



A DESCRIPTIVE STUDY OF CRANIO-CEREBRAL INJURIES ADMITTED IN NARAYANA MEDICAL COLLEGE AND GENERAL HOSPITAL, NELLORE DURING THE YEAR 2011-2014.

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ABSTRACT

Cranio-cerebral damage (commonly known as head injury) has been recognized since ages.¹ Head injury is a major public health problem and has already attained epidemic proportions in India⁴. Injuries to the head are particularly important because of the brain's vital role in sustaining the life of the individual⁵. Falls and motor vehicle accidents are the primary cause of cranio cerebral damage, while sports, assaults and gunshot wounds also contribute significantly to these types of injuries. Cranio-cerebral injuries results in significant social and financial burden and family issues as it commonly involve males in the age group of 20-40 years who are in the prime financial support of the family and also in sexually active age.

key words Head injury, social and financial burden, Major public health problem.

INTRODUCTION

Cranio-cerebral damage (commonly known as head injury) has been recognized since ages¹. Falls and motor vehicle accidents are the primary cause of Cranio-cerebral damage, while sports,

assaults and gunshot wounds also contribute significantly to these types of injuries. It is one of the leading causes of death and disability worldwide, including the developing world.⁷ Of all the regional injuries, cranio-cerebral injuries are most important in Forensic practice, as the incidence and severity of head injuries are increasing with burgeoning industrialization and more rapid methods of transportation¹. A sound practical understanding of the neuropathology of trauma is essential to the forensic pathologist like any other aspect of his subject, as head injuries provide the major contribution to death in assaults, falls and transportation accidents.³

DEFINITION

Head injury as defined by the national advisory neurological diseases and stroke council, “is a morbid state, resulting from gross or subtle structural changes in the scalp, skull, and or the contents of the skull, produced by mechanical forces”. To be complete however it should be taken into account that the impact responsible for the injury, need not be applied directly to the head².

EPIDEMIOLOGY

The National Crime Report Bureau in its report in 2009 states that road accidents in the country have increased by 1.4% during 2009 compared to 2008. The casualties in road accidents in the country have increased by 7.3% during 2009 as compared to 2008. Their proportion in total deaths due to unnatural causes has increased from 37.1% in 2008 to 37.9% in 2009. While trucks and two-wheelers were responsible for over 40% of deaths, peak traffic during the afternoon and evening rush hours is the most dangerous time to be on the roads. In a dubious distinction for the country, the World Health Organization has revealed in its first global report on road safety that more people die in road accidents in India than anywhere else in the world, including the more populous China¹².

After vehicular accidents, head injury due to fall is the second most common cause of cranio-cerebral trauma leading to death¹⁴. Falls are extremely common and responsible for many serious and fatal injuries every year¹⁵.

An assault leading to scalp injuries is mostly homicidal in nature, and is generally produced by blunt weapons and occasionally by cutting instruments⁴. A cranio-cerebral injury due to blunt trauma causes more homicidal deaths as compared with blunt trauma injury to other areas of the body¹⁷.

Cranio-cerebral injuries are the most common cause of death in case of road traffic accidents, fall from height, assault, etc. Therefore, this problem needs serious attention for the prevention of unnatural deaths, which requires a worldwide epidemiological, medico-legal and clinical study on such victims. The present study was therefore conducted to ascertain age, sex wise distribution, causes of head injury, intracranial hemorrhages, and outcome in head injury cases admitted in Narayana Medical College, Nellore.

OBJECTIVES

1. Causes of head injuries
2. Sex wise distribution
3. Age wise distribution
4. Time of incidence of head injuries
5. Place of incidence of head injuries
6. Alcohol conception in relation to head injuries.
7. Outcome and period of survival in victims of head injuries
8. Incidence of intra cranial haemorrhage.
- 9.

