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Original Research Article

Autopsy Based Study of Craniocerebral Injuries in Dependent Age Groups in Central Indian Population.

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Key words

Forensic Medicine,
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Abstract

Purpose: Brain is the most important vital organs in the body. Trauma to brain and its surrounding structures can lead to morbidity and mortality. Road traffic accidents, assaults on head and accidental falls are most common causes for craniocerebral trauma. Children, adolescents and old aged are dependent aged groups who require more attention and care as compared to adults. Current study aims to highlight the various age-wise distributions of various aspects of craniocerebral injuries in dependent aged groups. **Results:** Cases were equally distributed in both children & adolescents and old aged group. Males are commonly involved. Most of the cases died on the spot. Majority of the cases died less than 72 hours. Extreme weather conditions had majority of the cases. Pedestrians, cases of fall, cyclists, passengers of four wheeler and cases of assault were common circumstances. **Conclusion:** Craniocerebral injuries can have varied cause and effect on a growing child to a old age population in relation to its morbidity and mortality.

1. Introduction

Injury to brain and its surrounding structures are one of the most commonly encountered cases in medicolegal autopsies. Brain is the most important vital organs in the body. Road traffic accidents, assaults on head and accidental falls are most common causes for craniocerebral trauma. Craniocerebral injury or head injury is defined "morbid state on account off mechanical forces leading to gross or subtle structural changes in the scalp, skull and or the contents of the skull"¹ Human age is classified in four categories as child (0-12 years), adolescence (13-18 years), adult (19-59 years) and senior adult (60 years and above).² Children, adolescents and old aged are dependent aged groups

who require more attention and care as compared to adults. Head injury is the leading cause of mortality in children aged less than 15 years,^{3,4} while in elderly most frequent cause of traumatic brain injury was fall.^{5,6} Road traffic injuries is an increasing health problem globally and in particular in South-East Asia.⁷ Various characteristics of craniocerebral injuries in dependent aged group persons are studied in current study.

2. Material and Method:

A total of 2048 cases of medicolegal autopsy were prospectively studied at our tertiary care centre for a period of two years in the department of forensic medicine.

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Out of the total medicolegal autopsy cases a total of 46 cases of death due to craniocerebral injuries cases of dependent age groups (children, adolescents and old aged) 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. 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 relation to the various age group distribution in dependent age groups (children, adolescents and old aged). Data thus obtained were compiled and evaluated accordingly.

3. Results:

3.1. Age group wise distribution of cases (Table No 1).

23 (50 %) cases were children and adolescence also 23 (50 %) cases were senior Citizen Cases.

3.2. Age and sex wise distribution of craniocerebral injury cases (Table No 2).

36 (78.3 %) cases were males while remaining 10 (21.7 %) cases were females.

Table no 1: Age Group and sex wise distribution of cases.

Cases	Male	Female	Total
Children and adolescence Cases	19	4	23
Senior Citizen Cases	17	6	23
Total	36	10	46

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

Sr No	Age group in Years	Males	Females	Total
1	< 10	7	2	9 (19.6 %)
2	11 to 20	2	2	14 (30.4 %)
7	60 to 70	14	4	18 (39.1 %)
8	>71	3	2	5 (10.9 %)
Total		36 (78.3 %)	10 (21.7 %)	46

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

29 (63.1 %) cases died on the spot while remaining 17 (36.9 %) cases died admitted in hospital.

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

22 (47.9 %) cases were during winter season, 17 (36.9 %) cases were during summer season and 7 (15.2 %) cases were during rainy season.

