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Original Research Article

Critical Analysis of Cranio-cerebral Injuries in Adult Population at a Tertiary Health Centre: an Autopsy Study

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Key words

Cranio-cerebral injuries,
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Abstract

Background: Craniocerebral injuries are one of the commonly encountered medicolegal cases. Craniocerebral injuries include injuries to the scalp, skull and the contents of the skull. Adult group individuals are more subjected to various stresses in life and also various physical trauma. **Purpose:** Current study aims to see in details the various characteristics of craniocerebral injuries in relation to various age groups in adult population. In present study all the cases of craniocerebral injuries were studied. These included cases were the manner of death ranged from accident, suicide, and homicide. **Results:** Males outnumbered females in adult cases of craniocerebral injuries. Cases of craniocerebral injuries decreased as the age increased. Majority of cases died on the spot. Maximum cases were of accidental injuries by road traffic accidents. Craniocerebral cases were seen more in extreme temperature season i.e in winter and summer season. Cases were evenly distributed in all adult age groups as per the length of survival.

1. Introduction

Adult aged group population are the energetic, healthy group who are mostly working and earning for the family members. Because of it adult group individuals are more subjected to various stress in life and also various physical trauma. Craniocerebral injuries are one of the commonly encountered medicolegal cases. Craniocerebral injury or head injury is defined "morbid state resulting from gross or subtle structural changes in the scalp, skull and or the contents of the skull produced by mechanical forces"¹.

Craniocerebral injury can cause morbidity and mortality depending upon various factors. The current study aims to see in details the various

characteristics of craniocerebral injuries in relation to various age groups in adult population.

2. Material and Method:

A prospective study was conducted in the department of forensic medicine at our tertiary care centre for a period of two years. During the period of study a total of 2048 cases of medicolegal autopsy were evaluated. Out of the total medicolegal autopsy cases a total of 156 cases of death due to craniocerebral injuries in adult age groups were studied in the current study. Necessary permission for the present study was obtained from local institutional ethical committee of our institute. Details of the cases were obtained from the respective investigating agencies.

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Cases with inadequate history, doubtful findings and bodies which were brought in decomposed state were excluded. All the details of the cases were studied in detail in relation to the various age group distributions in adult age groups. Data thus obtained were compiled and evaluated accordingly.

3. Results:

3.1. Sex wise distribution (Table No 1).

139 (89.1 %) cases were males while remaining 17 (10.9 %) cases were females.

3.2. Age wise distribution (Table No 2).

62 (39.7 %) cases were in the age group 21 to 30 years, 43 (27.6 %) cases were in the age group 31 to 40 years, 30 (19.2 %) cases were in the age group 41 to 50 years and 21 (13.5 %) cases were in the age group 51 to 60 years.

3.3. Distribution as per place of death (Table No 3).

96 (61.5 %) cases died on the spot while remaining 57 (36.5 %) cases died admitted in hospital.

Table no 1: Sex wise distribution of cases.

Adult Cases	Male	Female
156	139 (89.1 %)	17 (10.9 %)

Table No 2: Age and sex wise distribution of craniocerebral injury cases.

Sr No	Age group in Years	Males	Females	Total
1	21 to 30	56	6	62 (39.7 %)
2	31 to 40	37	6	43 (27.6 %)
3	41 to 50	28	2	30 (19.2 %)
4	51 to 60	18	3	21 (13.5 %)
Total		139	17	156

Table No 3: Distribution of cases as per place of death.

Sr No	Age group in Years	Admitted in hospital (Observed)	Spot dead (Unobserved)	Total
1	21 to 30	22	40	62
2	31 to 40	16	27	43
3	41 to 50	11	19	30
4	51 to 60	11	10	21
Total		57 (36.5 %)	96 (61.5 %)	156

3.4. Age-wise distribution of cases with respect to seasonal variation (Table No 4).

70 (44.8 %) cases were during winter season, 64 (41 %) cases were during summer season and 22 (14.1 %) cases were during rainy season.

3.5. Age-wise distribution of cases with respect to Length of survival (Table No 5).

49 (31.4 %) cases survived less than 2 hours, 56 (35.9 %) cases survived 2 hours to 72 hours while 51 (32.7 %) cases survived 4th day and more.