HEAD INJURIES – ANATOMY & PATHOPHYSIOLOGY

SCALP

The scalp is vascular, hair-bearing skin; at its base is a thick fibrous membrane called the galea aponeurotica. Lying between the galea and the skull is a very thin sheet of connective tissue that is penetrated by blood vessels (emissary veins) emerging through the skull, and beneath this connective tissue is the periosteum of the outer table of the skull. The thickness of the scalp in the adult is variable, ranging from a few mm to about 15mm. Most wounds are caused by blunt force to the head, e.g. from falls or blows, and such wounds are contusions or

lacerations. Contusions may occur in the superficial fascia, in the temporalis muscles, or in the loose areolar tissue between the galea aponeurotica and the pericranium (subgaleal haemorrhage). Bruises of the scalp are associated with prominent oedema. Bruising of the scalp is better felt than seen. Lacerations of the scalp resemble incised wounds¹⁸.

SKULL AND SKULL FRACTURES

The skull consists of the 28 bones.

- a. The calvaria or brain case is composed of 14 bones

Paired: parietal, temporal, malleus, incus, stapes.

Unpaired: frontal, occipital, sphenoid, ethmoid.

- b. The facial skeleton is composed of 14 bones.

Paired: maxilla, zygomatic, nasal, lacrimal, palatine, inferior nasal concha.

Unpaired: mandible, vomer¹⁹.

The outer table of skull is twice the thickness of inner. Skull is thicker in the midfrontal, midoccipital, parietosphenoid and parietopetrous buttresses¹⁸. The tensile architecture of the skull has been well described by Rowbotham (1964). The more vulnerable thin areas lie in the parietotemporal, lateral frontal and lateral occipital zones³. The interior of the base of the skull is divided into three cranial fossae: anterior, middle and posterior. The anterior cranial fossa is separated from the middle cranial fossa by the lesser wing of the sphenoid, and the middle cranial fossa is separated from the posterior cranial fossa by the petrous part of the temporal bone²⁰. Skull fractures are caused by direct or indirect violence. Direct injuries may be caused by: (1) Crushing of the head under the wheel of a vehicle. (2) An object in motion striking the head. (3) Head in motion striking an object, as in falls and traffic injuries. Indirect injury of the skull occurs from a fall on the feet or buttocks. Fractures of the vault occur from direct violence¹⁸.

THE CRANIAL CAVITY

Cranium means the part of the skull enclosing the brain. The cranial cavity contains the brain and its surrounding meninges, portions of the cranial nerves, arteries, veins and venous sinuses²⁰.

MENINGES

The brain and spinal cord are entirely enveloped by three concentric membranes, the meninges, which provide support and protection.

The outermost meningeal layer is the duramater. Falxcerebri and tentorium cerebelli are the two great dural folds extend into the cranial cavity and help to stabilize the brain²¹. Beneath this lies the arachnoid mater. The innermost layer is the piamater. The dura is an opaque, tough, fibrous coat. It incompletely divides the cranial cavity into compartments and accommodates the dural venous sinuses. It is separated from the arachnoid by a narrow subdural space. The arachnoid is much thinner than the dura and is mostly translucent. It surrounds the brain loosely, spanning depressions and concavities. Beneath the arachnoid lies the subarachnoid space, which contains cerebrospinal fluid (CSF), secreted by the choroid plexus of the cerebroventricular system. The pia mater is a transparent, microscopically thin membrane that follows the contours of the brain and is closely adherent to its surface. Cranial and spinal meninges are continuous through the foramen magnum²². Epidural haemorrhage occurs between the skull and the dura mater, and is caused by a rupture of the middle meningeal artery, diploic veins or dural venous sinuses. forms a localized clot, which compresses and flattens the brain. Subdural haemorrhage is caused by tearing of the bridging veins that transverse the subdural space. Subarachnoid haemorrhage occurs between the arachnoid and the pia mater, and is usually found at the base of the brain. It is not localized, but it is diffused, mixes with the cerebrospinal fluid (CSF) in the subarachnoid space and spreads upwards over the surface of the brain, the haemorrhage is caused by injury to the arterial vessels crossing the subarachnoid space, and is usually associated with a traumatic fracture of the skull bones and with contusion or laceration of the cortex of the brain.

BRAIN

The brain is part of the central nervous system which lies within the cranial cavity.

