Estimation of Time Since Death from Na^+ Ion Concentration in CSF

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Abstract

In the present study 100 medico legal cases examined for Na^+ ion concentration in CSF (cerebrospinal fluid) at different postmortem interval in the department of Forensic Medicine Indira Gandhi Medical College, Nagpur. Analysis revealed that there is decrease in sodium ion concentration with PMI, and shows negative coefficient correlation r= -0.721. ($p<0.001$), the least square regression equation is found to be y = -1.027x + 138.7, where y= sodium ion concentration (independent variable) and x= time since death (dependent variable). The sodium ion concentration in CSF decreases after death and it is statistically significant but individual variation is such that we can't accurately calculate postmortem interval from sodium ion concentration.

***Key Words**: Na^+ ion concentration, time since death, postmortem interval (PMI)*

Introduction

Time since death that is the interval between death and the time of post-mortem examination also called as "Post-mortem interval". It provides a clue to the investigating officer to institute suitable enquiries to apprehend the persons likely to be responsible for the crime and to eliminate the innocent ones.[1] As per earlier study it was concluded that the sodium in CSF decreases with increasing post-mortem interval and decrease is not significant and hence cannot be utilize precisely to estimate post-mortem interval.[6]

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Therefore an attempt has been made with optimistic hope and expectation by carrying out a study of estimation of time since death from Na^+ ion concentration in CSF

Material and Methods

100 medico legal autopsies were selected where the exact time of death was known and the body had been kept in prevailing room temperature.

Inclusion criteria

1) Only those cases are included in the study whose time of death is known.

Exclusion criteria

1) Any cases of head injury, brain pathology, bleeding diathesis were excluded.

2) Decomposed bodies were excluded.

3) Cases of diabetes and if during postmortem examination kidney and liver shows gross pathological abnormality those cases were excluded.

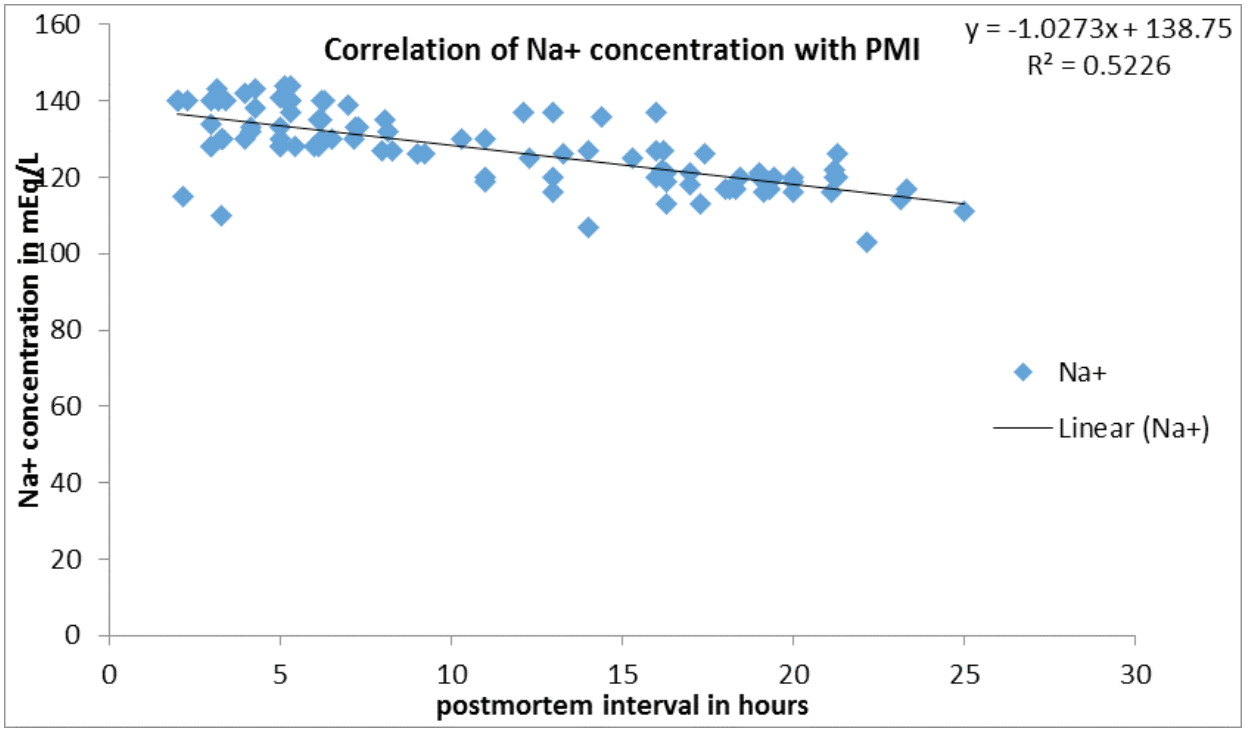
The cranial cavity was opened in usual way and the vault will be removed to expose the brain and dura.