Table No 4: Age wise distribution of cases with respect to seasonal variation.

Sr No	Age group in Years	Summer (March to June)	Rainy (July to Oct)	Winter (Nov to Feb)	Total
1	21 to 30	25	7	30	62
2	31 to 40	16	9	18	43
3	41 to 50	15	3	12	30
4	51 to 60	8	3	10	21
Total		64 (41 %)	22 (14.1 %)	70 (44.8 %)	156

Table No 5: Age wise distribution of cases with respect to period of survival.

Sr No	Age group in Years	Less than 2 hours	2 hours to 72 hours	4 th day and above	Total
1	21 to 30	16	23	23	62
2	31 to 40	10	14	19	43
3	41 to 50	16	8	6	30
4	51 to 60	7	11	3	21
Total		49 (31.4 %)	56 (35.9 %)	51 (32.7 %)	156

3.6. Age-wise distribution of cases with respect to Circumstances of death (Table No 6).

32 (20.5 %) cases were passengers of four-wheeler, 30 (19.2 %) cases were pedestrians, 27 (17.3 %) cases were drivers of two-wheeler motorcycles, 24 (15.4 %) cases were of fall, 17 (10.9 %) cases were of assault, 9 (5.8 %) cases were cyclists, 8 (5.1 %) cases were drivers of four-wheeler, 3 (1.9 %) cases were passengers of two-wheeler motorcycles and 6 (3.8 %) cases were of other causes.

3.7. Age wise distribution of cases with respect to fracture of skull bones (Table No 7).

Fracture of frontal bone was seen in 25 (16 %) cases. Fracture of parietal bone was seen in 27 (17.3 %) cases. Fracture of temporal bone was seen in 3 (1.9 %) cases.

3.8. Age wise distribution of cases with respect to various intracranial injuries (Table No 8).

Extradural hematoma was seen in 10 (6.4 %) cases. Subdural hematoma was seen in 89 (57.1%) cases. Subarachnoid hemorrhage was seen in 77 (49.4 %) cases.

4. Discussion

The current study was conducted in the department of forensic medicine at our tertiary care centre for a period of two years. During the period of study, a total of 2048 cases of medicolegal autopsy were evaluated. Out of the total medico-

Table No 6: Age wise distribution of cases with respect to Circumstances of death.

Sr No	Circumstances of death	21 to 30 years age group	31 to 40 years age group	41 to 50 years age group	51 to 60 years age group	Total	
1	Fall	5	10	5	4	24 (15.4 %)	
2	Four wheeler	Driver	5	2	1	0	8 (5.1 %)
		Passenger	14	12	3	3	32 (20.5 %)
3	Motorcycle	Driver	16	5	4	2	27 (17.3 %)
		Passenger	1	2	0	0	3 (1.9 %)
4	Cyclist	4	3	0	2	9 (5.8 %)	
5	Pedestrian	5	5	14	6	30 (19.2 %)	
6	Assault	9	3	3	2	17 (10.9 %)	
7	Others	3	1	0	2	6 (3.8 %)	
		62	43	30	21		

Table No 7: Age wise distribution of cases with respect to fracture of skull bones.

Sr No	Circumstances of death	21 to 30 years age group	31 to 40 years age group	41 to 50 years age group	51 to 60 years age group	Total	
1	Fracture of skull vault	Frontal bone	16	5	3	1	25 (16 %)
		Parietal bone	10	6	8	3	27 (17.3 %)
		Temporal bone	2	0	1	0	3 (1.9 %)
		Occipital bone	0	0	0	0	0
2	Fracture of cranial fossa bones	Anterior	10	4	0	2	16 (10.3 %)
		Middle	13	15	7	3	38 (24.4 %)
		Posterior	8	2	3	2	15 (9.6 %)
3	Fracture of bones	Occiput	1	1	0	1	3 (1.9 %)
		Orbital roof	0	2	0	1	3 (1.9 %)
		Sphenoid	0	1	0	1	2 (1.3 %)

Table No 8: Age wise distribution of cases with respect to various intracranial injuries.