- a) Forebrain: cerebrum and diencephalon(thalamus, hypothalamus), right and left lateral ventricles and third ventricles.
- b) Midbrain with cerebral aqueduct
- c) Hindbrain: pons, medulla oblongata, cerebellum, fourth ventricle and central canal²⁴.

Brainstem term is usually applied to the midbrain, pons, and medulla oblongata²⁴.

ARTERIES OF THE BRAIN

It provides the brain with 20% of the oxygen used by the body; 15% of the cardiac output goes to the brain. It consists of 2 pairs of vessels – the internal carotid arteries and the vertebral arteries. At the junction between the medulla and the pons, the two vertebral arteries fuse to form the basilar artery²⁵.

BRAIN INJURY

According to GF Rowbotham, injury to the brain (Contusions, lacerations of the brain) may either be due to movements of the brain in relation to the skull or to distortions of the skull. The falx cerebri and tentorium cerebelli divide the cranial cavity into three communicating compartments and have a partly restraining effect on brain movements²³.

Cerebral oedema, Compression of the brain- is caused by increased intracranial pressure, which disturbs the functions of the brain. It may result from a depressed fracture of a skull-bone or intracranial haemorrhage, acute spreading oedema, inflammatory exudation and the presence of any space occupying lesions like tumours, or abscess²³)

Intracerebral haemorrhage

Haemorrhages of a fairly large size in the substance of the brain are usually associated with the fracture of the skull as a result of traffic accidents, falls, or the impact of objects. Occasionally, a delayed traumatic haemorrhage after about seven to ten days may occur. A traumatic tear of the choroidal plexus will result in intra-ventricular haemorrhage (IVH)²³.

CAUSE OF DEATH IN HEAD INJURY

1. Most deaths are due to damage to vital cerebral areas, located around the posterior hypothalamus, midbrain and medulla. Usually respiratory failure or paralysis followed by

permanent cardiac arrest. Vital centres may be compressed or concussed directly or they may be injured by secondary changes.

2. Markedly raised intracranial pressure due to haematoma, contusions, lacerations, infarction or swelling is the common cause of death.
3. DAI
4. Ischaemic brain damage
5. Fat embolism
6. Other causes of death are infections, hypostatic pneumonia, pulmonary embolism and renal infection¹⁸.

METHODOLOGY OF STUDY

The present study was conducted in Narayana medical college and general hospital, Nellore. After getting approval from the Institutional Ethical Committee the study was undertaken. The study includes data over a period of 3 years (2 years retrospective and 1 year prospective). The various parameters include age, sex, causes of head injury, pattern of head injuries, skull fractures, brain injuries, intracranial hemorrhages, and outcome. In accident cases type of accident, incident victim, and type of vehicle involved in road traffic accident are noted. Computed Tomography findings and Magnetic Resonance Imaging findings are also included in this study. This study includes 338 cases (118 prospective cases and 220 retrospective cases) of head injury cases admitted in Narayana Medical College, Nellore during the year 2011-2014. In retrospective analysis data were collected from the medical records. Brief history was taken from patients and their relatives and findings were noted by observing the patients and from the medical records in case of prospective analysis. Cause of death was confirmed by autopsy findings in prospective cases of fatal head injuries admitted in Narayana medical college, Nellore. And these autopsies were conducted in Government medical college, Nellore.

Results:

Table 1: Cause of head injuries

Causes of head injuries	No of cases	%
Road Traffic Accident	256	75.74%
Fall From Height	49	14.50%
Ground Level Fall	11	3.25%
Assault	20	5.92%
Heavy blunt object fall on head	2	0.59%
Grand Total	338	100.00%

