

CHANGES IN THE LEVELS OF VITREOUS POTASSIUM WITH INCREASING TIME SINCE DEATH

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ABSTRACT:

This study was done to know the changes in the levels of potassium in the vitreous humour of eye with increasing time since death by flame photometry method. 200 cases brought to the mortuary of Govt. Medical College, Patiala, formed the material of this study. The cases were divided in 2 groups, burn cases (24) and non-burn cases (176). The data thus collected was analyzed statistically. It was found that the vitreous humour potassium concentration was increasing in a linear fashion with increasing time since death and this increase in the level was independent of the factors like age, sex, environmental temperature and humidity.

KEY WORDS: Potassium, vitreous humour, time since death.

INTRODUCTION:

For investigation of crime, it is very important to determine 'time since death' i.e. the interval between death and the time of postmortem examination also called as 'postmortem interval'. This is very important in criminal cases as it shows the track to the investigators to reach the suspected person and to obligate the innocent ones. In the matters of transfer of property also the time since death plays an important role and some times these matters depends solely on the time since death.

In spite of its great importance, to fix the time of death within the limits of probability is a recurring problem in forensic medicine. It is self-evident that the longer the time interval between death and the examination of the body the wider will be the limits of probability. The routine methods to estimate postmortem interval are cooling of body, changes in eye, postmortem staining, rigor mortis, decomposition changes, contents of stomach and bowels, contents of urinary bladder and circumstantial evidence. From these methods only the approximate time of death can be estimated.

Various body fluids like blood, spinal fluid, aqueous humour and vitreous humour of eye show chemical changes immediately or shortly after death. These changes progress in a fairly orderly fashion until the body disintegrates. Each change

has its own time factor or rate. Thus determination of these chemical changes could help the forensic pathologists to ascertain time since death more precisely [2].

The determinations that may prove valuable include the potassium content of the aqueous humour and lactic acid, ascorbic acid, non-protein nitrogen, sodium and chloride [5] and magnesium, phosphate and bicarbonate [10] content of the vitreous humour. Although no single measurement gives a completely reliable estimate of the postmortem interval, combinations of chemical determinations can be useful adjuncts in cases of un-witness death [4]. Amongst these vitreous humour of eye is relatively stable, less susceptible than other body fluids to rapid chemical changes and contamination, easily accessible and its composition is quite similar to that of aqueous fluid, cerebrospinal fluid and serum; thus it is suitable for many analyses to estimate postmortem interval [8].

The accurate prediction of time of death is of great value in medico- legal investigations of serious crimes, thus as a result several workers have reported the possibility of accurate prediction of time since death (within two hours), from measurement of the levels of potassium in the vitreous humour [1].

In this study a relationship between the potassium levels of vitreous humour collected separately from each eye and the increasing time since death was found.

MATERIAL AND METHODS:

Two hundred cases brought to the mortuary at Government Medical College; Patiala formed the material for collection of vitreous humour. The information regarding time of death was gathered from police records, hospital records and from eye witnesses, relatives, friends and attendants of the deceased. Cases where exact time of death was not known were not included in this study.

The cases were studied in two groups as burn and non-burn cases.

Two samples were drawn, the first from the right eye as early as possible after the delivery of dead body to the mortuary and the second from the left eye at the time of commencement of autopsy (only the clear samples were taken, samples having any particulate matter were discarded). All the information about the deceased i.e. age, sex, address, cause of death, exact time of death, time of each sampling, temperature and humidity were recorded.

Vitreous humour was collected at autopsy from the posterior chamber of the eye, slowly and gradually avoiding tearing of loose fragments of tissues by needle aspiration through a puncture made 5-6 mm away from the limbus using 10 ml sterile syringe and 20 gauze needle and was poured in a rubber stoppered vial. Syringe and rubber stoppered glass vials washed with deionised double distilled water and dried in hot air oven and were used for sampling. Liquid paraffin gel was injected in the posterior chamber of eye for cosmetic purposes.

As much of the vitreous humour as can be aspirated was removed because the vitreous humour next to the retina has a different concentration of solutes than in the central portion of the globe. The samples were analyzed in the Department of Biochemistry, Government Medical College, Patiala. Each sample was centrifuged at 3000rpm for 10 minutes and the supernatant fluid was taken for determination of potassium by flame photometry method [11] and the values were expressed in mEq/l.

OBSERVATIONS & DISCUSSION:

After determining the potassium concentration the statistical analyses was done which showed a highly significant increase in the levels of vitreous potassium with the increasing time since death in both the groups (Table 1) which was linear in fashion.

Further it was observed that the vitreous potassium levels were significantly higher in burn cases. So it is evident that there is a significant effect of temperature at the time of death on the levels of potassium (Graph 1).

When the samples from both the eyes were taken at the same time and analyzed separately, no significant difference was observed.

It was also observed that there was no effect of other parameters like age, sex, temperature and humidity on the levels of vitreous potassium.

CONCLUSIONS:

From the present study it is concluded that:

1. There is linear relationship between vitreous potassium concentration and time since death.
2. Potassium levels were found to increase up to 104 hrs.

Table 1 showing mean potassium concentration (mEq/l) in relation to time since death

TSD (hrs)	Mean K ⁺ (mEq/l) ± SD			
	Non-Burn Cases (176)		Burn Cases (24)	
	1 st Eye	2 nd Eye	1 st Eye	2 nd Eye
Within 12 hrs	05.66 ± 1.76	06.78 ± 2.11	6.05 ± 1.59	07.20 ± 0.64
12.1 – 24 hrs	08.59 ± 1.06	09.42 ± 1.14	9.84 ± 1.51	11.24 ± 1.34
Above 24 hrs	12.88 ± 2.49	12.14 ± 1.98	-	15.00 ± 0.00

3. The factors like age, sex, temperature and humidity have no appreciable effect on the concentration of vitreous potassium.
4. Potassium values in burn cases are found to be higher than the non-burn cases.
5. The levels of potassium in vitreous humour are found to be the same, when the vitreous samples from both eyes were drawn at the same time and were examined as separate samples.

SUGGESTIONS FOR FUTURE STUDY:

1. As we did not correlate the electrolyte concentration of the blood at the time of death which may disturb the vitreous electrolyte concentration, so these parameters should be included in the future studies [7].
2. The combined estimations of various electrolytes in body fluids can help in estimating time since death more precisely like 3-MT (3-methoxytyramine), in the putamen of the brain in combination with vitreous potassium [9] and using both potassium and hypoxanthine levels

in vitreous humor of eye can be included in the future studies [6].

3. The newer method of capillary zone electrophoresis (CZE) can help to achieve a rapid and simultaneous determination of inorganic ions in the extra cellular fluid and substantial improvement of postmortem interval prediction [3].

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