Sr No	Various intracranial injuries	21 to 30 years age group	31 to 40 years age group	41 to 50 years age group	51 to 60 years age group	Total
1	Extradural hematoma	5	2	3	0	10 (6.4 %)
2	Subdural hematoma	34	22	18	15	89 (57.1 %)
3	Subarachnoid hemorrhage	29	21	19	8	77 (49.4 %)
4	Cerebral Contusion	4	4	4	0	12 (7.7 %)
5	Cerebral Laceration	5	2	2	2	11 (7.6 %)
6	Both cerebral laceration and cerebral contusion	3	1	3	0	7 (4.5 %)
7	Cerebellar laceration or/ and contusion	3	3	0	0	6 (3.9 %)

legal autopsy cases a total of 156 adult cases of death due to craniocerebral injuries were studied in present study.

4.1. Sex wise distribution (Table No 1).

139 (89.1 %) cases were males while remaining 17 (10.9 %) cases were females. Majority of adult cases of craniocerebral injuries were males as they are main member responsible for family earning and hence are more outside for working thereby

increases their susceptibility for craniocerebral injuries. While in Indian societies adult females are housewives and thus decreases their susceptibility for craniocerebral injuries. Similar findings of males as commonly involved as compared to females are also found in other studies.^{2,3,4,5}

4.2. Age wise distribution (Table No 2).

62 (39.7 %) cases were in the age group 21 to 30 years, 43 (27.6 %) cases were in the age group 31 to

40 years, 30 (19.2 %) cases were in the age group 41 to 50 years and 21 (13.5 %) cases were in the age group 51 to 60 years. Cases of craniocerebral injuries decreased as the age group increased. This may be due to the fact that young adults are more enthusiastic and risk taking and they drive in high speeds thereby increases the incidences of accidents. While as a person ages one becomes more responsible and drive safely and hence reduces the incidences of accident.

4.3. Distribution as per place of death (Table No 3).

96 (61.5 %) cases died on the spot while remaining 57 (36.5 %) cases died admitted in hospital. 61.5 % cases died on the spot. This is can be due to the fact that craniocerebral injury cases are more fatal and cause death more instantaneously. Out of the 96 cases who died on the spot 40 cases were in the age group 21 to 30 years, 27 cases were in the age group 31 to 40 years, 19 cases were in the age group 41 to 50 years and 10 cases were in the age group 51 to 60 years. Cases who died on the spot decreases as the age increases in consistency with the distribution of cases. Out of the 57 cases who died admitted in hospital; 22 cases were in the age group 21 to 30 years, 16 cases were in the age group 31 to 40 years, 11 cases were in the age group 41 to 50 years and 11 cases were in the age group 51 to 60 years. Cases who died admitted in hospital were evenly distributed in all age group showing a general predisposition in all age group.

4.4. Age wise distribution of cases with respect to seasonal variation (Table No 4).

70 (44.8 %) cases were during winter season, 64 (41 %) cases were during summer season and 22 (14.1 %) cases were during rainy season. Craniocerebral cases were seen more in extreme temperature season with 44.8 % cases in winter season and 41 % cases in summer season. This is in accordance with Bijleveld F et al. ⁶ Out of the 70 cases who were during winter season; 30 cases were in the age group 21 to 30 years, 18 cases were in the age group 31 to 40 years, 12 cases were in the age group 41 to 50 years and 10 cases were in the age group 51 to 60 years. Cases who were during winter season shows decrease in number as age increases. This is in accordance with the age wise distribution of overall cases. Out of the 64 cases who were during summer season; 25 cases were in the age group 21 to 30 years, 16 cases were in the age group 31 to 40 years,

15 cases were in the age group 41 to 50 years and 8 cases were in the age group 51 to 60 years. Cases who were during summer season shows decrease in number as age increases. This is in accordance with the age wise distribution of overall cases. Out of the 22 cases that were during rainy season; 7 cases were in the age group 21 to 30 years, 9 cases were in the age group 31 to 40 years, 3 cases were in the age group 41 to 50 years and 3 cases were in the age group 51 to 60 years. Cases who were during summer season shows decrease in number as age increases. This is in accordance with the age wise distribution of overall cases.

