Original Article

A Comprehensive Study of Two Wheeler MotorVehicular Fatalities Brought to Department of Forensic Medicine for Autopsy Examination

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Abstract:
110 cases of motor-vehicular fatalities received to GMC morgue for postmortem examination from in and around GMC were studied during April 2018 to March 2019. Data was analyzed with respect to age, sex, injury pattern, cause and time of death, use of helmets, etc. Head injury including cervical spine injuries were the common causes of death. The deceased were mostly the single riders. In cases with pillion riders, deaths were more seen in pillion riders.

Keywords:motor-vehicular accident; injuries; fatal.

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Introduction

Department of Forensic medicine and Toxicology, Goa Medical College conducts postmortem examinations in all cases of unnatural deaths. It has been noted that there has been a significant increase in postmortem conducted in the recent years even with newer and advanced techniques of disease management. Motor cycle accidents are most predictable and hence can be preventable.[1]

A motorcycle is a single track, two wheeled motor-vehicle powered by an engine.[1] According to NCRB data, In 2019, two-wheeler deaths accounted for 38 per cent of all road deaths, up from around 35 per cent in **2018**.[2]

Several studies showed that use of helmets has reduced mortality in Motor vehicular accidents. However helmets are known to increase the risk of neck injuries and it is a known fact that the field of vision and hearing are restricted.[1]

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"Accidents" according to WHO are considered to be an unpremeditated event resulting in recognizable damage. The American Safety Council defines it as "Occurrence in a sequence of events which usually produces unintended injury, death or property damage[3]

Materials and Methods

The study was carried out at department of Forensic Medicine and Toxicology at Goa Medical College from April 2018- March 2019. The subjects were all victims of fatal motor cycle accidents which were subjected for postmortem examination by Goa Police. This study was undertaken 1) to study and analyse the pattern of injuries case of victims of two wheeler accidents, 2) To study the survival period of victims of two wheeler accidents. 3) To assess the effectiveness of protection offered by wearing helmet and 4) To compare the results obtained with similar studies.

Relevant details of scene of incidence/ offence were obtained from the investigating officers, hospital records and near relations. Results were tabulated and the analysis was done using SPSS. Test of significance was applied and p value <0.05 was taken to be significant.

Results

It was observed that fatal motor vehicular accidents accounted for 7.86% of all autopsies (1399) conducted at Forensic Medicine Department, GMC.

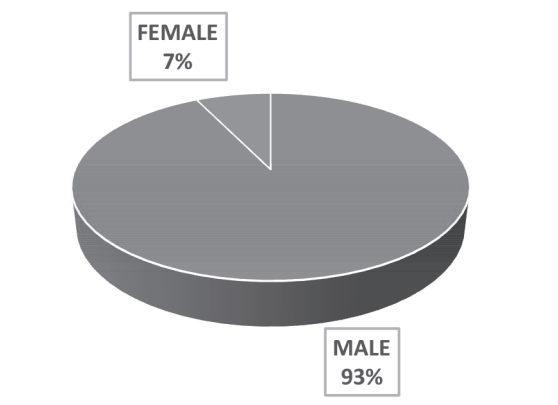
A total of 107 cases of motor-vehicular accidents with fatalities were registered, which resulted in deaths of 110 occupants. Out of 107 cases, 90 cases were single rider and 17 cases were with pillion rider. Out of 17 cases having pillion riders, 10 cases revealed death of only pillion riders, 03 cases revealed death of both rider and pillion & 04 cases only rider. Out of 110 fatalities, 97 deceased were riders and 13 were pillion riders.

Table no 1 - Distribution of fatal cases based on occupancy of bike

Fatal cases	Single Occupant	With pillion			Total
Deceased		Only pillion	Pillion + rider	Only rider	
Rider	90	-	3	4	97
Pillion	-	10	3	-	13
Total	90	10	6	4	110

The victims were mostly males as compared to females amounting to 12.75:1 ratio.

Figure No 1: Showing distribution of cases based on Gender



Maximum number of cases were seen among young adults in their 3rd decade of life. No cases were reported in the 1st decade of life.

None of the pillion riders were wearing helmet at the time of incidence. However, 48 deceased riders (43.63%) were wearing helmet at the time of accident.