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	< 10	2	7	9
2	11 to 20	4	10	14
7	61 to 70	7	11	18
8	>71	4	1	5
Total		17 (36.9 %)	29 (63.1 %)	46

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 October)	Winter (November to February)	Total
1	< 10	3	2	4	9
2	11 to 20	3	2	9	14
3	61 to 70	8	2	8	18
4	> 71	3	1	1	5
Total		17 (36.9 %)	7 (15.2 %)	22 (47.9 %)	46

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

Sr No	Age group in Years	Less than 2 hours	2 hours to 72 hours	4 th day and above	Total
1	< 10	3	1	5	9
2	11 to 20	1	8	5	14
3	61 to 70	11	4	3	18
4	> 71	4	1	0	5
Total		19 (41.3 %)	14 (30.4 %)	13 (28.3 %)	46

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

19 (41.3 %) cases survived less than 2 hours, 14 (30.4 %) cases survived 2 hours to 72 hours while 13 (28.3 %) cases survived 4th day and more.

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

21 (45.7 %) cases were pedestrians, 11 (23.9 %) cases were of fall, 6 (13 %) cases were cyclists, 3 (6.5 %) cases were passengers of four-wheeler, 2 (4.3 %) cases were of assault and 3 (6.5 %) 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 7 (15.2 %) cases. Fracture of parietal bone was seen in 9 (19.6 %) cases.

Fracture of temporal bone was seen in 1 (2.2 %) case.
Fracture of occiput bone was seen in 1(2.2 %) case.
Fracture of orbital roof was seen in 1(2.2 %) case.

Extradural hematoma was seen in 5 (10.9 %) cases.
Subdural hematoma was seen in 23 (50 %) cases.
Subarachnoid haemorrhage was seen in 22 (47.8 %) cases.

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

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

Sr No	Circumstances of death		< 10 years age group	11 to 20 years age group	61 to 70 years age group	>71 years age group	Total
1	Fall		1	4	5	1	11 (23.9 %)
2	Four wheeler	Driver	0	0	0	0	0
		Passenger	1	1	1	0	3 (6.5 %)
3	Motorcycle	Driver	0	0	0	0	0
		Passenger	0	0	0	0	0
4	Cyclist		2	2	2	0	6 (13 %)
5	Pedestrian		4	5	8	4	21 (45.7 %)
6	Assault		0	1	1	0	2 (4.3 %)
7	Others		1	1	1	0	3 (6.5 %)
			9	14	18	5	

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

Sr No	Circumstances of death		< 10 years age group	11 to 20 years age group	61 to 70 years age group	>71 years age group	Total
1	Fracture of skull vault	Frontal bone	2	2	3	0	7 (15.2 %)
		Parietal bone	2	3	2	2	9 (19.6 %)
		Temporal bone	0	0	0	1	1 (2.2 %)
		Occipital bone	0	0	0	0	0
2	Fracture of cranial fossa bones	Anterior	0	0	1	0	1 (2.2 %)
		Middle	2	1	5	1	9 (19.6 %)
		Posterior	0	2	2	0	4 (8.8 %)
3	Fracture of bones	Occiput	0	0	1	0	1(2.2 %)
		Orbital roof	0	0	1	0	1 (2.2 %)
		Sphenoid	0	0	0	0	0

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

Sr No	Various intracranial injuries	< 10 years age group	11 to 20 years age group	61 to 70 years age group	>71 years age group	Total
1	Extradural hematoma	0	1	2	2	5 (10.9 %)
2	Subdural hematoma	3	4	14	2	23 (50 %)
3	Subarachnoid hemorrhage	1	5	15	1	22 (47.8 %)
4	Cerebral Contusion	2	1	1	0	4 (8.8 %)
5	Cerebral Laceration	0	0	0	1	1 (2.2 %)
6	Both cerebral laceration and cerebral contusion	1	2	1	1	5 (10.9 %)
7	Cerebellar laceration and/ or contusion	0	0	0	0	0

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 medicolegal autopsy cases a total of 46 dependent age group cases of death due to craniocerebral injuries were studied.

4.1. Age group wise distribution of cases (Table No 1).

23 (50 %) cases were children and adolescence also 23 (50 %) cases were senior citizen Cases. Thus, there were equal distribution of children & adolescents and senior citizen cases in death due to craniocerebral injuries. This can be attributed due to the facts that dependent populations are usually accompanied by adults and hence dependent populations are equally predisposed for craniocerebral injuries.

