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STUDY OF POSTMORTEM INTERVAL FROM RIGOR MORTIS

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ABSTRACT

Whenever a postmortem is conducted we always have to opine about postmortem interval and when we do so we always feel that we should have some better data so that we can be more precise in answering this query. With this feeling in our minds we conducted this study and some interesting and important findings will be presented in this paper.

KEYWORDS : Postmortem interval, rigor mortis

INTRODUCTION

In the medico legal autopsies, apart from giving the cause of death and mode of death one important question to be answered is the time elasped between death and post mortem examination. In spite of the best possible solutions for this query it can be said that the time of death can only be estimated within broad limits [1] and it is usual to give a period of time during which death could have taken place. The methods of estimating the time of death rely on the changes that occur in the body after death as are known today.

No such study has been reported from this region of Indian i.e. Punjab, so it becomes more imperative to do such a study and apply the knowledge so obtained to those cases of unwitnessed deaths in future in coming to a right conclusion of time since death. Estimating the time of death is notoriously one of the most difficult and inaccurate technique in forensic pathology and various evidences must be correlated to each other in order to arrive at some sensible time bracket within which the death could have occurred [2].

MATERIAL AND METHODS

SELECTION OF CASES

As per plan 128 cases were selected from the various medico legal cases brought to the mortuary complex of Medical College, Amritsar. Criteria which we adopted for the selection of cases were as follows :

(i) Only those cases were selected in which time since death was exactly known.

(ii) Only those cases, in which no artificial means of preservation (e.g. cooling with ice) were used, were selected.

(iii) Cases which depicted cold stiffening, heat stiffening and instantaneous rigor mortis were not included.

HISTORY OF CASES

History was taken carefully from the relatives and friends of the deceased and the investigating police officers, to come to a right conclusion regarding time of death and to know if the ice has been used or not to preserve the dead body during any stage (At home, scene or during transfer of the body to the mortuary). In Hospital deaths, time of death mentioned in the hospital record was

recorded.

RECORDING OF TEMPERATURE AND HUMIDITY

We used a good quality hygrometer for recording the humidity. It consisted of dry and wet bulb type. We noted the temperature from the dry bulb of the hygrometer. Temperature and humidity were recorded from the hall where the dead bodies brought to the mortuary complex are kept. Humidity was calculated from the chart provided with the hygrometer.

RIGOR MORTIS

Rigor mortis was studied by gently moving the parts (eyelids, lips) or gently bending or moving the joints. It was studied whether it was complete, partial or absent.

OBSERVATIONS

In this study progression of rigor mortis was proximo-distal and the disappearance was also proximo-distal. Appearance of rigor mortis in fingers and toes was very erratic as shown in Group III. We noticed in certain cases that disappearance of rigor mortis started earlier in proximal parts of the body even when rigor mortis had not completely appeared in the fingers and toes (44% of group III cases)

Onset of rigor mortis was seen at the earliest by 3 hours with an average duration of 3 hours 15 minutes. The longest duration in which rigor mortis had not completely appeared in the body was 14 hours. Average duration for group I was 9 hours and 19 minutes.

Average duration for group II was 17 hours 34 minutes. The shortest duration in which rigor mortis had completely appeared in the body was 3 hours and the longest duration in which the rigor mortis was completely present in the body was 29 hours.

Average duration for group III was 19 hours 52 minutes. The shortest duration in which the rigor mortis had started disappearing from the body was 7 hours. The longest duration in which the rigor mortis had not completely disappeared from the body was 39 hours.

The shortest duration in which the rigor mortis had completely disappeared from the body was 15 hours.

GROUP I

TABLE NO. 1

14 cases of Group I (Partial appearance of rigor mortis) depicting effect of temperature and humidity in relation to postmortem interval.