Chart 1: Cause of head injuries

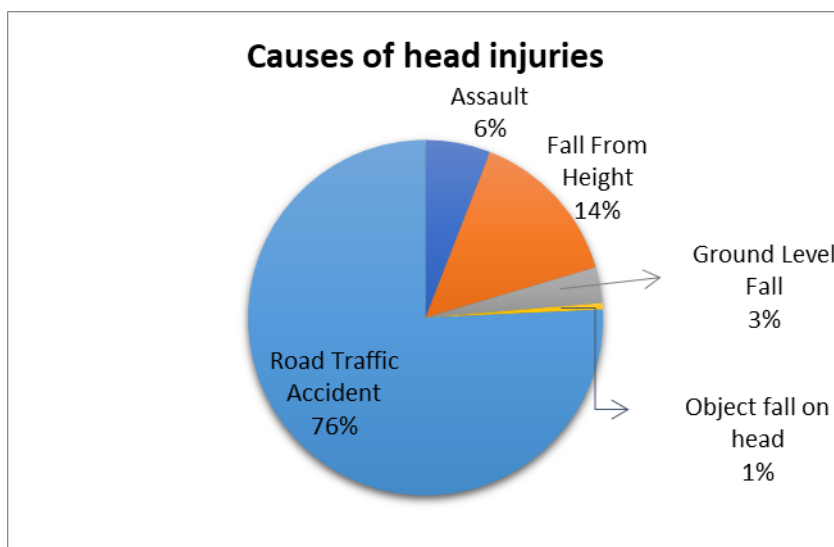


Table 2: Sex wise distribution

	SEX					
	Female		Male		Total	
Cause of injury	No of cases	%	No of cases	%	No of cases	%
Assault	3	15.00%	17	85.00%	20	100%
Fall From Height	12	24.49%	37	75.51%	49	100%
Ground Level Fall	4	36.36%	7	63.64%	11	100%
Object fall on head	0	0.00%	2	100.00%	2	100%
Road Traffic Accident	48	18.75%	208	81.25%	256	100%
Grand Total	67	19.82%	271	80.18%	338	100%

Chart 2: Sex wise distribution

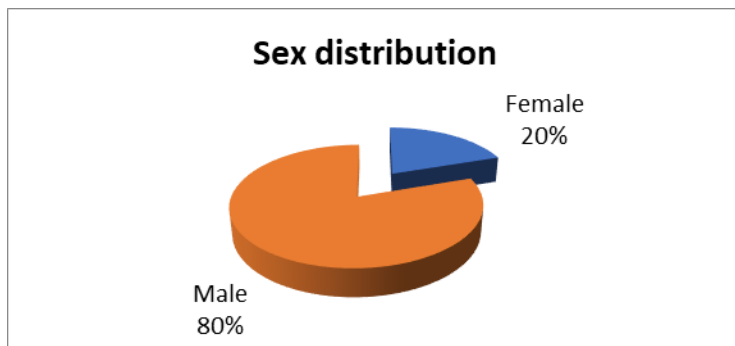


Table 3: Age wise distribution

Age(years)	1-10 years	11-20 years	21-30 years	31-40 years	41-50 years	51-60 years	61-70 years	71-80 years	81-90 years	Total
No of cases	20	37	96	68	61	37	12	5	2	338
%	5.92	10.94	28.40	20.12	18.05	10.95	3.55	1.48	0.59	100

Chart 3: Age wise distribution

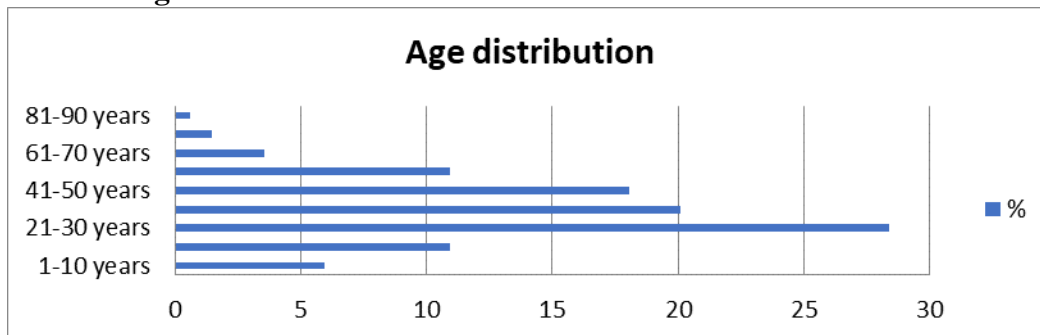


Table 4: Time of incidence

Time of injury	1-2	2-3	3-4	4-5	5-6	6-7	7-8	8-9	9-10	10-11	11-12	12-1	Grand Total
No of cases at AM	0	6	4	3	5	12	15	11	12	12	14	9	103
No of cases at PM	17	20	19	26	30	18	22	19	20	15	12	17	235
Grand Total	17	26	23	29	35	30	37	30	32	27	26	26	338