4.5. Age-wise distribution of cases with respect to Length of survival (Table No 5).

49 (31.4 %) cases survived less than 2 hours, 56 (35.9 %) cases survived 2 hours to 72 hours while 51 (32.7 %) cases survived 4th day and more. Cases were evenly distributed as per the length of survival. This can be said that adult populations are not predisposed for any period of survival. Out of the 49 cases who survived less than 2 hours; 16 cases were in the age group 21 to 30 years, 10 cases were in the age group 31 to 40 years, 16 cases were in the age group 41 to 50 years and 7 cases were in the age group 51 to 60 years. Cases who survived less than 2 hours were evenly distributed in all age groups as per the length of survival. Out of the 56 cases who survived 2 hours to 72 hours; 23 cases were in the age group 21 to 30 years, 14 cases were in the age group 31 to 40 years, 8 cases were in the age group 41 to 50 years and 11 cases were in the age group 51 to 60 years. Cases who survived 2 hours to 72 hours were evenly distributed in all age groups as per the length of survival. Out of the 51 cases who survived 4th day and more; 23 cases were in the age group 21 to 30 years, 19 cases were in the age group 31 to 40 years, 6 cases were in the age group 41 to 50 years and 3 cases were in the age group 51 to 60 years. Cases who survived 4th day and more were more in early adult groups i.e., 21 to 30 years and 31 to 40 years. This can be due to the fact the protective barrier; skull bone is stronger in early adult age group as compared to late adult age group. Hence skull bone can withstand more force and hence less internal damages in early adult groups and hence more survival period.

4.6. Age-wise distribution of cases with respect to Circumstances of death (Table No 6).

32 (20.5 %) cases were passengers of four-wheeler, 30 (19.2 %) cases were pedestrians, 27 (17.3 %) cases were drivers of two-wheeler motorcycles, 24 (15.4 %) cases were of fall, 17 (10.9 %) cases were of assault, 9 (5.8 %) cases were cyclists, 8 (5.1 %) cases were drivers of four-wheeler, 3 (1.9 %) cases were passengers of two-wheeler motorcycles and 6 (3.8 %) cases were of other causes. Tonge J.I et al⁷ in study of 1004 traffic crash fatalities cases found 331 car drivers, 225 car passengers, 306 pedestrians, 76 motor cyclists, 29 pedal cyclists and 37 other category participants. Out of the 32 (20.5 %) cases of passengers of four-wheeler; 14 cases were in the age group 21 to 30 years, 12 cases were in the age group 31 to 40 years, 3 cases were in the age group 41 to 50 years and 3 cases were in the age group 51 to 60 years. Cases of passengers of four-wheeler were more in the early adult age group i.e., 21 to 30 years and 31 to 40 years. Out of the 30 (19.2 %) cases of pedestrians; 5 cases were in the age group 21 to 30 years, 5 cases were in the age group 31 to 40 years, 14 cases were in the age group 41 to 50 years and 6 cases were in the age group 51 to 60 years. Cases of pedestrians were in all age group with particularly more cases in the age group 41 to 50 years. Out of the 27 (17.3 %) cases of drivers of two-wheeler motorcycles; 16 cases were in the age group 21 to 30 years, 5 cases were in the age group 31 to 40 years, 4 cases were in the age group 41 to 50 years and 2 cases were in the age group 51 to 60 years. Cases of drivers of two-wheeler motorcycles were in all age groups with particularly more cases in the age group 21 to 30 years. Out of the 24 (15.4 %) cases of fall; 5 cases were in the age group 21 to 30 years, 10 cases were in the age group 31 to 40 years, 5 cases were in the age group 41 to 50 years and 4 cases were in the age group 51 to 60 years. Cases of falls were in all age groups with particularly more cases in the age group 31 to 40 years. Out of the 17 (10.9 %) cases of assault; 9 cases were in the age group 21 to 30 years, 3 cases were in the age group 31 to 40 years, 3 cases were in the age group 41 to 50 years and 2 cases were in the age group 51 to 60 years. Out of the 9 (5.8 %) cases of cyclists; 4 cases were in the age group 21 to 30 years; 3 cases were in the age group 31 to 40 years and 2 cases were in the age group 51 to 60 years. There was no case in the age group 41 to 50 years. Out of the 8 (5.1 %) cases of drivers of four-wheeler; 5 cases were

in the age group 21 to 30 years; 2 cases were in the age group 31 to 40 years and 1 case was in the age group 41 to 50 years. There was no case in the age group 51 to 60 years. Out of the 3 (1.9 %) cases of passengers of two-wheeler motorcycles; 1 case was in the age group 21 to 30 years; 2 cases were in the age group 31 to 40 years. There was no case in the age group 41 to 50 years and age group 51 to 60 years. Out of the 6 (3.8 %) cases of other causes; 3 cases were in the age group 21 to 30 years; 1 case was in the age group 31 to 40 years and 2 cases were in the age group 51 to 60 years. There was no case in the age group 41 to 50 years.