Atmospheric Temp. in C	Humidity %	Postmortem Interval in hours
19	72	10 (4)
19	72	11 (5)
32	61	8 (11)
32	61	8 (12)
32	61	8 (13)
43	94	12 (20)
34	56	3½ (24)
33	61	3 (25)
37	53	14 (27)
37	53	10 (30)
30	54	13 (33)
30	54	14 (34)
28	79	8 (35)
28	79	8 (36)
31	65	9 (19)

TABLE NO. 2

65 cases (Fully developed rigor mortis) depicting effect of temperature and humidity in relation to postmortem interval

Atmospheric Temp. in C	Humidity %	Postmortem Interval in hours
20	81	25 (1)
20	81	25 (2)
20	81	25 (3)
35	74	7 (9)
43	94	15 (14)
43	94	15 (15)
43	94	15 (16)
43	94	15 (17)
43	94	15 (18)
43	94	11 (19)
43	94	13 (21)
33	67	13 (22)
33	67	13 (23)
37	53	3 (26)
37	64	14 (28)
38	59	9 (29)
37	53	11 (31)
37	59	12 (32)
37	59	17 (37)
36	69	18 (38)
36	63	5 (39)
36	69	20 (40)

Atmospheric Temp. in C	Humidity %	Postmortem Interval in hours
29	64	19 (4)
29	64	19 (42)
29	64	19 (43)
29	64	15 (45)
29	64	6 (46)
29	52	21 (47)
29	52	15 (48)
30	65	15 (49)
30	65	19 (51)
30	65	19 (52)
30	65	19 (53)
22	82	28 (55)
22	82	28 (56)
22	82	28 (57)
16	79	20 (60)
16	79	17 (62)
16	79	17 (63)
16	79	17 (64)
14	89	24 (66)
16	89	15 (68)
15	89	21 (70)
15	89	21 (71)

Atmospheric Temp. in C	Humidity %	Postmortem Interval in hours
15	89	20 (72)
15	89	20 (73)
15	89	20 (74)
15	89	21 (75)
15	89	21 (76)
15	89	22 (77)
15	89	22 (78)
15	89	22 (79)
16	89	21 (80)
25	61	18 (82)
16	89	24 (85)
16	79	20 (86)
16	79	16 (87)
16	79	18 (88)
16	79	16 (89)
20	81	15 (90)
20	81	16 (91)
36	38	29 (92)
36	38	29 (93)
35	47	8 (113)
38	54	7 (117)
26-64	74-84	17 hr. 34

Case number shown in bracket in last column

TABLE NO. 3

25 cases (studied during disappearing rigor mortis) depiciting effect of temperature and humidity in relation to postmortem interval.

Atmospheric Temp. in C	Humidity %	Postmortem Interval in hours
19	72	11 (6)
34	62	31 (7)
34	62	31 (8)
35	74	16 (10)
29	64	7 (44)
30	65	15 (50)
24	60	20 (54)
22	82	28 (58)
22	82	23 (59)
16	79	20 (61)
16	79	18 (67)
15	89	21 (69)
25	61	39 (81)
36	38	15 (94)
36	38	15 (95)
36	38	15 (96)
36	38	21 (97)
36	38	16 (98)
33	45	21 (99)
33	45	21 (100)
34	45	23 (101)
36	53	20 (114)
36	53	20 (115)
38	54	12 (116)
29	60.60	19 hr. 52 min.

Case number shown in bracket in last column

TABLE NO. 4

24 cases (Indicating cases in which rigor mortis disappeared completely) depicting effect of temperature & humidity in relation to postmortem interval

Atmospheric Temp. in C	Humidity %	Postmortem Interval in hours
25	61	39 Hrs. (83)
25	61	39 Hrs. (84)
34	56	26 Hrs. (102)
34	56	78 Hrs. (103)
34	56	78 Hrs. (104)
34	56	126 Hrs. (105)
34	56	78 Hrs. (106)
34	51	78 Hrs. (107)
34	51	100 Hrs. (108)
34	51	100 Hrs. (109)
34	51	100 Hrs. (110)
34	51	100 Hrs. (111)
34	51	100 Hrs. (112)
35	47	6 months (118)
35	47	6 months (119)
35	47	6 months (120)
35	47	6 months (121)
35	47	6 months (122)
36	53	3 months (123)
36	58	3 months (124)
35	42	6 months (125)
35	42	6 months (126)
40	66	3 Yrs. (127)
33	80	15 Hrs. (128)
33.91	53.29	*75 hrs. 12 min.