Chart 4: Time of incidence

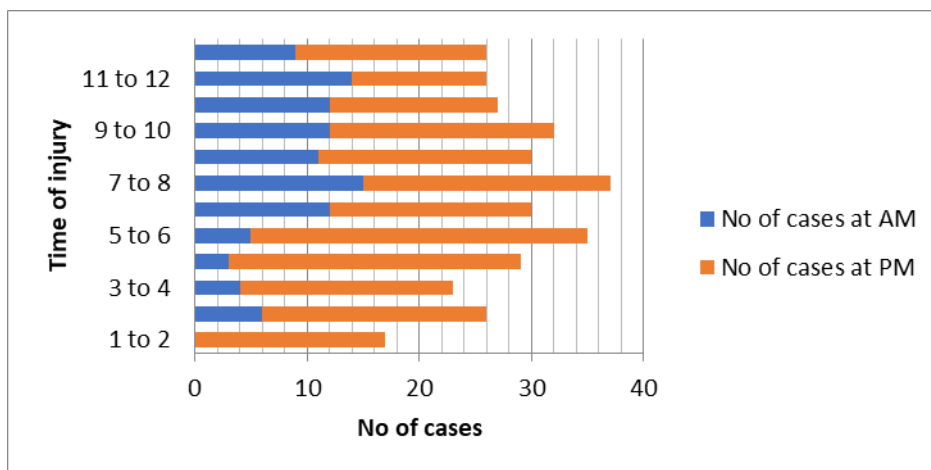


Table 5: Place of incidence

Sex	Location				Total no of cases	Total %
	Rural		Urban			
	No of cases	%	No of cases	%		
Female	34	20.00%	33	19.64%	67	19.82%
Male	136	80.00%	135	80.36%	271	80.18%
Grand Total	170	100.00%	168	100.00%	338	100.00%

Chart 5: Place of incidence

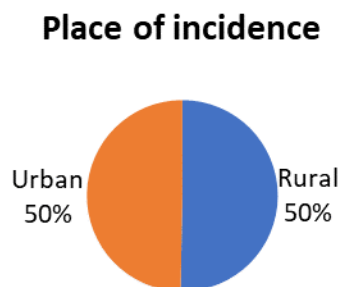


Table 6: Alcohol consumption in relation to head injuries

History of alcohol consumption by the victim				
Cause of injury	No of cases consumed	Total no of cases	% of cases consumed	Total %
Assault	6	20	30.00%	100%
Fall From Height	2	49	4.08%	100%
Ground Level Fall	0	11	0.00%	100%
Object fall on head	0	2	0.00%	100%
Road Traffic Accident	68	256	26.56%	100%
Grand Total	76	338	22.49%	100%

Outcome and period of survival in victims of head injuries

Table 7: Outcome in victims of head injuries

Outcome	Cause of injury					Grand Total
	Assault	Fall From Height	Ground Level Fall	Object fall on head	Road Traffic Accident	
Alive	20	43	11	2	240	316
Dead	0	6	0	0	16	22
Grand Total	20	49	11	2	256	338

