Are Pedestrians Safe on Roads in Kerala: An Opportunity to Intervene: Profile of Adult Pedestrian Injuries in a Tertiary Referral Centre in Mid Kerala: A Prospective Study

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ABSTRACT

BACKGROUND
Trauma forms one of the most important causes of deaths involving most productive age group in the world. From various studies across the world in India pedestrians contribute to around 30 to 40% injuries. In India Pedestrian related crashes cause an estimated death of 1.2 million and 50 million injuries world-wide. This injury also varies between various economic strata of countries amounting to almost 45% of road traffic deaths in undeveloped countries. In Kerala also trauma related injuries in pedestrians are found to be in a relative increase following in lifting of alcohol ban. Government Medical College, Thrissur, which is the main referral center for the 3 Mid Kerala districts of Palakkad, Thrissur and Malappuram receives more than 100 trauma patients per day.

METHODS
This prospective study undertaken studied 307 cases of adult pedestrian injuries of which 72 were fatal injuries (23%). The study was undertaken to analyses in depth the causative pattern of injuries and the distribution of injury pattern in pedestrians in the Mid Kerala districts of Kerala.

RESULTS
This study analysed in detail the various aspects of pedestrian accidents on the road and brings out the pattern of injuries in pedestrian trauma in detail both in fatal and non-fatal and is distributed in detail across 17 variables.

CONCLUSIONS
The final outcome of the study has provided valuable inputs for the institution and district law enforcing agencies regarding the various aspects of pedestrian accidents like the roads where the pedestrian accidents are high, the common areas of pedestrian impacts, the timing and days where more care should be undertaken and litigatory measures for drunken & drug abuse drivers.

KEYWORDS
Pedestrian Injuries, Injury Severity Score, Fatal Injuries, Non-Fatal Injuries
BACKGROUND

Trauma forms one of the most important causes of deaths involving most productive age group in the world. Worldwide, road traffic injuries are a leading cause of death with more than 1.2 million fatalities each year and in India pedestrian injuries contribute to around 30 to 40% injuries. All around the world as per recent US and UK data the pedestrian injuries are on the increase and there were 470 pedestrian deaths in the UK in 2017, a 5% increase on 2016. 26% of all road deaths were pedestrians.1

Road-traffic pedestrian injuries are a significant public health concern, annually killing over 4,000 people in the U.S. and almost. 2 million worldwide. The magnitude of non-fatal injuries is staggering, with over 60,000 people injured in the U.S. and between 20 million and 50 million worldwide. Data indicate that these injuries will rise dramatically by the year 2020, particularly in countries that are rapidly motorizing.2

In Kerala also trauma related injuries in pedestrians are found to be in a relative increase following in lifting of alcohol ban. Government Medical College, Thrissur which is the main referral center for the 3 Mid Kerala districts of Palakkad, Thrissur and Malappuram receives more than 100 trauma patients per day. The details of pedestrian injuries with reference to various aspects were not studied in detail in any of the previous studies of Kerala.

This study was undertaken to identify the quantum of pedestrian injuries, mode of injuries and various patterns of injuries in 3 major Mid Kerala districts. The study is undertaken to analyse in depth the causative pattern of injuries and the distribution of injury pattern in pedestrians in the Mid Kerala districts of Kerala. This study has identified the pattern of nonfatal and fatal injuries in pedestrian trauma and also more importantly identify the causative pattern of injuries in detail.

The final outcome of the study has given valuable inputs for the institution and district law enforcing agencies regarding the various aspects of pedestrian accidents like the roads where the pedestrian accidents are high, the common areas of pedestrian impacts, the timing and days where more care should be undertaken.

METHODS

We conducted a prospective study of 307 patients of pedestrian injuries attended the emergency and trauma department of government medical college Thrissur with 72 fatal injuries and 235 non-fatal injuries with an intention analyses various aspects of occurrence and injury patterns in a period of continuous 6 months from November 2018 to April 2019. This was a prospective study design was undertaken included all adult patients attending the emergency trauma units and the pattern of injuries and details was collected by Performa every day by resident and researchers. Those admitted was followed up for a period till they are discharged or otherwise.

