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Original Research Article

ESTIMATION OF TIME SINCE DEATH FROM THE CHANGES IN VITREOUS HUMOUR SODIUM (Na^+) AND POTASSIUM (K^+) LEVEL

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Abstract

Background: 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.

Methods: The present study was conducted in Forensic Medicine Department on cases died in Dr. S.N. Medical College & associated Group of Hospitals, Jodhpur in association with Department of Biochemistry.

Results: The linear correlation of the vitreous sodium (Na^+) ion concentration was found statistically insignificant (r=0.045) therefore the coefficient of correlation could not be derived.

Conclusion: We have observed linear rise of potassium (K^+) ion concentration in the vitreous humour. The linear relationship of the increase in vitreous potassium (K^+) ion concentration with increasing postmortem interval is both arithmatic as well as logarithmatic (statistically significant).

Keywords: Na, K, Postmortem.

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[3].

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

Material and methods

The Study has been carried out for a period of one year (04.06.2020 to 31-10-2020) at the Department of Forensic Medicine and Toxicology, in association with Department of Biochemistry, Dr. S. N. Medical College, Jodhpur. This study was done on 80 medico legal cases of death at Dr. S.N. Medical College, Jodhpur and attached M.G.H./M.D.M Hospital, Jodhpur. The information regarding time of death will be gathered from hospital records.

For the extraction of vitreous human following procedure is done:

The eyelid will be retracted with the help of self-retaining lid retractor. Vitreous fluid will be collected from posterior chamber of eye by needle aspiration through a puncture made 5-6mm away from limbus using a 10 ml sterile syringe and 20 gauze needle syringe and rubber stopper glass vial washed with deionized distilled water and dried in hot air oven will be used for sampling . Gelatins or water will be placed in posterior chamber for cosmetic purpose.

The sample will be immediately taken to Department of Biochemistry Dr. S. N. Medical College, Jodhpur.

So many methods are available for vitreous humor Biochemistry but here we will use ELECTROLYTE ANALYZER.

Environmental temperature will be recorded at the time of collecting sample.

All information about the deceased i.e. age, sex, cause of death, exact time of death, time of sampling and corresponding Na^+, and K^+ level will be fully recorded in proforma attached.

All the cases where the time of death is unknown or body in advanced stage of decomposition or due to any other reason the extracted sample become spoiled or case of ocular disorder or amount aspirated is less than 0.5ml will be excluded from the study .

The data will be collected and recorded on proforma and subjected to statistical analysis.

Results

Table 1: Vitreous Potassium (K^+) ion concentration vis-a-vis Cause of death

Cause of death	**Trauma**	**Burn**	**Poisoning**	**Natural Death**
No. of Eyes	**88**	**10**	**50**	**12**
Time since death (hrs)	**K^+ concentration in meq/l**			
0-3	7.20	-		-
3.1-6	5.68	-	6.35	-
6.1-12	7.42	7.40	7.12	-
12.1-24	8.79	8.37	9.06	9.46

It is concluded from table no. 1 that there is statistically insignificant correlation of the vitreous potassium ion concentration in relation to the various causes of death.

Table 2: Vitreous Sodium (Na^+) ion concentration vis-a-vis causes of death

Cause of death	**Trauma**	**Burn**	**Poisoning**	**Natural Death**
No. of Eyes	**88**	**10**	**50**	**12**
Time since death (hrs)	**Na^+ concentration in meq/l**			
0-3	131.90	-	-	-
3.1-6	136.90	-	131.50	-
6.1-12	135.11	129.70	133.20	-
12.1-24	127.54	131.72	126.76	127.70

It is concluded from above table that there is no statistically significant correlation of vitreous sodium ion concentration in relation to various causes of death.

***We have calculated the following statistics*:-**

1. Coefficient of correlation
2. Coefficient of regression
3. Regression equation

1. ***Coefficient of Correlation*:** It was calculated using INDOSTAT software. The objective of this study was to assess the relationship between the Postmortem interval and individual regresser. The data shows that the coefficient of correlation for potassium (K^+) ion concentration in the vitreous humour is 0.831. This indicates that there is high degree of correlation between postmortem interval and potassium (K^+) ion concentration of vitreous humour. Therefore we can say that the postmortem interval can be calculated, if vitreous potassium (K^+) ion concentration is known.

The linear correlation of the vitreous sodium (Na^+) ion concentration was found statistically insignificant (r=0.045) therefore the coefficient of correlation could not be derived.

2. ***Coefficient of Regression*:** The coefficient of regression was calculated using same INDOSTAT software. The value of coefficient of regression is 3.46 meq/l/hr. It appears that 1meq/l potassium (K^+) ion concentration of vitreous increases in 3.46 hrs of postmortem interval.

3. ***Regression Equation*:** The same was calculated by using INDOSTAT software.

The regression equation for each variable is as under

- Postmortem Interval = $-16.22 + 3.75 \times K^+$
- Postmortem Interval $=165.70 + 1.15 \times Na^+$

Where:

K^+ = Potassium ion concentration in Vitreous

Na^+ = Sodium ion concentration in Vitreous

Discussion

The most important tool in medico legal autopsy is estimation of time since death. Though physical changes like cooling of body, eye changes, postmortem staining, rigor mortis, decomposition, stomach contents, bowel contents, bladder contents and circumstantial evidence help in estimating the time since death, the biochemical changes which occur in an orderly fashion give more accurate result.

Adelson et al [4] used 349 samples from 269 cases. No significant difference was noted in the K+ levels of two eyes as determined by flame photometry. Mulla

A et al[5] hypothesised in his study that the concentration of vitreous biochemicalconstituents in the same pair of eyes change at the same rate and this change that occurs in a time dependent fashion may be utilized in accurately estimating the post mortem interval. There was a linear rise of potassium values ranging from 7.04 mEq/L to 15.81meq/, which is comparable to the values reported by Govekar G[6].

Conclusion

We have observed linear rise of potassium (K^+) ion concentration in the vitreous humour. The linear relationship of the increase in vitreous potassium (K^+) ion concentration with increasing postmortem interval is both arithmatic as well as logarithmatic (statistically significant).

References

1. Mathur A, Agrawal YK. An overview of methods used for estimation of time since death. Aust J Forensic Sci 2011;43:275e85.
2. Parikh CK. Textbook of medical jurisprudence, forensic medicine and toxicology. 6th ed. New Delhi: CBS Publisher & Distributors; 20043.1.
3. Henssge C, Madea B. Estimation of time since death. Forensic Sci Int 2007;165: 182e4.
4. Adelson L, Sunshine I, Rushforth NB, Mankoff M. Vitreous potassium concentration as an indicator of the postmortem interval. J Forensic Sci. 1963; 54: 503-14.
5. Mulla A, Massey KL, Kalra J. Vitreous humor biochemical constituents: Evaluation of between eye differences. Am J Forensic Med Pathol. 2005; 26: 146-49.
6. Govekar G. Study of potassium in vitreous in relation to time since death and cause of death. J For Med. 1997; 14 (1):26-28.