Chart 6: Outcome in victims of head injuries

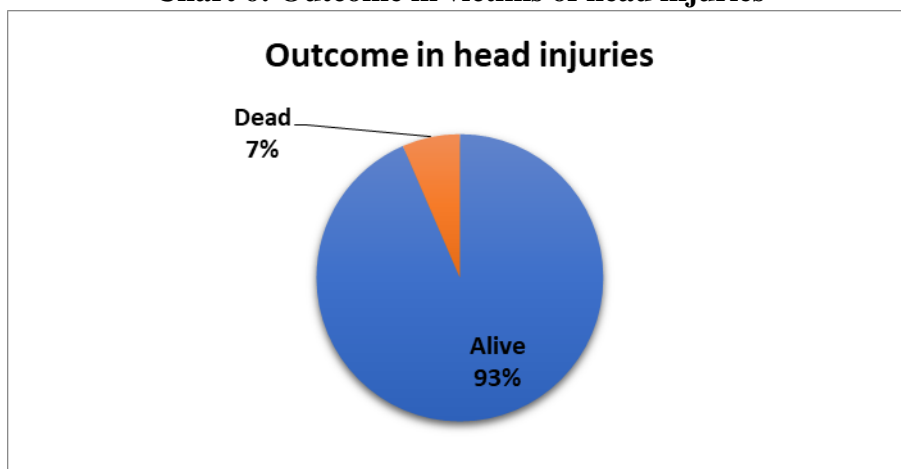


Table 8: Period of survival in victims of head injuries

Survival period in dead victims	3 Hours	5 Hours	10 Hours	13 Hours	2 Days	3 Days	4 Days	5 Days	6 Days	8 Days	17 Days	20 Days
No of cases	1	1	2	1	1	3	4	3	1	2	2	1

Chart 7: Period of survival in victims of head injuries

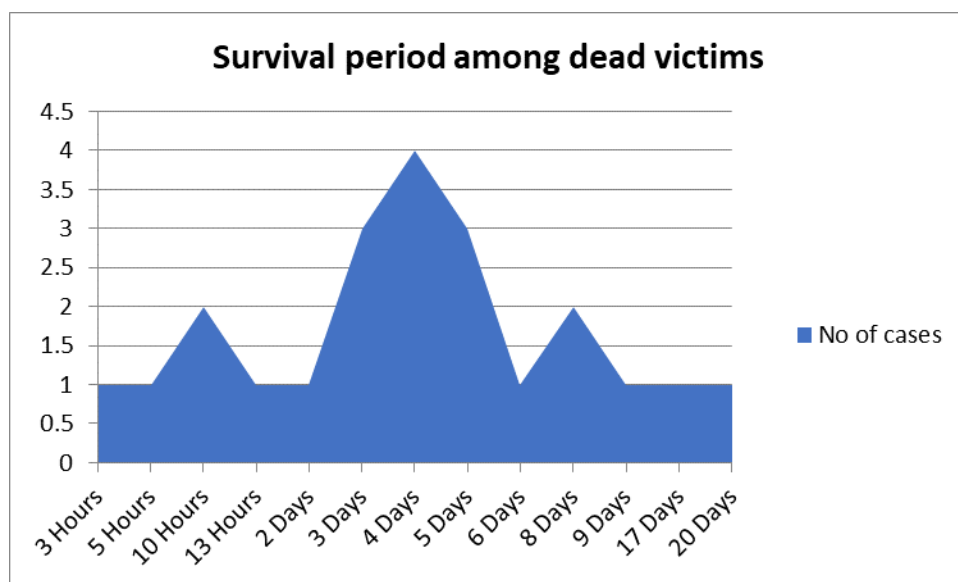


Table 9: Intracranial haemorrhages

Cause of injury	Intracranial haemorrhages					
	Present		Absent		Total	
	No of cases	%	No of cases	%	No of cases	%
Assault	8	40.00%	12	60.00%	20	100%
Fall From Height	31	63.27%	18	36.73%	49	100%
Ground Level Fall	6	54.55%	5	45.45%	11	100%
Object fall on head	1	50.00%	1	50.00%	2	100%
Road Traffic Accident	135	52.73%	121	47.27%	256	100%
Grand Total	181	53.55%	157	46.45%	338	100%

