

Medico-Legal Importance of Ocular Signs in Determining Times since Death; a Study from Rural India



Medical Science

KEYWORDS : Post mortem; Ocular signs; Times since Death; medical Ethics; rural India.

Dr. Anupama Tandon

Associate Professor (Ophthalmology). UP Rural Institute of Medical Science and Research safai. Etawah (U.P) India.

Dr. Alok Kumar

Additional Professor & Head (Forensic Medicine & Toxicology). UP Rural Institute of Medical Science and Research safai. Etawah (U.P) India.

ABSTRACT

Aim: present study was aimed at confirmation of death by examination of eye as well as to evaluate time since death through ocular changes (extra ocular, intraocular and retinal changes).

Study design: Prospective, noncomparative and non interventional.

Material and Methods: This study includes thorough eye examination of 12 dead bodies of individuals of 40-55 years of age, from Nov. 2011 to Dec. 2013. No external preservative was used in eyes. Direct and Indirect Ophthalmoscopy was done for Retinal Examination. Results: In all cases both eyes were examined. Most deceased were around ± 50 years. As far as ophthalmic features are concerned; retinal changes remain the mainstay for the estimation of time since death. Most common retinal sign was segmentation of blood in large vessels, seen in more than 50% of cases. Extraocular signs were also helpful in 50% of cases but they can only be considered as added information to retinal changes. 6 dead bodies were from Road Traffic Accidents (RTA); 2 dead bodies had other symptoms like papilloedema with haemorrhages when other causes i.e. meningitis were considered.

Conclusions: The external ocular changes and final retinal changes can determine time since death in minutes (moving segments) or hrs for up to 24 hours. Later on, only necrosis can be reported. This study is particularly useful in determining the time of death in recent cases for various medico-legal issues.

Introduction:

The interval between death and time of examination of body is called post-mortem interval (PMI). This is important to know when the crime was committed. It provides a starting point to the investigating authorities, for their inquiries and allows them dealing more efficiently with the information available. It might enable to exclude some suspects and search for the likely culprits and to confirm or disprove an alibi and to check on suspect's statement. The most important medico-legal issue in any post-mortem Examination is to determine time since death. Accurate determination of post-mortem interval, applies not only to civil law, in which ascertaining the exact time of death is of practical necessity in settling family, social and business matters but also to criminal law, where the accurate determination of time since death may either exclude or include a suspect or accused of particular homicide. Since time immemorial, it was known that stiffening, cooling and certain other changes in the physical appearance of a body, takes a short time after death, but these changes are not much accurate in estimating PMI. Later on biochemical estimations were introduced to assist precise estimation of the time since death. But these sophisticated, automatic, biochemical methods demands a modern setup, trained technicians and good infrastructure, which is not commonly available in most of hospitals of developing countries, particularly in rural and remote areas.

Post mortem eye changes are important evidences to assess post mortem interval. Post-mortem eye changes have been discussed extensively in almost every forensic literature. These changes are helpful in assessing the brain death, early signs of death and post-mortem interval (PMI)¹ However, ocular signs are not conclusive evidence of death; rather they are only supportive evidences.

A detailed knowledge of post-mortem eye changes is necessary to provide eye banking services to the community. Present Study was conducted to observe post-mortem eye changes. The whole study depended on former condition of the patient, certain individual peculiarities, the mode of death, the environment in which the body is kept influence the ocular signs.

The chronological changes occurring in retina after death were first studied by Bouchut (1863). He advanced them as constituting the earliest and most accurate signs of death. These are actually signs of cessation of blood flow to the bulb as discussed below².

1. Central Retinal artery and branches become pale with the blood in them at first granular for minutes.
2. Colour changes in the retina and choroidal coats. Retina and choroids become pale and optic disc ghastly white and sharply outlined. The pallor starts at disc at disc and later progresses to periphery. Macula appears as red spot and later deep grey after hours.
3. Retinal venous changes: Blood in veins become beaded. The segments continue to move smoothly for 10-20 minutes after death and finally become static. Finally magenta coloured venous segments on a grey retina with no traces of artery.