4.7. Age wise distribution of cases with respect to fracture of skull bones (Table No 7).

Fracture of frontal bone was seen in 25 (16 %) cases. Fracture of parietal bone was seen in 27 (17.3 %) cases. Fracture of temporal bone was seen in 3 (1.9 %) cases. Tonge J.I et al⁷ found fractures of the skull in 48.3 % of total casualties. Out of the 25 cases of fracture of frontal bone; 16 cases were in the age group 21 to 30 years, 5 cases were in the age group 31 to 40 years, 3 cases were in the age group 41 to 50 years and 1 case was in the age group 51 to 60 years. Thus, fracture of frontal bones was observed to be decreasing with the increase in the age of the victims. Out of the 27 (17.3 %) cases of fracture of parietal bone; 10 cases were in the age group 21 to 30 years, 6 cases were in the age group 31 to 40 years, 8 cases were in the age group 41 to 50 years and 3 cases were in the age group 51 to 60 years. Thus, cases were evenly distributed in all age groups. Out of the 3 (1.9 %) cases of fracture of temporal bone; 2 cases were in the age group 21 to 30 years and 1 case was in the age group 41 to 50 years. There was no case in the age group 31 to 40 years and in the age group 51 to 60 years. Thus, fracture of temporal bones was less frequently found. Fracture of anterior cranial fossa bones was seen in 16 (10.3 %) cases. Fracture of middle cranial fossa bones was seen in 38 (24.4 %) cases. Fracture of posterior cranial fossa bones was seen in 15 (9.6 %) cases. Out of the 16 (10.3 %) cases of fracture of anterior cranial fossa bones; 10 cases were in the age group 21 to 30 years; 4 cases were in the age group 31 to 40 years and 2 cases was in the age group 51 to 60 years. There was no case in the age group 41 to 50 years. Thus, fracture of anterior cranial fossa bones was observed more commonly in early adult age

groups. Out of the 38 (24.4 %) cases of fracture of middle cranial fossa bones; 13 cases were in the age group 21 to 30 years, 15 cases were in the age group 31 to 40 years, 7 cases were in the age group 41 to 50 years and 3 cases was in the age group 51 to 60 years. Thus, fracture of middle cranial fossa bones was observed to be decreasing with the increase in the age of the victims. Out of the 15 (9.6 %) cases of fracture of posterior cranial fossa bones; 8 cases were in the age group 21 to 30 years, 2 cases were in the age group 31 to 40 years, 3 cases were in the age group 41 to 50 years and 2 cases was in the age group 51 to 60 years. Thus, fracture of posterior cranial fossa bones was observed to be distributed in all age groups. Fracture of occiput bone was seen in 3 (1.9 %) cases. Fracture of orbital roof was seen in 3 (1.9 %) cases. Fracture of sphenoid bone was seen in 2 (1.3 %) cases. Out of the 3 (1.9 %) cases of fracture of occiput bone; 1 case were in the age group 21 to 30 years; 1 case were in the age group 31 to 40 years and 1 case was in the age group 51 to 60 years. There was no case in the age group 41 to 50 years. Thus, fracture of occiput bone was less frequently found and was observed in early and late adult age groups. Out of the 3 (1.9 %) cases of fracture of orbital roof; 2 cases were in the age group 31 to 40 years and 1 case was in the age group 51 to 60 years. There was no case in the age group 21 to 30 years and in the age group 41 to 50 years. Thus, fracture of orbital roof was less frequently found and were observed in middle adult and late adult age groups. Out of the 2 (1.3 %) cases of fracture of sphenoid bone; 1 case was in the age group 31 to 40 years and 1 case was in the age group 51 to 60 years. There was no case in the age group 21 to 30 years and in the age group 41 to 50 years. Thus, fracture of sphenoid bone was less frequently found as compared to other bones.