Dura is gently cut from the vault region of the brain both cerebral hemispheres are separated apart from midline by left hand to expose corpus callosum 10ml plastic disposable syringe with wide bore canula (18 gauge) is inserted on the posterior and depended part of corpus callosum for 1.5cm depth. The needle is directed posteriorly, downwards and slightly laterally in each hemisphere and cerebrospinal fluid was withdrawn and immediately centrifuged and analyzed for sodium ion on Dimension Xpand plus automatic analyzer (indirect ion selective method) after centrifugation, in the dept. of biochemistry IGGMC Nagpur.

Observation and Results

In the present study out of 100 cases 68 cases were males 32 cases were females, 37 cases were studied in summer, 38 cases were studied in rainy days, 25 cases were studied in winter. Environmental temperature ranges from 30 - 46^{0}C in summer, 22 – 39^{0}C in rainy days and 18 – 33^{0}C in winter. Cause of death was poisoning in 24 cases, blunt trauma to chest in 11 cases, coronary artery disease in 16 cases, burns in 13 cases, hanging in 9 cases, snake bite in 1case, septicemia in 10 cases, drowning in 2 cases, peritonitis in 3 cases and 3 were bilateral pulmonary consolidation cases. The cases were grouped into four groups on the basis of postmortem interval (PMI) i.e. 0-6, >6-12, >12-18, >18-25. The list PMI observed was 2 hours and maximum was 25 hours.

The below table and graph is showing decrease in sodium ion concentration with PMI, and shows negative coefficient correlation r= -0.721. ($p<0.001$).



The mean value is 127.37mEq/L and value ranges from 103mEq/L to 144mEq/L with a standard deviation ±9.48 mEq/L. The sodium ion values showed a significant negative correlation coefficient r = - 0.721 (i.e. Na^+ values decrease with time since death) which is statistically significant. ($p<0.001$)

The least square regression equation is found to be y = -1.027x + 138.7, where y= sodium ion concentration (independent variable) and x= time since death (dependent variable)

Table showing distribution of cases in different postmortem interval, with mean values and standard deviation, and range of values of Na^+ ion in that postmortem interval

PMI Group	0-6	>6-12	>12-18	>18-25
Mean ±S.D. Values of Na+	134.32±7.89	130.71±5.66	123.35±8.082	117.71±4.34
Ranges From	144 to 110mEq/L	140 to119 mEq/L	137 to 107 mEq/L	126 to 103 mEq/L

The 95% limits of confidence interval of CSF sodium ion, at 0-6 hour postmortem interval are 134.32 ±2.75mEq/L, at >6-12 postmortem interval are 130.71±2.58 mEq/L, at >12-18 hour postmortem interval are 123.35± 3.49 mEq/L, at >18-25 hour postmortem interval are 117.39±1.83 mEq/L

Discussion

Nauman H.N. (1958) had analyzed 157 samples of postmortem CSF consisting of 131 males autopsied on the average 10.5 hours after death. He found that the postmortem CSF sodium ranges from 107 to 150meq/L, with an average of 127meq/L.[2]

Paulson G.W. and Stickney D. (1971) evaluated the postmortem CSF for sodium. In

his 17 cases studied from postmortem interval of 1.5 hour to 17 hour, the value at six

hour is 120 and 149meq/L (2 cases); at 11 to 14 hours, the value was 138 and

129meq/L (2 cases); and at 17 hour, it was 130meq/L (1case). He noted that there

was fall of sodium in the postmortem period.[3]

Karkela J.T. (1993) studies the sodium in the postmortem CSF of 40 different adult cadavers. The samples were drawn at 2, 4, 10 and 24 hour after death and found mean values for Na^+ 141mmol/L at 2 hour, 139mmol/L at 4 hour, 131mmol/L at 10 hour and122 at 24 hour.[4]

Bardale R. V. and Dongre A.P. (2004) studied CSF in 100 medicolegal cases. They noted that there was decrease of sodium concentration with increasing postmortem interval, at sixth hour of PMI, the values ranges between 88.3 to 210meq/L with an average of 124.8meq/L and SD 20.01. There was decrease of sodium at 12 hour PMI with range of 56.4 to 175.4meq/L with a mean of 103.46meq/L, and SD 18.12. By 18 hour after death, the value of sodium ranges from 42.1 to 152meq/L with a mean of 85.60meq/L, and SD 18.73.[5]

Yadav J et al (2007) Results revealed a significant correlation of sodium and potassium ion in CSF up to 25 hours of time since death. The study concludes that changes in CSF electrolytes are a significant parameter to estimate time since death.[6]

We found the mean value is 127.37mEq/L and value ranges from 103mEq/L to 144mEq/L with a standard deviation ±9.48 mEq/L. The sodium values showed a significant negative correlation coefficient r = - 0.721 (i.e. Na^+ values decrease with time since death) which is statistically significant. ($p<0.001$)

My findings are consistent with Yadav J et al, Bardale R. V.and Dongre A.P., Karkela J.T., Paulson G.W. and Stickney D. and Nauman H.N.

Conclusion

The sodium ion concentration in CSF decreases after death and it is statistically significant but individual variation is such that we can't calculate postmortem interval from sodium ion concentration.

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Conflict of Interest – no conflict of interest

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