The only known vital process which mimics retinal vascular changes is central retinal artery occlusion but changes are slow.

Main objectives of the present study were to investigate the utility of ocular findings in estimating post mortem interval (PMI). In a rural setup where this study has been performed; this method based on ocular examination could be of immense value. To the best of author's knowledge, such study in a rural hospital of India has not been done previously.

Material and Methods:

This Prospective, randomized non interventional study includes 12 dead bodies of individuals of 40-50 years of age. They died due to various diseases in the hospital, or in RTA and were brought dead to the hospital or died immediately after the hospitalization. The study was conducted from Nov. 2011 to Dec. 2013 after approval of institutional ethics committee.

The information regarding exact time of death was gathered from police inquest report, dead body challan, clinical details from hospital records; correlated and checked from relatives, friends and attendants of the deceased. Cases where exact time of death was not known were excluded. All the information about the deceased i.e. age, sex, address, cause of death, exact time of death, temperature etc were recorded in a well structured proforma.

Cause of death was noted by forensic expert. Ocular examination included external examination with torchlight, pupillary reaction, and fundus examination with direct ophthalmoscope and digital tonometry. Ocular examination was performed by the ophthalmologist in the presence of the forensic expert. Ocular findings were noted and data was analyzed (Table-1).

The sophisticated instrumentation was not required but the experience of observers (the ophthalmologists and forensic experts) was of great value. The ocular examination was done in a special room with 32°C temperature and 101 luxmeter intensity light. All dead bodies underwent full examination in semi reclining position by ophthalmologists and forensic experts. It was difficult to see retina in 4 dead bodies as pupil was constricted so phenylephrine was used to dilate. To overcome lenticular changes as a hindrance; both direct and indirect ophthalmoscope was done. Green cobalt filter was helpful in determining level of blood vessels. Retina was seen through red green filter.

Normal physiological saline was used every 30 to 60 seconds to maintain corneal temperature. Since both eyes have similar changes in fundus at the time of death unilateral examination was sufficient but we examined both eyes to correlate these findings. The use of physiological saline allowed us to see details clearly for few hours.

After ocular examination, detail post-mortem examination carried out and the general relevant findings were documented in the proforma with details of livor mortis, rigor mortis, external and internal sign of decomposition.

Results:

In all 12 dead bodies both eyes were examined. Mean age of dead bodies was ± 50 years. When only ophthalmic signs and symptoms are considered retinal changes remain the mainstay of detection of time since death. Most common retinal sign was segment of blood in large retinal vessels in more than 50% of cases. Extraocular signs in almost half of cases were helpful but they can be only considered as added information to retinal changes.

6 deceased were victims of Road Traffic Accidents, 2 dead bodies had other symptoms like papilloedema with haemorrhages when other causes i.e. meningitis were considered.

Discussion:

Time since death is a question of day to day challenge faced by teams of investigators during their course of investigations. After somatic death certain tissues, cells and enzymes in the body continues to live individually or collectively for a period of time depending to some extent on the cause of death, condition of the cells or tissues before death and their oxygen requirement². Since the cornea of eye remains in direct contact to environment and continues to get oxygen for its metabolism, it remains viable for longer period until it is desiccated. This is the basic principle of eye banking and keratoplasty which is the simplest and most effective organ transplantation³.

All post-mortem ocular changes are classified as early post-mortem changes. Loss of corneal reflex, clouding of cornea, "tache noir" (wrinkled and brown corneal surface exposed between eyelids) are some of the post-mortem corneal changes⁴. Pupils are dilated and fixed initially but may be constricted with the onset of rigor mortis⁵. Pupils react to atropine for about an hour after death⁶. This simple test could be performed in few cases where the death was immediate. Typical findings in retina are fragmentation of blood column in retinal vessels (Cattle-truck appearance)⁷.

