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CORRELATION OF PMI WITH SODIUM, POTASSIUM, ASCORBIC ACID AND ALKALINE PHOSPHATASE IN VITREOUS HUMOUR

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ABSTRACT

Biochemical and enzymatic changes are observed in the blood and other body fluids such as C.S.F., Vitreous fluid, Synovial fluid, etc. which usually start immediately or shortly after death. In this study, we have tried to find out the correlation of sodium, potassium, ascorbic acid and alkaline phosphatase in vitreous humour with time since death (PMI).

Material and Methods

The present study was carried out in Jhalawar Medical College, Jhalawar. 110 samples were collected in the mortuary of the Forensic Medicine Department & Biochemical analysis was done in the Department of Biochemistry, using Beckman Coulter automated analyser while vitreous ascorbic acid was estimated manually. Data was analyzed on the basis of SPSS20.0 software and results obtained using Student's unpaired t- test.

Results

According to the statistical analysis vitreous potassium increases with time since death, while vitreous sodium, ascorbic acid and alkaline phosphatase do not have significant correlation with time since death.

Conclusions

We observed a linear rise of potassium (K^+) ion concentration in the vitreous humour with an increasing postmortem interval. Correlation of sodium (Na^+) ion concentration, levels of ascorbic acid and levels of Alkaline Phosphatase (ALP) in vitreous humour with post-mortem interval have not been found statistically significant.

KEYWORDS: PMI, K^+, Na^+, Ascorbic acid, ALP

INTRODUCTION

Biochemical and enzymatic changes are observed in the blood and other body fluids such as C.S.F., Vitreous fluid, Synovial fluid, etc. which usually start immediately or shortly after death. These changes progress in a fairly orderly manner until the body disintegrates, which is used by forensic experts / biochemists in the estimation of time passed since death.

The vitreous humour of the eye is relatively stable, easy to sample during post-mortem examination and its composition is quite similar to that of aqueous fluid, CSF and serum. It is relatively free from contamination by blood, bacteria and products of the post-mortem autolysis[1].

Analysis of chemical changes in intraocular fluid after death was introduced by Nauman[2] in 1959. Amongst various chemicals studied such as Na^+, K^+, ascorbic acid, alkaline phosphatase, Cl^-, xanthine and urea, changes of potassium level in vitreous humour is said to be one of the most important indicator of estimating time since death.

The biochemical value of vitreous humour was given by MS Devgun[3] et al (1986).

- Refractive Index – 1.34
- Potassium – 2.6 to 4.2 meq/l
- Sodium – 118 to 154.0 meq/l
- Chloride – 108.0 to 142.0 meq/l
- Creatinine – 0.8 to 0.9 mg/100ml
- Calcium – 36.0 meq/l
- Glucose – 52 to 69 mg/100ml
- Urea – 16 to 20 mg/100ml
- Phosphorus – 0.8 meq/l

The aim of this work is to present some practical, postmortem biochemistry applications to illustrate the usefulness of this discipline and reassert the importance of carrying out biochemical investigations as integral part of the autopsy process. Thus the determination of the chemical abnormalities is a useful supplementary procedure which could help forensic pathologists to ascertain time since death more precisely.

MATERIAL AND METHODS

This study was carried out in Department of Biochemistry, in association with Department of Forensic Medicine on 110 medico legal cases who were admitted in the Jhalawar Medical College, Jhalawar and died subsequently from the period 02/08/2015 to 15/12/2016. Information regarding the time of death was collected from hospital records.

EXCLUSION CRITERIA

All the cases where the time of death was unknown or the body was in advanced stage of decomposition or the extracted sample became hemorrhagic or cases of ocular disorder or cases of head injury involving orbit or amount aspirated less than 0.5 ml were excluded from this study.

Aspiration of vitreous humour was done and it was analyzed on the Beckman Coulter automated analyzer and manually by using 2, 4-DNP. All information about deceased viz. Age, sex, address, cause of death, exact time of death, time of collecting samples, temperature and corresponding sodium, potassium and ascorbic acid concentration were fully recorded in a set proforma and were fed in the master chart, from where computer assisted statistical evaluation and analysis were done.

RESULTS

Table 1: Correlation of Time since Death with Potassium, Sodium, Ascorbic Acid and ALP

	Mean + Std. Deviation	N	P value	Significance
TIME SINCE DEATH in HR	9.3580 + 8.65835	110		
POTASSIUM	6.6764 + 2.21505	110	<0.0001	Significant
SODIUM	135.3391 + 4.81055	110	0.158	Not sig.
ASCORBICACID	3.6368 + 1.13029	110	0.088	Not Sig.
ALP	3.6455 + 1.26207	110	0.051	Not Sig.

DISCUSSIONS

Establishing the postmortem interval is one of the frustrating challenges faced by forensic experts. The Biochemical tests to determine the postmortem interval have been increased largely in the last few decades based on changes occurring in the body fluids such as whole blood, serum, spinal fluid, aqueous humour and vitreous humour immediately or shortly after death.

In this study vitreous humour potassium (K^+), Sodium (Na^+), ascorbic acid and alkaline phosphatase concentration were investigated in 110 dead bodies brought to Jhalawar hospital and medical college with known time of death to find out the simple and accurate method of estimation of postmortem interval during the period from 02/08/2015 to15/12/2016.

In this study it was observed that there is a considerable rise in the vitreous potassium level with increasing postmortem interval. The rise of vitreous potassium ion concentration varied from 3.70 to 15.10 meq/l with a p value < 0.0001 showing it to be statistically significant. This observation is supported by many workers, including Jaffe[4] (1962), Sturner[5] et al (1964), Munoz Basus JI[6] et al (2001), Jashnani KD[7] et al (2010) and Ahi[8] et al (2011).

On the other hand the vitreous sodium (Na^+) ion concentration decreased with increasing postmortem interval in our study. However, this decline is not statistically significant as the p value was 0.158. Level of ascorbic acid in vitreous humour was observed to decrease up to 3 hrs then increase up to 6 hrs of postmortem interval and then again show slow decline. The p value was 0.088 showing it to be statistically insignificant. Level of Alkaline Phosphatase in vitreous humour was observed to increase, but not proportionally with time since death. The p value was 0.051 showing the relation to be statistically insignificant.

CONCLUSIONS

By this study, we conclude that the potassium ion concentration in the vitreous humour increases with the postmortem interval and can be used to access the time since death. On the other hand the concentration of sodium ions, ascorbic acid and alkaline phosphatase are not related to the PMI significantly.

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