4.2. Age and sex wise distribution of craniocerebral injury cases (Table No 2).

36 (78.3 %) cases were males while remaining 10 (21.7 %) cases were females. The high proportion of cases being males may be due to the fact that dependent age group females are shy and stay at home as compared to males. Males like to explore the outside world and hence they go out of house more frequently as compared to females. Males are commonly involved in various other studies.^{8,9,10,11}

18 (39.1 %) cases were in the age group 61 to 70 years, 14 (30.4 %) cases were in the age group 11 to 20 years, 9 (19.6 %) cases were in the age group <10 years and 5 (10.9 %) cases were in the age group >70 years. 39.1 % cases were in the age group 61 to 70 years. As age increases attention, alertness and reflex activities decreases. Hence extreme age individuals are more likely to be involved in accidents. 30.4 % cases were in the age group 11 to 20 years. During adolescences individuals are full of energy and enthusiasm. Adolescents are also more risk taking.

These could be the reason for increased percentages of cases of craniocerebral injuries. Extreme age group individuals i.e., <10 years and >70 years were comparatively less. This could be due to the fact that such persons are always kept in close watch by other members of the family. Extreme age group individuals are mostly accompanied by other members of family.

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

29 (63.1 %) cases died on the spot while remaining 17 (36.9 %) cases died admitted in hospital. 63.1 % cases died on the spot. This can be attributed as craniocerebral injury cases are deadlier and causes death instantaneously. Out of the 29 cases who died on the spot; 7 cases were in the age group <10 years, 10 cases were in the age group 11 to 20 years, 11 cases were in the age group 61 to 70 years and 1 case was in the age group >71 years. Cases who died on the spot were evenly distributed in all age group

except in age group >71 showing a general predisposition in all dependent age group. Out of the 17 cases who died admitted in hospital; 2 cases were in the age group <10 years, 4 cases were in the age group 11 to 20 years, 7 cases were in the age group 61 to 70 years and 4 cases were in the age group >71 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).

22 (47.9 %) cases were during winter season, 17 (36.9 %) cases were during summer season and 7 (15.2 %) cases were during rainy season. Craniocerebral cases were seen more in extreme temperature season with 47.9 % cases in winter season and 36.9 % cases in summer season. Out of the 22 cases who were during winter season; 4 cases were in the age group <10 years, 9 cases were in the age group 11 to 20 years, 8 cases were in the age group 61 to 70 years and 1 case was in the age group >71 years. Cases who were during winter season were evenly distributed in all age group except in age group >71 showing a general predisposition in all dependent age group. Out of the 17 cases who were during summer season; 3 cases were in the age group <10 years, 3 cases were in the age group 11 to 20 years, 8 cases were in the age group 61 to 70 years and 3 cases were in the age group >71 years. Cases who were during summer season were evenly distributed in all age groups showing a general predisposition in all dependent age group. Out of the 7 cases who were during rainy season; 2 cases were in the age group <10 years, 2 cases were in the age group 11 to 20 years, 2 cases were in the age group 61 to 70 years and 1 case was in the age group >71 years. Cases who were during rainy season were evenly distributed in all age groups showing a general predisposition in all dependent age group.

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

19 (41.3 %) cases survived less than 2 hours, 14 (30.4 %) cases survived 2 hours to 72 hours while 13 (28.3 %) cases survived 4th day and more. A large number of cases (71.7 %) died early duration (<72 hours). Thus, it can be inferred that craniocerebral injury cases are more likely to cause death in early periods after infliction of injury. Out of the 19 cases who survived less than 2 hours; 3 cases were in the age