Table No 2: Age wise distribution of cases

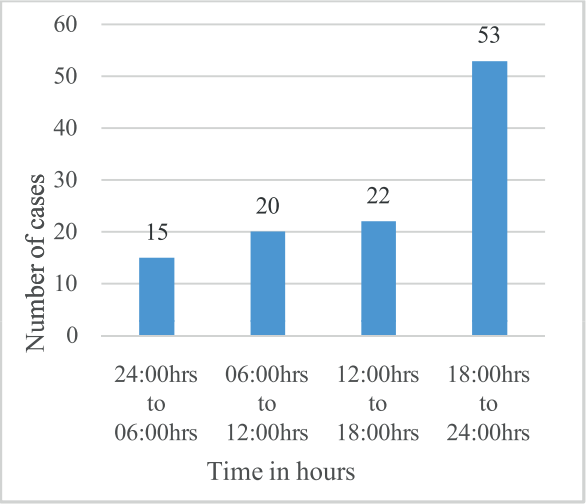
Age (years)	Total	Percentage	Male	Female
0-10	0	0	0	0
11-20	4	3.64	4	0
21-30	50	45.45	44	6
31-40	30	27.27	28	2
41-50	12	10.91	10	2
51-60	8	7.27	8	0
Above 6oyrs	6	5.45	6	0

Table no 3: Use of helmets in occupants

Use of Helmet	No of Cases			
	Driver	Pillion	Total	%
Helmet used	48	0	48	43.63
Helmet not used	49	13	62	56.36
Total	97	13	110	100

Maximum accidents were observed during the late night hours (18:00 to 24:00Hrs) i.e. 48.18% and the least 13.63% during 24:00Hrs to 06:00 Hrs. In majority of cases the offending vehicles were heavy weight motor vehicles followed by medium weight vehicles.

FigureNo 2: Timing of accidents



In 34 cases, death was on the spot followed by cases brought dead to hospital (26 cases). Head and face was the most vulnerable and affected part involved in 62 cases i.e. 56.36% cases followed by thorax in 23 cases (20.91%).

Table no 4: Distribution based on Survival Period

Sr No.	Survival Time	No. of Cases	%
1.	Died on spot	34	30.91
2.	Brought dead to hospital	26	23.64
3.	Upto 24hrs	12	10.91
4.	1 day to week	30	27.27
5.	More than 1week	08	7.27

In 50 cases i.e. 45.45% cases, head injury was the leading cause of death followed by blunt chest trauma (18 cases i.e. 16.36% cases). It was observed that among helmet users (15) the incidence of death due to head injury was less (31.25%) as compared to non–helmet users (35) where head injury was seen in 56.45% cases.

Death due to cervical spine injury were seen in 17cases. Although helmet use showed lesser incidence of head injury as the cause of death, it was observed that cervical spine damage was more prevalent in helmet users (11cases) i.e. 22.91% along with other injuries as compared with non-helmet users (06 cases) i.e. 9.67%.

Table no 5: Distribution based on injured body region

Sr No	Body Region	No. of Cases	%
1.	Head and face	62	56.36
2.	Neck	18	16.36
3.	Thorax	23	20.91
4.	Abdomen & Pelvis	20	18.18
5.	Extremities	08	07.27

With respect to pattern of injuries among helmet users we observed that head and face was affected in 20 cases followed by neck in 12 cases and the extremities the least in 03 cases and among non-helmet users, head and face was affected in 42cases followed by injuries to thorax in 15 cases and the extremities the least in 05 cases.

Discussion

It is a well-known fact that motor vehicular accident deaths are one of the leading cause of deaths and accounts to maximum number of morbidity worldwide. Road traffic crashes cost most countries 3% of their gross domestic product. 93% of the world's fatalities on the roads occur in low- and middle-income countries, even though these countries have approximately 60% of the world's vehicles.[4]

India accounts for about 10 percent of road accident fatalities worldwide, 85% of all road accident deaths occurring in developing countries, and nearly half in the Asia-Pacific region. [5]

The increased rate of fatal road traffic accident worldwide has been attributed to population explosion and increased motorization.[6]

There were 110 cases of motorcycle fatalities observed amounting to 7.86% of total medicolegal autopsies conducted during period of April 2018 - March 2019 at Department of Forensic Medicine & Toxicology.