RESULTS

We analysed the Patients, who were categorized according to AIS injury severity score. Out of total number of surgical and trauma causalities, over the study period of 6 months 307 pedestrian injury were recorded, 72 (23%) of which were fatal injuries. The most vulnerable are those between 40 to 60 years of age (34.5%), followed by patients above 60 years accounting to 30.90%, and only 8.5% of patients were below 20 years.

Occurrence of accidents among each gender is compared and found that males are the most affected 72.20% of total and females 27.70% and similar distribution was identified on the fatal injuries as well. The majority of the patients received in the casualty belonged to ISS score below 10 (54.7%) and 26.7% of the patients received had ISS score above 15 indicating the severe form of pedestrian impact. We also analysed the pattern of fatality according to injury severity score and found that (64/72) has mean ISS score 23.6 on arrival.

<table>
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<th>Particulars</th>
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<td>Severe</td>
<td>22</td>
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Table 1. Age, Gender Distribution of Fatal and Non-Fatal Injuries

When the pattern of occurrence of injuries were analyzed systematically it was found that 77.9% of the total pedestrian injuries were documented to be on the urban roads, more in state highways than in national highways and local roads. 22.1% of the accidents occurred on rural area roads. State highways had the greatest number of accidents 48.90%, followed by local roads 26.1% and national highways 25.1%. The fatal injuries were more on the National high way pedestrian injuries.

We analyzed the temporal distribution of the injuries with reference to the day and timing of injuries in details and found that there is no statistical difference in the injury pattern on any of the weekdays but significant number of injuries occurred between 4-8 pm (33.6%) and 8 pm to 12 pm (23.8%) reflecting pattern of pedestrian movements.

The major bulk of accidents were caused by Bike riders accounting for more than half of the incidents (55.7%), car (13%), unknown vehicles (6.8%), hit and run (6.2%) in total
and in fatal injuries in national highways were caused by car impacts. Occurrence of injury is mostly by while Crossing the road (67.3%), walking along (16%), standing by the road (2.6%). The impact of the injuries was analyzed and 75.2% of the patient had side impact when crossing or walking along side and 17.90% had impact on the back. Only 9.7% had direct impact from front.

The pattern of injuries and the various other factors were compared between the Fatal patients and non-fatal injuries and it was found that majority of the fatal accidents occurred in national highway crossings and affected people above 40 years. The distribution injuries showed that Fatal patients had a mean ISS score of 23.1 on admission and the pattern of distribution of injuries showing Head injury (82%) Chest and abdominal injuries in 72% and severe limb injuries in 93% compared to 32%, 6% and 67% in non-fatal injuries.

DISCUSSION

Worldwide, road traffic injuries are a leading cause of death with more than 1.2 million fatalities each year. Road-traffic pedestrian injuries are a significant public health concern, with an average number of 4,000 people in the U.S. and almost 0.2 million worldwide. The magnitude of non-fatal injuries is also alarming between 20 million and 50 million worldwide. It is denoting that injuries will rise dramatically by the year 2020, particularly in countries that are rapidly motorizing.\(^1,2\) In UK there were 470 pedestrian deaths in the UK in 2017, a 5% increase on 2016 and 26% of all road deaths were pedestrians.\(^3\) In Kerala also the incidence of Pedestrian injuries was increasing and so far, no documented study was undertaken in this regard, so we decided to analyse in detail the pattern and profile of these injuries in detail in Mid Kerala tertiary referral centre.

Pedestrians are highly vulnerable as the impact is on the unprotected body and direct and severe injuries can occur due to unique kinetics. The most vulnerable are those between 40 to 60 years of age, 34.5% of total, followed by patients above 60 years accounting to 30.90% denoting the vulnerability of these age groups due to multiple factors. The males were commonly involved in this study as in Kerala, the gender behaviour also may be a contributory factor for this significance difference.