Retinal findings are inconclusive in present study which is in contrary to the work of Amberg R, Pollak S who reported that different patterns of fundoscopic findings seem to correspond to different types of injuries such as craniocerebral trauma, traumatic asphyxia and compression sickness and may allow some insight into the respective pathogenic mechanism⁸. Also, Dolezalova Y reported that examination of ocular fundus after death could contribute to the assessment of time of death⁹. Further study is required on this topic as it is a useful indicator of post-mortem interval.

To the best of authors knowledge this is the first such study in our region in which ocular signs after death have been used as a medico legal finding.

In 4 cases use of topical dilators was necessary as a cause of reaction to light. Extra ocular signs were taken into consideration in 6 cases for medico legal aspects when more than 12 hours have passed since death when no chronological retinal changes are visible (Pines 1931)¹⁰. The pallor of fundus and Optic disc was observed immediately after death. (Wurdemann 1920)⁷. The retinal arteries were not visible. The time 30 minutes can be calculated after death. The fundus findings of sudden modes of death like meningitis, IHD remain same.

Albrand determined the onset of death, body position and time by the persistence of venous cattle track at 6 hours¹¹. Gayet concluded that the existence of papilloedema and sub retinal haemorrhages can determine mode of death which can be as a result of pre-existing disease¹².

As the circulation stops venous blood segmentation occurs. The CRAO is the only process which produces Retinal vascular changes similarly. Clinical death i.e. segments move is of importance in resuscitation cases.

Conclusion:

Present study gives a concise description of various post-mortem eye changes and their applicability in calculating PMI. To find out the exact time of death is of immense value particularly in medico legal cases as well as for developing eye banking services. Further studies with larger number of cases need to be performed. This study can be adjunct to other similar post-mortem ocular studies in estimating post mortem interval so as to reduce the error in estimating time since death. Ocular changes can play a vital role in estimation of time since death in recent cases. Such examination is particularly significant in hospitals where more sophisticated methods and experts are not available.

Source(s) of support: Nil

Conflicting Interest: None declared.

REFERENCE

1. Taylor's principles and practices of medical jurisprudence. Thirteenth edition 1994; pp.130-6(24) | 2. Bouchut, E. Atlas d' Ophthalmoscope medicate et de Cerebroscopie. J.b. Bailliere et Fils, paris, 1876, pp. 56-57. (figure 111, opposite p. r39, "Le fond de l'oeil après la mort.") | 3. Basic surgical principles of penetrating keratoplasty. www.ncbi.nlm.nih.gov/pubmed/2043555 by JD Lanier - 1991 - Cited by 2 - Related articles. | 4. Salisbury, C.R., and Melvin, G.S. Ophthalmoscopic signs of death. Brit. M.J. 1936, 1, 1249-125. | 5. Henssge C, Knight B, Krompechen T, Madea B, Nokes L 1995. The estimation of the time since death in the early post mortem Period, Edward Arnold, London. | 6. Narayan Reddy: The Essentials of Forensic Medicine and Toxicology, 17th Edition 1998: 117-8. | 7. Wurdemann, H.V. The fundus of the eye after death. Am. J. Ophth., 1920, 3, 32-3. | 8. Amberg R, Pollak S, Post mortem endoscopy of ocular fundus: A valuable tool in post mortem practice. Forensic Int 2001; 27, 124(2-3): 157-62. | 9. Dolezalova V, Post Mortem examination of ocular fundus to determine the time of death Cesk sol ophthalmol 1997; 53(1): 57-60. | 10. 212.117.161.3/genesis/259000/.../_as/534861_coinread.com. pdf pairs of electrocardiograms taken only 1 minute apart from 92 patients, the Pines J, Pines LU, Hall A, et al. | 11. Brain pdfs. journals.lww.com/jonmd/1907/03000/Brain.14.pdf. | 12. Gayet, a. The Ocular signs of death In: System of diseases of the Eye, Norris, W.F., and Oliver, C.A. (eds.) J.B. Lippincott Co., Philadelphia, 1900, 4, 907-919. |