4.8. Age wise distribution of cases with respect to various intracranial injuries (Table No 8).

Extradural hematoma was seen in 10 (6.4 %) cases. Subdural hematoma was seen in 89 (57.1%) cases. Subarachnoid haemorrhage was seen in 77 (49.4 %) cases. Chandra Kumar PC et al⁸ also found findings more or less as similar to our study. Tonge J.I et al⁷ found intracranial haemorrhages in 60 % of total participants, injuries to the brain were present in 54.5 % cases. Subarachnoid haemorrhage was present in 13.1 % cases, subdural in 12.3 % cases,

intracerebral haemorrhage in 7.2 % cases, extradural haemorrhage in 0.9 % cases and combinations of various haemorrhages in 25.8 % cases. Out of the 10 (6.4 %) cases of extradural hematoma; 5 cases were in the age group 21 to 30 years; 2 cases were in the age group 31 to 40 years and 3 cases were in the age group 41 to 50 years. There was no case in the age group 51 to 60 years. Thus, extradural hematoma was observed more commonly in early and middle adult age groups and absent in late adult age group. Out of the 89 (57.1%) cases of subdural hematoma; 34 cases were in the age group 21 to 30 years, 22 cases were in the age group 31 to 40 years, 18 cases were in the age group 41 to 50 years and 15 case was in the age group 51 to 60 years. Thus, subdural hematoma was observed to be decreasing with the increase in the age of the victims. Out of the 77 (49.4 %) cases of subarachnoid haemorrhage; 29 cases were in the age group 21 to 30 years, 21 cases were in the age group 31 to 40 years, 19 cases were in the age group 41 to 50 years and 8 case was in the age group 51 to 60 years. Thus, subarachnoid haemorrhage was observed to be decreasing with the increase in the age of the victims. Cerebral contusion was seen in 12 (7.7 %) cases. Cerebral laceration was seen in 11 (7.6 %) cases. Both cerebral laceration and cerebral contusion was seen in 7 (4.5 %) cases. Cerebellar laceration or/ and contusion was seen in 6 (3.9 %) cases. Tonge J.I et al⁷ found contusions of the brain in 22.1 % cases and lacerations were seen in 15.3 % cases. Out of the 12 (7.7 %) cases of cerebral contusion; 4 cases were in the age group 21 to 30 years; 4 cases were in the age group 31 to 40 years and 4 cases were in the age group 41 to 50 years. There was no case in the age group 51 to 60 years. Thus, cerebral contusion was observed in early and middle adult age groups and absent in late adult age group. Out of the 11 (7.6 %) cases of cerebral laceration; 5 cases were in the age group 21 to 30 years, 2 cases were in the age group 31 to 40 years, 2 cases were in the age group 41 to 50 years and 2 case was in the age group 51 to 60 years. Thus, cerebral laceration was observed in all adult age groups. Out of the 7 (4.5 %) cases of both cerebral laceration and cerebral contusion; 3 cases were in the age group 21 to 30 years; 1 case was in the age group 31 to 40 years and 3 cases were in the age group 41 to 50 years. There was no case in the age

group 51 to 60 years. Thus, cases of both cerebral laceration and cerebral contusion were observed in early and middle adult age groups and absent in late adult age group. Out of the 6 (3.9 %) cases of cerebellar laceration or/ and contusion; 3 cases were in the age group 21 to 30 years and 3 cases were in the age group 31 to 40 years. There was no case in the age group 41 to 50 years and in the age group 51 to 60 years. Thus, cases of cerebellar laceration or/ and contusion were observed in early adult age groups and absent in late adult age group.

5. Conclusion

Males outnumbered females in adult cases of craniocerebral injuries. Cases of craniocerebral injuries decreased as the age increased. Majority of cases died on the spot. Craniocerebral cases were seen more in extreme temperature season i.e. in winter and summer season. Cases were evenly distributed in all adult age groups as per the length of survival. Passengers of four-wheeler, pedestrians, drivers of two-wheeler motorcycles, cases of fall and cases of assault are common circumstances of cases. Age wise distribution of various aspects of craniocerebral injuries are important for better understanding.

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