group <10 years, 1 case was in the age group 11 to 20 years, 11 cases were in the age group 61 to 70 years and 4 case was in the age group >71 years. Cases who survived less than 2 hours shows more prevalence in old age group individuals. This could be due to the fact that as age increases the protective barrier skull bone becomes more susceptible due to osteoporosis. Hence old age people suffer more fatal injuries to internal structures and hence may die immediately. While children and adolescents die comparatively less immediately. Out of the 14 cases who survived 2 hours to 72 hours; 1 case was in the age group <10 years, 8 cases were in the age group 11 to 20 years, 4 cases were in the age group 61 to 70 years and 1 case was in the age group >71 years. Cases who survived 2 hours to 72 hours are distributed approximately equally in old age and in child & adolescent groups. Out of the 13 cases who survived 4th day and more; 5 cases were in the age group <10 years, 5 cases were in the age group 11 to 20 years and 3 cases were in the age group 61 to 70 years. There was no case in the age group >71 years. Cases who survived 4th day and more shows more prevalence in child & adolescent groups individuals. This could be due to the fact that child & adolescent groups protective barrier skull bone is comparatively stronger as compared to old aged persons. Hence child & adolescent groups can withstand more force, limiting the injuries to internal structures and hence may survive for long duration of time.

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

21 (45.7 %) cases were pedestrians, 11 (23.9 %) cases were of fall, 6 (13 %) cases were cyclists, 3 (6.5 %) cases were passengers of four-wheeler, 2 (4.3 %) cases were of assault and 3 (6.5 %) cases were of other causes. Sevitt¹² in study of 175 cases head injury fatal road accidents found 79 pedestrians, 33 motorcyclists, 15 pedal cyclists, 19 vehicle drivers, 22 vehicular passengers, 5 bus passengers and 2 others. Out of the 21 cases of pedestrians; 4 cases were in the age group <10 years, 5 cases were in the age group 11 to 20 years, 8 cases were in the age group 61 to 70 years and 4 case was in the age group >71 years. Out of the 11 cases of fall; 1 case was in the age group <10 years, 4 cases were in the age group 11 to 20 years, 5 cases were in the age group 61 to 70 years and 1 case was in the age group >71 years. Out of the 6 cases of cyclists; 2 cases were in the age group <10 years, 2

cases were in the age group 11 to 20 years and 2 cases were in the age group 61 to 70 years. There was no case in the age group >71 years. Out of the 3 cases of passengers of four-wheeler; 1 case was in the age group <10 years, 1 case was in the age group 11 to 20 years and 1 case was in the age group 61 to 70 years. There was no case in the age group >71 years. Out of the 2 cases of assault; 1 case was in the age group 11 to 20 years and 1 case was in the age group 61 to 70 years. There was no case in the age group <10 years and also in >71 years. Out of the 3 cases of other causes; 1 case was in the age group <10 years, 1 case was in the age group 11 to 20 years and 1 case was in the age group 61 to 70 years. There was no case in the age group >71 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 7 (15.2 %) cases. Fracture of parietal bone was seen in 9 (19.6 %) cases. Fracture of temporal bone was seen in 1 (2.2 %) case. Chandra Kumar PC et al¹³ found fracture of frontal bone in 9.4 % cases, fracture of parietal bone in 3% cases and fracture of temporal bone in 8.2 % cases. Out of the 7 (15.2 %) cases of fracture of frontal bone; 2 cases were in the age group <10 years, 2 cases were in the age group 11 to 20 years and 3 cases were in the age group 61 to 70 years. There was no case in the age group >71 years. Thus, fracture of frontal bone was seen in both children and old aged cases. Out of the 9 (19.6 %) cases of fracture of parietal bone; 2 cases were in the age group <10 years, 3 cases were in the age group 11 to 20 years, 2 cases were in the age group 61 to 70 years and 2 case was in the age group >71 years. Thus, fracture of parietal bone was seen equally distributed in all children and old aged groups. 1(2.2 %) case of fracture of temporal bone was in the age group >71 years. Thus, fracture of temporal bone was seen only in extreme old aged group. Fracture of anterior cranial fossa bones was seen in 1 (2.2 %) case. Fracture of middle cranial fossa bones was seen in 9 (19.6 %) cases. Fracture of posterior cranial fossa bones was seen in 4 (8.8 %) cases. Dinesh Kumar et al¹⁴ found that middle cranial fossa was the commonest region involved (52.2%) followed by posterior cranial (25.4%) and anterior cranial fossa (22.4%). 1 (2.2 %) cases of fracture of anterior cranial fossa bones were in the age group 61 to 70 years. Thus, only case of fracture of anterior cranial fossa bones was seen only in old aged group.