A total of 107 cases of motor-vehicular accidents with fatalities were registered, which resulted in deaths of 110 occupants. Out of 107 cases, 84.11% (90) cases were single rider and 15.8% (17) cases were with pillion rider. Out of 17 cases having pillion riders, in 58% (10) cases death of only pillion riders were seen, in 17.6% (03) cases both rider and pillion rider died and in 23.52% (04)cases, only riders died. Out of 110 fatalities, 88.18% (97) deceased were riders and 11.81% (13) were pillion riders as shown in Table No 1.

Fatalities were mostly seen in single riders as compared to one with pillion rider the reason being single riders are more involved in speeding and rash driving as compared to one with pillion rider. When pillion rider is present rider tends to be overcautious.

Although percentage of fatalities were more in riders, it was observed that deaths of pillion riders were more as compared to riders in double occupancy. The reason being is non-use of helmets by pillion riders, lack of attention and alertness when sudden brake is applied or when two wheelers suddenly stops.

Majority of cases (92.7%) were males as compared to females (7.27%) as shown in Figure No 1. It is a known fact that more of males and less of females have a craze about racing and speeding on the roads and streets. More oftenly some males drive under the influence of alcohol and meet with accidents. Similar findings were recorded in studies by *KasantiKul v. et al*[7] and *BeheraC. et al*[1]. Reason being males are often exposed to out of the household surroundings for earning that puts them at more risk, therefore explaining the increased males involved in fatal motor vehicular accidents. Male: female Ratio was 12.75: 1 in the present study similar to the one observed by C. *Behera et al*[1], *Nilsson B et al*[8].*Animesh Jain et al* [17]found that Accident rate among males (83%) was higher than that among females (17%).

As shown in table No 2, the commonest age group involved was 3rd decade (45.45%) of life, followed by 4th decade (27.27%). 3rd and 4th decade age groups are the maximum known two wheeler users and it is considered to be active phase of life and hence maximum number of accidents and deaths relating to this accidents are seen in this age groups. *Raj TS et al*[9] observed similar findings in his study held in Hyderabad. *NilambarJha et*[18]found that highest number i.e 31.3% victims were between 20-29 years of life. About 71% of victims were under 40yrs.Individuals in this age group are found frequently involved in outdoor activities due to their social, job related, educational and other commitments.

In the present study, main offending vehicle involved in the accidents were two wheelers. It is due to the fact the total numbers of two wheelers outnumber the four wheelers and are popular mode of transport among young generation in the city. This creates massive traffic management issues in most parts of the city, also leads to traffic rule violations and increase in number of RTAs. However, other studies have noted different findings due to the fact that mode of conveyance is different in different cities as per the infrastructural setup of that city. *Kasantikul V Et al*[7] in their study in Thailand had a contrasting picture and noted that most vulnerable age group was below 21 yrs. *Animesh Jain et al* [17]found thatHighest number of accidents was seen during 6-10 pm.

It was noted that accidents were more commonly noted during late night hours as compared to rest of the day as shown in Figure No2. 48.18% of accidents occurred during 18:00hrs to 24:00hrs followed by 20% during 12:00hrs to 18:00hrs and the least 13.63% during 24:00hrs to 06:00hrs. The basic reason behind this probably is that in Goa night life is more active than the days socially.

Not surprisingly in rural parts of India, it is expected that the child starts earning at an early stage which makes them leave home and compels their discontinuation of education[10]. In our study, most of the accidents occurred in early night hours (18-24 hours), the reason being this being peak hours of heavy traffic on roads sometimes in hurry & anxiety to reach their destination they meet up with accident. The findings of our study coincide reasonably with other studies.[10,11,12,13,14]. As per *Aygencel et al*[12] these hours correspond to the time range that people actively work and travel, and then go back to their homes after finishing work. An increased number of vehicles in the traffic, and reduced attention of drivers and pedestrians related to the fatigue of the day;

failures to follow traffic rules, associated with improper infrastructure like the absence of footpaths were the greatest cause of accidents.[13]

In our study we noticed that 34 cases i.e. 30.91% died on the spot and 26cases i.e. 23.64 died on the way to hospital (brought dead). A significant number of subjects 30cases i.e. 27.27% died within 1day to 1week of hospitalization as shown in Table no 4. This implies that two wheeler accidents are fatal in nature. Our findings were similar to *Animesh Jain et al* [17] Who found that 45 subjects died on the spot.

