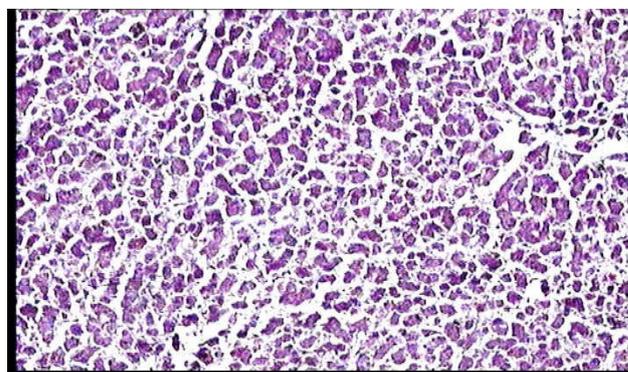


Fig. 4. [46 hrs, 24.3/30.5°C , H & E stain, 10X]. Disorganization of hepatic lobule with complete fragmentation of hepatic cords and hepatocytes are separated from each other

- Hepatic lobule- architecture is maintained, slightly expanded.
- Hepatic cord- architecture is maintained, hepatocytes are arranged in cords.

Study no-4. PMI-10 hrs, temp-23.1/34.4°C, humidity-18/46,

Study no-5. PMI-10 hrs, Temp-8.2/23.9°C, humidity- 26/83%,

Study no -6. PMI-11 hrs, Temp-23.1/34.4°C, humidity- 18/46%

- Hepatic lobule- organized but expanded.

- Hepatic cord- maintained, hepatocytes are arranged in cords.

Study no-7. PMI-12.50hrs, Temp-23.8/39.3°C, humidity-18/35% [Fig. 2]

Study no-8. PMI -13 hrs, temp-8.2-23.9°C, humidity- 26-83%,

Study no-9. PMI-13.30 hrs, temp-29.1-43.1°C, humidity- 23-43% [Fig. 3]

- Hepatic lobule-expanded.
- Hepatic cord-fragmented more adjacent to central vein.

Study no -10. PMI-13.45 hrs, temp-10.5-28°C, humidity-34-68%,

Study no.-11. PMI-14 hrs, temp-10.5-28°C, humidity-18/37%,

Study no.-12. PMI-14 hrs, Temp-24.5-38.6°C, humidity-34/68%

- Hepatic lobule- expanded.
- Hepatic cord-broken at most places.

Study no-13. PMI-14.30hrs, temp-21/39°C, humidity-8/36%

Study no-14. PMI-14.55 hrs, temp-11/25°C, humidity-39/82%

Study no-15. PMI-15hrs, temp-11/25°C, humidity- 39/82%

Study no -16. PMI-15.30 hrs, temp-17.3/27.7°C, humidity-71/94%

- Hepatic lobule- expanded.
- Hepatic cord- broken at many places, but in subcapsular region hepatic cords is intact.

Study no -17. PMI-16 hrs, Temp-27.5/42.2°C, Humidity-12/59%

Study no.-18 PMI-16 hrs, Temp-18.6/28.2°C, Humidity-78/98%

Study no.-19 PMI-17 hrs, Temp-27.5/42.2°C, Humidity-12/59%

- Hepatic lobule-expanded.
- Hepatic cord-hepatocytes arranged in cords.

Study no.-20 PMI-17.20 hrs, Temp-18.6/28.2°C, Humidity-78-98%

- Hepatic lobule-expanded hepatic lobule.
- Hepatic cord-disorganized adjacent to central vein.

Study no-21. PMI-17.30hrs, Temp-23.3/26.6°C, Humidity-84/88%

- Hepatic lobule-expanded.
- Hepatic cord-fragmented.

Study no-22. PMI-18 hrs, Temp-8.2/23.9°C, Humidity-26/83%,

Study no-23. PMI-18 hrs, Temp- 27.5/42.2°C, Humidity-12/59%

- Hepatic lobule-expanded.
- Hepatic cord- arranged in the hepatic cords mostly but in fragments of hepatic cords at places also.

Study no-24. PMI-18.30hrs, Temp-29.6/45.2°C -, Humidity-25/51%

- Hepatic lobule-expanded.
- Hepatic cord- completely fragmented.

Study no.-25. PMI-19hrs, Temp-8.2/23.9°C, Humidity-26/83%,

Study no.-26. PMI-19hrs, Temp-26.5/42.1°C, Humidity-18/37%,

Study no.-27. PMI-20hrs, Temp-24.3/40.6°C, Humidity-16/46%

- Hepatic lobule-expanded.
- Hepatic cord-fragmented.

Study no-28. PMI-39.40hrs, Temp-24.3/32.2°C, Humidity-68/87%

- Hepatic lobule- markedly expanded.
- Hepatic cord- fragmented.