There are some studies in literature in which strikingly, women were overrepresented in the pedestrian group when compared to motor vehicle occupants. Barely any evidence is known regarding this gender distribution in collision trauma patients.\(^4,5\) Some researchers have reported higher rate of children in pedestrian motor vehicle crashes and is not surprising because their unpredictable behaviour as road traffic participants.\(^6,7\) We haven’t included the pedestrian paediatric cases for detail analysis in this study.

In our study most of the patients were having injury severity score of below 10 and 82 patients had an ISS score of above 17. The fatal injury patients had a mean ISS score of 23.1 and ISS score on admission is found to predict the progression as in all trauma victims.\(^8,9,10,11\) The pattern of distribution of injuries in fatal patients showed Head injury (82%), Chest and abdominal injuries in 72% and severe limb injuries in 93% compared to 32%, 6% and 67% in non-fatal injuries. Pedestrian injury patterns comprise three major physical impacts: the bumper, the hood and windscreen and the ground impact. Based upon this, specific injury patterns in Pedestrians could be
described. In 1965, Farley introduced the term “fatal triad” as a combination out of injuries of the lower extremities, the pelvis and the head. Over the past 40 years, contradicting literature was published in various countries regarding this topic. While several authors aimed to object the theories of Waddle and Farley, the significance of most studies is limited by methodological aspects such as small study populations. In several studies, no specific injury combination could be identified but lower extremity musculoskeletal injuries could be labelled as the most common injuries in victims of Pedestrian motor vehicle injuries. Our study showed there is a definite statistical difference in the pattern of injuries in the fatal patients with predominant involvement of Head injuries, torso injuries. The Lower muscular skeletal injuries were the most common injury in the whole group.

When the pattern of occurrence of injuries were analysed systematically it was found that 77.9% of the total pedestrian injuries were documented to be on the urban roads, more in state highways than in national highways and local roads. The fatal injuries were more reported on the National highways. This points to the fact of unprotected pedestrians in these high-speed roads as one sole reason for this. The lack of proper zebra crossings and under passages may be the reasons for the pedestrians to cross the road and get hit by the speeding motor vehicles.

We analysed the temporal distribution of the injuries with reference to the day and timing of injuries in details and found that there is no statistical difference in the injury pattern on any of the weekdays but significant number of injuries occurred between 4-8 pm (33.6%) and 8 pm to 12 pm (23.8%). This denotes that the vulnerable time between 4 pm to 12 pm and it may be due to lack of adequate lightings on the road and a greater number of pedestrians on the road. Occurrence of injury is mostly by while Crossing the road (67.3%), walking along (16%), standing by the road (2.6%). The impact of the injuries was analysed and 75.2% of the patient had side impact when crossing or walking along side and 17.90% had impact on the back only 9.7% had direct impact from Front.

The majority of impacts was caused while crossing the road and by bike riders also delineates the science of injuries in most occasions. There are various factors that can be accountable for these injuries like improper illumination on roads, speedy drivers, lack of traffic regulations, walking on the wrong side of roads, lack of Zebra crossings and adequate number of under passages or over ground passages on the Highways. Complete segregation of pedestrians from the highway, Zebra crossings and subways at appropriate places may be essential requirement and ensuring Speed limits near populated areas may be a worthy solution.

CONCLUSIONS

The study was undertaken with a high interest on the social impact of planning intervention measures to reduce the loss of life on the roads. It’s essential to note that the doctor’s responsibility should go beyond emergency treatment, but to focus on a holistic approach to this growing epidemic. Because pedestrian motor-vehicle collisions have a predictable pattern and they can very well be prevented. Future research and implementation of strategic plans can reduce the risk exposure to those vulnerable population. Advocacy for pedestrian safety can involve health-policy issues at the local, regional or legislative level.

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REFERENCES