Case number shown in bracket in last column
***Except mummified cases**

TABLE NO. 5

Depicting correlation of temperature with duration of rigor mortis

S.N.	Atmospheric Temperature in Centigrades	Group I			Group Ii			Group III			Group IV		
		Number of Cases	Ave. Hrs.	Dr. Min.	Number of Cases	Ave. Hrs.	Dr. Min.	Number of Cases	Ave. Hrs.	Dur Min.	Number of Cases	Ave. Hrs.	Dr. Min.
1.	< 20^0	2	10	30	27	20	37	5	17	36	_	_	_
2	21^0 25^0	_	_	_	4	25	30	4	27	30	2	39	00
3	26^0 30^0	4	10	45	11	16	54	2	16	00	_	_	_
4	31^0 35^0	5	6	06	4	10	15	6	25	24	12	81	15
5	35^0 40^0	2	12	00	12	14	30	8	16	45	10	8 M.	12 D.
6	> 40^0	1	12	00	7	14	08	_	_	_	Cases of Partial or Complete Mummific--action		
	Total	14	9	19	65	17	34	25	19	52	24	75	12*
	Percentage	10.93%			50.78%			19.53%			18.75%		

*Except - Mummified Bodies

TABLE NO. 6

Depicting correlation of Humidity with duration of rigor mortis

S.N.	Atmospheric Temper--ature in Centigra--des	Group I						Group II						Group III						Group IV					
			Humidity %					Humidity %						Humidity %						Humidity %					
			<50		51-75		>75	<50		51-75		>75		<50		51-75		>75		<50		51-75		>75	
		No.	A-D H-M	No.	A-D	No.	A-D	No.	A-D	No.	A-D	No.	A-D	No.	A-D	No.	A-D	No.	A-D	No.	A-D	No.	A-D	No.	A-D
1	<20	_	___	2	10.30	_	___	_	___	_	___	27	20.37	_	___	1	11.00	4	19.15	_	___	_	___	_	___
2	21-25	_	___	_	___	_	___	_	___	1	18.00	3	28.00	_	___	2	29.30	2	25.30	_	___	2	39.00	_	___
3	26-30	_	___	2	13.30	2	8.00	_	___	10	17.18	1	19.00	_	___	2	11.00	_	___	_	___	_	___	_	___
4	31-35	_	___	5	6.06	_	___	1	8.00	3	11.00	_	___	3	21.39	3	26.00	_	___	_	___	11	87.16	1	15.00
5	36-40	_	___	2	12.00	_	___	2	29.00	10	11.36	_	___	5	16.24	3	17.20	_	___	10	Cases of Mummification				
6	>40	_	___	_	___	1	12.00	_	___	_	___	7	14.08	_	___	_	___	_	___	_	___	_	___	_	___
	Total			11	9.16	3	9.20	3	21.20	24	14.09	38	19.57	8	18.22	11	22.12	6	21.20			13	80.21	1	15.00

A-D=Average Duration

H-M = Hours and Minutes

DISCUSSION

In this study the progression of rigor mortis was proximo-distal and the disappearance was also proximo-distal. Our findings are consistent with many [3-6] but are different from Shapiro [7] It has been observed in this study that it is not a thumb rule that rigor mortis will appear in the complete body and starts disappearing because in certain cases even the rigor mortis had not completely appeared in the distal parts of the limbs whereas it had already disappeared from the proximal parts of the body i.e. face and neck muscles etc.

The shortest duration in which the rigor mortis had completely disappeared from the body was 15 hours which has been reported as 12-18 hours by De Saram [8]. Average duration of 39 hours at an atmospheric temperature range of 21-25 degree centigrade coincides with the findings of 39 hours of Mackangie [9] and 36-48 hours of Glaister [10] and Camps [4].

CONCLUSIONS

From the study of rigor mortis, we found that the changes are fairly good indicators of time since death. With the given facilities so far as our country is concerned. In the early stages it is the onset of rigor mortis, which helps in coming to a conclusion.

If the rigor mortis has not yet appeared in any body part it can be inferred that postmortem interval is less than 3 hours 15 minutes.

The longest duration in which rigor mortis had not completely appeared in the body was 14 hours.

The average duration for fully developed rigor mortis was 17 hours 34 minutes and the shortest duration being 3 hours. This average duration was minimum at a temperature range of 31^0C-35^0C (10 hours 15 minutes).

The average duration of disappearing rigor mortis was 19 hours 52 minutes with the longest duration as long as 39 hours. This duration increases with decrease of temperature. The shortest duration in which the rigor mortis had completely disappeared was 15 hours.

So from this study we find that rigor mortis gives us a fairly satisfactory postmortem interval when due weightage is given to temperature and humidity.

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