Table 10: Intracranial haemorrhages

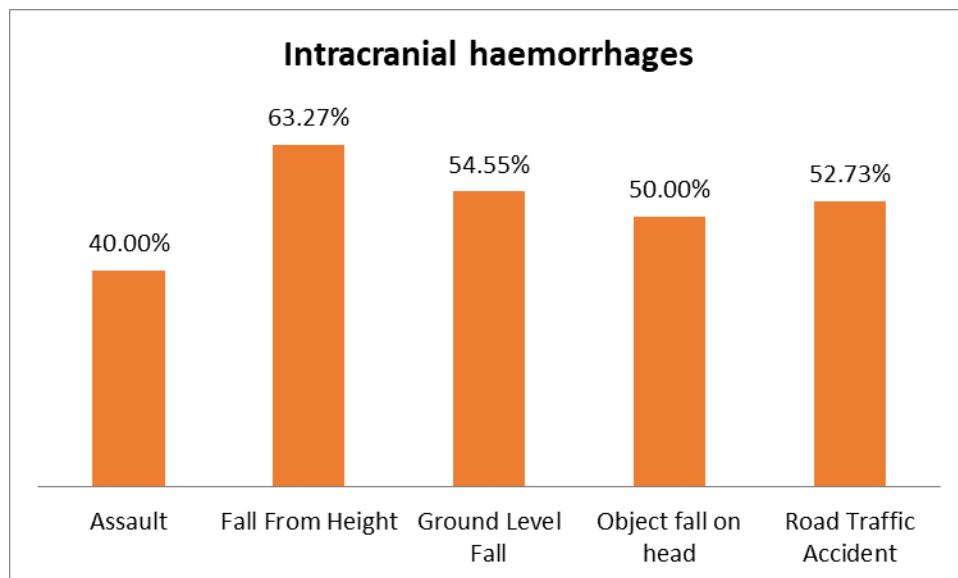
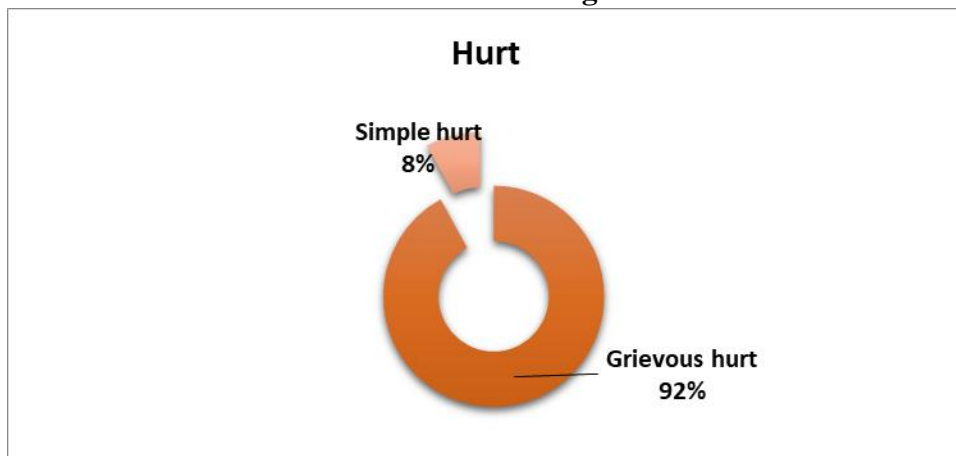


Table 37: Autopsy findings

Autopsy findings in deceased	No of cases	%
Scalp injuries	6	85.71%
Skull fractures	2	28.57%
Intracranial haemorrhage	6	85.71%
Extradural haemorrhage	2	28.57%
Subdural haemorrhage	5	71.43%
Subarachnoid haemorrhage	3	42.86%
Intraventricularhaemorrhage	2	28.57%
Brain contusion	2	28.57%
Cerebral oedema	2	28.57%
Total no of cases	7	100.00%

