

Post Mortem analysis of electrolytes in vitreous humour to determine time since death

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ABSTRACT

Background: It has been found that so many biochemical materials, including electrolytes, remain remarkably stable after death while others show varying degrees of change; hence, the analysis of electrolytes in vitreous humour has great medico-legal importance.

Method: 95 autopsies were studied by making a puncture 5–6 mm away from the limbus by using a 10 ml sterile syringe and 20 gauge needles. Aspirated vitreous was poured into a rubber stopped vial. The collected fluid was sent to the biochemistry department for electrolyte analysis. The analysis was carried out using the iron selective electrode method, and the results were noted and compared.

Results: The PM interval for 27 cases (28.4%) was < 12 hours, 32 cases (33.6%) was between 12-24 hours, and 36 cases (37.8%) was >24 hours. In the study of different electrolytes, the sodium chloride value remained insignificant, but the potassium value had a highly significant p value ($p < 0.001$). The highest mean value of potassium 10.62 (± 1.90) in accidental falls and least in snake bite deaths was 6.7 (± 0.23).

Conclusion: The present pragmatic study has proved that vitreous potassium is the single best parameter to estimate and predict post mortem death accurately.

Keywords: iron selective electrode, vitreous humour electrolyte, autopsy, Maharashtra.

INTRODUCTION

The objectives of conducting medico-legal autopsies are to determine the cause of death and to estimate time since death⁽¹⁾. Estimation of TSD is one of the most important aspects of a medico-legal study⁽²⁾. Many physiochemical changes begin to take place in the body immediately or shortly after death and progress in a fairly orderly fashion until the body disintegrates⁽³⁾. Each change has its own time factor or rate. Unfortunately, these rates of development of postmortem changes

are strongly influenced by unpredictable endogenous and environmental factors. Consequently the longer the postmortem interval (PMI), leads to the wider the range of estimates as to when it probably occurred.

The post-mortem changes used for estimating the TSD are several and based on different parameters: purely physical processes (body cooling, hypostasis), metabolic processes (supravital reactions), autolytic (loss of selective membrane permeability diffusion) physiochemical

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process (spacing rigor. mortis) Microbial actions (putrefaction) Vitreous humour is a fluid that is relatively protected from post-mortem degradation and contamination due to its post mortem stability. Biochemical constituents of vitreous humour proportion vary due to delay in post-mortem. It has been found that the some biochemical material remains remarkably stable after death ⁽⁴⁾. Hence, an attempt was made to evaluate the quantity and quality of electrolytes in vitreous humour in different cases post mortem.

MATERIAL AND METHOD

95 (Ninety five) autopsies were carried out in the mortuary of the Government Medical College, Aurangabad-431001, Maharashtra.

Inclusive Criteria

The dead bodies aged between 16 to 60 years with crystal clear vitreous humour were selected for study.

Exclusion Criteria

Murder cases, custodial deaths, decomposed bodies, bodies with damaged eyeballs due to assault trauma, RTA, one eyed dead bodies, and visibly discoloured samples were excluded from the study.

METHOD

Vitreous humour was collected by making a puncture 5–6 mm away from the limbus using a 10 ml sterile syringe and 20 gauze needles. Aspirated vitreous was poured into a rubber-stop vial. Normal saline is injected into the eye for cosmetic purposes. The collected specimen was sent to the department of biochemistry for biochemical analysis. It was immediately centrifuged for ten minutes at 3000 revolutions per unit of supernatant fluoride for the iron selective electrode method, and reports were studied accordingly.

Observation and Results

Table-1: Causes of deaths was 36 (37.8%) RTA, 17 (17.8%) were burns, 15 (15.7%) poison, 9 (9.47%) hanging, 6 (6.31%) accidental fall, 4 (4.21%) Electro citation, 3 (3.15%) natural death, 3 (3.15%) head injury, 2 (2.10%) snake bite

Table-2: Study of post-mortem intervals – 27 (28.4%) had > 12 hours, 32 (33.6%) 12-24 hours, 36 (37.8%) > 24 hours

Table-3: Study of different electrolytes in post-mortem cases

Sodium – range value 114 to 182 and average finding was 145.5 (\pm 15.4) and $p > 0.86$

Table 1: Reason for Death of post-mortem cases

Cause of death	No of cases	Percentage
RTA	36	37.8
Burns	17	17.8
Poison	15	15.7
Hanging	9	9.47
Accidental fall	6	6.31
Electrocution	4	4.21
Natural death	3	3.15
Head injury	3	3.15
Snake bite	2	2.10
Total	95	99.69

RTA = Road traffic Accident

Table 2: Study of post-mortem intervals

PM Interval	No of cases	Percentage (%)
< 12 hours	27	28.4
12-24 hours	32	33.6
> 24 hours	36	37.8
Total	95	99.8

Table 3: Study of different electrolytes in post-mortem cases

Electrolytes	Range value	Average value mean	P value
Sodium	114 to 182	145.5 (\pm 15.4)	p>0.86
Chloride	119.3 to 151.3	123.95 (\pm 15.2)	p>0.15
Potassium	6.02 to 8.05	12.35 (\pm 1.6)	P<0.001

Potassium value is highly significant

Table 4: Study of mean value (SDI) of electrolytes in different post mortem cases