In our study 43.63% (48 cases) deceased had worn helmets and 56.36% (62cases) deceased did not wear helmets at the time of incidence. *Graf L L et a1*[15]observed in their study that more than 60% were non-helmet users. *K.Prasannan et al*[19]noticed that Only 38.1% were wearing helmet in spite of helmet wearers. Non-helmet users mostly died due to head injuries (56.45%) as compared to head injury among helmet users (31.25%). Cervical spine damage was seen in 22.91% cases of helmet users and 9.67% cases of non-helmet users as shown in Table no 6. It was found that chances of cervical spine damage were higher in helmet users and chances of head injury was higher among non-helmet users. We also observed that among helmet users, BCT accounted for 16.66% deaths, BAT for 18.75% deaths and combined injuries in 10.41% cases & among non-helmet users, BCT accounted for 16.12% deaths, BAT for 11.29% deaths and combined injuries in 06.45% cases. *K.Prasannan et al*[19] observed that head injury was the cause of death in 49.6%. Incidence of head injury was slightly more in pillion riders, may be due to helmet use by drivers. Use of helmet reduces chances of head injuries and the resultant mortality. *Gupta V et al*[20] showed 17.8% fatality cases associated with thoracic injury in two-wheeler accidents.

Table no 7 & 8 shows spectrum of pattern of injuries among helmet users and non-helmet users. It is observed that among helmet users, 41.66% cases injury to head & face proved to be fatal followed by injury to neck in 25% cases and the extremities least in 06.25% cases. Among the non-helmet users' injuries for head and face were seen in 67.74% cases followed by thorax in 24.19% cases and the least i.e. 8.06% cases injury for extremities was seen. In helmet users head injuries were significantly reduced however it was seen that force of impact on the head was transmitted to the neck leading to cervical spine injury. 2/3rd of all crashes resulted in injury to head, face and neck. Despite the legal requirement, people in Goa avoid using helmets, hence mortality as a consequence of head injury secondary to motor cycle fatalities is common. *Kasantikul V et al*[7]observed that upper and lower limbs were injured more frequently although these injuries were not life threatening. *Chinn B et al*[16]observed that limbs, head and thorax were the most commonly injured body parts and these injuries individually or in combination proved to be fatal in few cases. *Gupta V et al*[20] study showed mortality is mainly associated with head injury (24.7%) then followed by thoracic injury (17.8%) and abdominal injury (15.7%).

Conclusion

Fatalities in two wheeler motor vehicular accident cases are very common.Incidence of two wheeler motor vehicular accidents with fatalities are higher in single riders as compared to that with pillion rider. Among rider with the pillion rider death was more in pillion as compared to rider.Deceased were mostly males as compared to females.Age group of 20 to 40 years are most common victims. Accidents usually occur after 18:00hrs. Maximum number of our subjects died on the spot. Head and face injury including cervical spine damage were the common causes of death. Helmet use significantly reduces the risk of head injuries.

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Ethical clearance: Obtained from Institutional Ethics committee

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Table no 6: Cause of death

Sr No.	Cause	No. of Cases					
		Helmet Users	%	Non-Helmet Users	%	Total	%
1.	Head injury	15	31.25	35	56.45	50	45.45
2.	Cervical spine damage	11	22.91	06	9.67	17	15.45
3.	BCT	08	16.66	10	16.12	18	16.36
4.	BAT	09	18.75	07	11.29	16	14.54
5.	Combined	05	10.41	04	6.45	09	8.18
	Total	48		62		110	

Table no 7: Pattern of injury among helmet users

Sr No	Body Region	No. of Cases	%
1.	Head and face	20	41.66
2.	Neck	12	25
3.	Thorax	8	16.66
4.	Abdomen & pelvis	10	20.83
5.	Extremity	3	06.25

Table no 8: Pattern of injury among non-helmet users

Sr No	Body Region	No. of Cases	%
1.	Head and face	42	67.74
2.	Neck	6	09.67
3.	Thorax	15	24.19
4.	Abdomen & pelvis	10	16.12
5.	Extremity	05	8.06