Chart 28: Distribution of victims according to nature of hurt



CONCLUSION

In the present study among total 338 head injury cases road traffic accidents constitute majority (256(75.74%)), followed by 60(17.75%) cases of head injuries due to fall. Of these head injuries due to falls, fall from height were 49(14.50%) and ground level fall were 11(3.25%). There were 20(5.92%) assault cases, and only 2(0.59%) cases of heavy blunt object fall on head. Of which 1(2 years/male) injured in home due to TV stand fall on head and another (23 years/male) injured in workplace due to cement bag fall on head. among total 338 head injury cases males comprised a majority and constituted 271(80.18%) compared to females who were 67(19.82%) with male: female ratio of 4:1. Among 256 road traffic accidents males were 208(81.25%) and females were 48(18.75%). Among 49 falls from height males were 37(75.51%) and females were 12(24.49%). Among 11 ground level falls males were 7(63.64%) and females were 4(36.36%). Among 20 assaults males were 17(85%) and females were 3(15%). Among 2 cases of heavy blunt object fall on head both 2(100%) were males. The age of the victims varied from 1-87 years. The peak incidence was observed in the age group 21-30 years comprising 96 cases (28.40%). It was also observed that 68(20.12%) belonged to the age group of 31-40 years and 61(18.05%) belonged to the age group of 41-50 years. Thus 66.57% of cases belonged to the age group of 21-50 years. Individual in the old age group 60-90 years were the least affected 5.62% followed by 5.92% belonged to young age group 1-10 years. In 256 RTA cases, the most common age group was 21-40 years comprising 136 cases (53.12%). Fall from height was more common in 21-40 years age group in 21(42.86%) cases and peak incidence occurred at 40 years

of age comprising 12.24% (6 cases). The commonest head injury in the age group up to 3 years was fall from height (3 cases). In 11 ground level falls peak (3(27.27%)) incidence occurred at 60 years of age. In 20 assaults more (6(30%)) cases belong to 31-40 years of age. In 2 cases of heavy blunt object fall on head 1(50%) was 2 years and another was 23(50%) years. Most of the incidents irrespective of the cause, occurred between 5-10PM comprising 164(48.52%) of total cases. The more number of incidence occur between 7-8PM comprising 37(10.94%) followed by 5-6PM comprising 35(10.35%) cases. And between 6PM and 6AM were 16(45.31%). More number (7(14.28%)) of falls from height occurred between 5-7PM. More number (2(18.18%)) of ground level falls occurred between 3-4PM. Most of assaults occurred between 4-5PM (3(15%)) and 9-10AM (3(15%)). In 2 cases of heavy blunt object fall on head 1(2 years) occurred at 11AM in home and another (23 years) occurred at 4PM in workplace. Among 338 cases, 170(50.30%) cases belonged to rural areas and 168(49.70%) cases belonged to urban areas. In case of RTA 68(26.56%) victims had history of alcohol intake before the incident. In case of assaults 6(30%) victims had history of alcohol intake before the incident. In case of fall from height 2(4.08%) had history of alcohol intake before the incident. Among total 338 cases 316(93.49%) cases were survived and 22(6.51%) cases were dead. Among 22 deaths, survival of a victim after sustaining injury varied from 3 hours to 20 days. Most of deaths 10(45.45%) occurred between 3-5 days followed by 5(22.73%) between 3-13 hours. Among 256 RTA cases death occurred in only 16(6.25%) cases. In that majority (7(43.75%)) died between 3-5 days after sustaining injury. Deaths in cases below 18 years were only 2(0.59%) and those were due to road traffic accidents. Among 49, fall from height cases death occurred in only 6(12.24%) cases. In that majority (3(50%)) died on 4th day of sustaining injury. No deaths in cases of ground level falls, assaults and heavy blunt object fall on head. Because of advanced life saving measures, death of patients were low even in cases of head injury. There were 181 (53.55%) victims with intracranial haemorrhages. Out of 338 head injury cases, 311(92.01%) belonged to grievous hurt and only 27(7.99%) belonged to simple hurt.

RECOMMENDATIONS

- The alcohol incidence in head injuries were about 26.56% in road traffic accidents. Strict traffic rules must be implemented and proper checking by traffic police to prevent drunk and drive.

- 7.75% victims of motorcycle riders were below 18 years of age. Implementation of rules to prevent drive by children below 18 years.
- 16.41% victims of RTA were pedestrians. This can be prevented by constructing foot paths and make their usage compulsory.

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