Study no.-29- PMI-44hrs, Temp-23.3/30.5°C, Humidity-83/92%,

Study no.-30 PMI-46hrs, Temp-23.3/30.5°C, Humidity-83/92% [Fig. 4]

- Hepatic lobule- disorganized completely.
- Hepatic cord- fragmented completely.

Conclusion

In the present study the post mortem histological changes after 3.30 to 4.30 hrs Post Mortem Interval (PMI) at 11 to 42.2 °C temperature were expansion of hepatic lobules, mild dilatation of sinusoids and central vein, oedema in epithelial wall of Interlobular Bile Duct (IBD) in the portal triad, and oedematous hepatocytes with vacuolated cytoplasm and vesicular nucleus having nucleolus. Expansion of hepatic lobule and dilatation of sinusoids after 3.30 hrs PMI (27.5 to 42.2 °C) was more than that of 4.10 hrs PMI (11 to 25.8 °C) and 4.30 hrs PMI (11 to 25.8 °C). Architecture of hepatic lobule was maintained. Hepatic cords were intact [Fig.1]. In the present study between 13 hrs to 14 hrs PMI at 8.2 to 43.1°C findings were progressive expansion of hepatic lobules, fragmentation of hepatic cords [Fig. 2]. Fragmentation of hepatic cords was observed after 13.30 hrs PMI (29.1 to 43.1 °C) adjacent to central vein [Fig. 3]. The architecture of hepatic cord was maintained.

Kushwaha *et al* found in their study after 13- 18 hrs PMI, with increasing temperature of up to 31 to 35°C, found moderate & severe changes i.e. architecture is maintained, cloudy swelling of cytoplasm more, cord pattern maintained, sinus dilatation while only 3 cases out of 13 cases show severe changes at temperature range 26 - 30°C, 3 out of 5 cases show mild cloudy swelling in cytoplasm, only 2 cases show severe changes. In a study done on liver tissues of goat by Chandra N. and Naresh M. found Loss of alignment of the liver cells after 48 hrs in open air and pond water and on 21st day in tissue kept in a refrigerated

temperature. In the present study between 13 hrs to 14 hrs PMI at 8.2 to 43.1°C findings were progressive expansion of hepatic lobules, fragmentation of hepatic cords, dilatation of sinusoids and central vein but hepatic cords were intact in subcapsular region. Fragmentation of hepatic cords was observed after 13.30 hrs PMI (29.1 to 43.1 °C) adjacent to central vein. The architecture of hepatic cord was maintained, blood was present in the central vein after 12.50 hrs (23.8 to 39.3°C) and after 13 hrs PMI (8.2 to 23.9°C). Kushwaha *et al.*, 2009 stated after 13- 18 hrs PMI, with increasing temperature of up to 31 to 35°C, moderate & severe changes are seen i.e. architecture is maintained. Between 17 hrs to 20 hrs PMI at 8.2 to 45.2°C findings in most of the cases were marked expansion of hepatic lobules which were widely separated from each other also. Hepatic cords were fragmented but intact mostly in the subcapsular region. After 17.20 hrs PMI (18.6 to 28.2 °C) hepatic cords were fragmented adjacent to central vein while intact adjacent to portal vein. After 18 hrs PMI (8.2 to 23.9 °C) hepatic cords were intact in most of the places including in the sub capsular region. After 19 hrs PMI (8.2 to 23.9°C) hepatic cords were maintained in most of the places. At 20 hrs PMI (24.3 to 40.6°C) fragmentation of hepatic cords adjacent to central vein as well as adjacent to portal triad.

After 44 hrs PMI at 23.3 to 30.5 °C findings were marked expansion of hepatic lobule and at places disorganization also, complete fragmentation of hepatic cords, hepatocytes were scattered not arranged in cords remarkable changes in hepatocyte was the karyopyknosis at places. Kimura M, Abe M. found in rat that there was atrophy of hepatocytes after 48 hrs at 5°C. In present study after 46 hrs PMI at 23.3 to 30.5 °C findings were disorganization of hepatic lobule, complete fragmentation of hepatic cords. Hepatocytes were scattered, not arranged in hepatic cords, oedematous as well as shrunken also.

In the present study hepatic cords were observed to be intact after 11 hrs PMI. Occurrence of the fragmentation of the hepatic cords were seen at 13.30 hrs PMI (29.1 to 43.1°C) adjacent to central vein but hepatic cords were intact adjacent to portal triad. After 14 hrs PMI (21.9 to 38.6 °C) hepatic cords were broken at most of the places but in the subcapsular region hepatic cords were intact. After 44 hrs PMI at 23.3 to 30.5 °C complete fragmentation of hepatic cords was seen with scattering of hepatocytes [Fig. 4].

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