Out of the 9 (19.6 %) cases of fracture of middle cranial fossa bones; 2 cases were in the age group <10 years, 1 case was in the age group 11 to 20 years, 5 cases were in the age group 61 to 70 years and 1 case was in the age group >71 years. Thus, fracture of middle cranial fossa bones was seen distributed in all children and old aged groups. Out of the 4 (8.8 %) cases of fracture of posterior cranial fossa bones; 2 cases were in the age group 11 to 20 years and 2 cases were in the age group 61 to 70 years. There were no cases in the age group <10 years and in the age group >71 years. Thus, fracture of posterior cranial fossa bones was not seen in extreme old and young aged groups. Fracture of occiput bone was seen in 1(2.2 %) case. Fracture of orbital roof was seen in 1(2.2 %) case. 1 (1.9 %) case of fracture of occiput bone was in the age group 61 to 70 years. Thus, only case of fracture of occiput bone was seen in extreme old aged group. 1 (1.9 %) case of fracture of orbital roof was in the age group 61 to 70 years. Thus, only case of fracture of orbital roof was seen in extreme old aged group.

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

Extradural hematoma was seen in 5 (10.9 %) cases. Subdural hematoma was seen in 23 (50 %) cases. Subarachnoid haemorrhage was seen in 22 (47.8 %) cases. Chandra Kumar PC et al¹³ also found findings mostly as similar as our study. Out of the 5 (10.9 %) cases of extradural hematoma; 1 case were in the age group 11 to 20 years; 2 cases were in the age group 61 to 70 years and 2 case was in the age group >71 years. Thus, extradural hematoma was not seen in extreme young aged group. Out of the 23 (50 %) cases of subdural hematoma; 3 cases were in the age group <10 years, 4 cases were in the age group 11 to 20 years, 14 cases were in the age group 61 to 70 years and 2 case was in the age group >71 years. Thus, subdural hematoma was seen distributed in all children and old aged groups but most cases were in 61 to 70 years' age group. Out of the 22 (47.8 %) cases of subarachnoid haemorrhage; 1 case was in the age group <10 years, 5 cases were in the age group 11 to 20 years, 15 cases were in the age group 61 to 70 years and 1 case was in the age group >71 years. Most cases of subarachnoid haemorrhage were seen in 61 to 70 years' age group. Cerebral contusion was seen in 4 (8.8 %) cases. Cerebral laceration was seen in 1 (2.2 %) case. Both cerebral laceration and cerebral

contusion was seen in 5 (10.9 %) cases. Out of the 4 (8.8 %) cases of cerebral contusion; 2 cases were in the age group <10 years, 1 case were in the age group 11 to 20 years and 1 case was in the age group 61 to 70 years. There was no case in the age group >71 years. Thus, cerebral contusion was seen in all children and old aged groups except in >71 years' age group. 1 (2.2 %) cases of cerebral laceration were in the age group >71 years. Only case of cerebral laceration was seen in extreme old aged >71 years age group. Out of the 5 (10.9 %) cases of both cerebral laceration and cerebral contusion; 1 case was in the age group <10 years, 2 cases were in the age group 11 to 20 years, 1 case was in the age group 61 to 70 years and 1 case was in the age group >71 years. Thus, cases of both cerebral laceration and cerebral contusion were seen distributed in all age groups in children and old aged.

5. Conclusion

Cases were equally distributed in both children & adolescents and old aged group. Males are commonly involved. Most of the cases died on the spot. Majority of the cases died less than 72 hours. Extreme weather conditions had majority of the cases. Pedestrians, cases of fall, cyclists, passengers of four-wheeler and cases of assault were common circumstances. Injuries to various craniocerebral structures were studied in detail in relation to age group in children and old aged people. Thus, such injuries can have varied cause and effect on a growing child to an old age population in relation to its morbidity and mortality.

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Conflict of interests: None.

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