Cause of death	No. of (Na)	Sodium (Na)	Potassium (K)	Chloride
Accidental fall	6	155.34 (\pm 14.4)	10.62 (\pm 1.90)	134.72 (\pm 16.3)
Burns	17	140.6 (\pm 14.2)	10.02 (\pm 2.30)	17.36 (\pm 10.52)
Electrocution	4	146.32 (\pm 15.08)	9.23 (\pm 0.32)	124.23 (\pm 7.32)
Hanging	9	140.8 (\pm 5.48)	10.52 (\pm 3.23)	119.6 (\pm 2.80)
Head injury	3	135.32 (\pm 4.62)	8.51 (\pm 0.66)	113 (\pm 3.42)
Natural death	3	148.23 (\pm 6.47)	9.22 (\pm 2.42)	132.30 (\pm 3.82)
Poison death	15	145.24 (\pm 9.79)	8.27 (\pm 1.82)	117.69 (\pm 8.62)
RTA	36	146.77 (\pm 11.29)	10.28 (\pm 2.56)	126 (\pm 11.47)
Snake bite	2	132.4 (\pm 5.29)	6.7 (\pm 0.23)	120.3 (\pm 15.27)

Chloride - range value 119.3 to 151.3 average finding was 123.95 (\pm 15.2) and p>0.15

Potassium - range value 6.02 to 8.05 average finding was 12.35 (\pm 1.6) and p<0.011 (p value was highly significant)

Table-4: Study of Mean value of electrolytes in different PM cases

- In accidental fall - 115.34 (\pm 14.4) sodium, 10.62 (\pm 1.90) potassium, 134.72 (\pm 16.3) chlorides
- In Burn cases - 140.65 (\pm 14.2) sodium, 10.2 (\pm 2.30) potassium, (k) 117.56 (\pm 0.52) chlorides
- Electrocution - 146.32 (\pm 15.08) sodium, 9.23 (\pm 0.2) potassium, 124.23 (\pm 7.32) chlorides

- Hanging - 140.8 (\pm 5.48) sodium, 10.52 (\pm 3.23) potassium, 119.6 (\pm 2.80) chlorides
- Head injury - 135.32 (\pm 4.62) sodium, 8.51 (\pm 0.66) potassium, 113 (\pm 6.42) chlorides
- Natural death- 148.23 (\pm 6.47) sodium, 9.22 (\pm 2.42) potassium, 132.30 (\pm 3.82) chlorides
- Poisoning - 145.24 (\pm 9.79) sodium, 8.27 (\pm 1.82) potassium, 117.69 (\pm 8.62) chlorides
- RTA - 146.77 (\pm 11.29) sodium, 10.28 (\pm 2.56) potassium, 126 (\pm 11.42) chlorides
- Snake bite - 132.4 (\pm 5.29) sodium, 6.7 (\pm 0.23) potassium, 120.3 (\pm 15.27) chlorides

DISCUSSION

Present post-mortem analysis of electrolytes in vitreous humour in Maharashtra autopsies. The cause of death was 36 (37.8%) RTA, 17 (17.8%) burns, 15 (15.7%) poison, 9 (9.47%) hanging, 6 (6.31%) accidents falling, 4 (4.21%) electrocution, 3 (3.15%) natural death, 3 (3.15%) head injury, and 2 (2.10%) snake bites (Table 1). 27 (28.4%) cases PM interval was < 2 hours, 32 (33.6%) had 12-24 hour intent, and 36 (37.8%) had > 24 hour interval (Table 2). In the study of different electrolytes - 6.02 was the range value, 12.35 (\pm 1.6) was obtained, and $p < 0.001$, the p value was highly significant (Table 3). In the study of the presence of potassium in different PM cases, the highest value of potassium was 10.62 (\pm 1.90) in accident falls, and the least value was observed at 6.77 (\pm 0.23) in snake bite cases (Table 4). These findings were more or less in agreement with previous studies (5)(6)(7).

Vitreous humour in the eyes is anatomically separated and well protected; sterile fluid resistance to putrefaction for a long time/ Energy metabolism continues for a relatively long period. The diffusion process is slower in vitreous humour when compared to other body fluids. It is reported that sodium concentration by iron elective electrode, method did not show any significant relation between sodium concentration in vitreous

humour and time since death (TSD) ⁽⁸⁾⁽⁹⁾. It was also that, the samples were analysed on Easylyte, plus NA/K/CL were analysed, and sodium and chloride had no significant correlations ⁽¹⁰⁾.

The potassium concentration in vitreous humour had a significant correlation, and the p value was highly significant ⁽¹¹⁾. It was seen that the vitreous humour potassium concentration was directly proportional to the increase in post-mortem interval (PMI) (linear arithmetic relationship). The calcium concentration in vitreous humour ranged from 2.4 to 9 mg / dl with a mean of 5.08 mg/ dl and a p -value of 0.86. The correlation was found to be statistically insignificant ⁽¹²⁾. Similarly, it was found to be insignificant when correlated with concentration on vitreous humour. The rise in potassium level is due to the autolysis of vascular choroids and retinal cells in the eye. There was a linear increase in vitreous potassium level with the rise of PMI. This indicates that, rise in potassium levels after death has a strong correlation with PMI.

SUMMARY AND CONCLUSION

In the post-mortem analysis of electrolytes in vitreous humour at our centre in Maharashtra, there was a significant elevation in potassium levels correlated with PMI. Hence, potassium level elevation has medico-legal importance, followed by time since death. The present study demands a large number of autopsies with the latest biochemical technologies to confirm these significant results.

LIMITATION OF STUDIES

Owing to the small number of dead bodies and the lack of the latest instruments, we have limited findings and results.

- **This research work has been approved by the ethical committee of Govt. Medical College, Aurangabad, 431001, Maharashtra.**
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