Impact of Driver Characteristics on the Severity of Injuries and Final Outcome of Four-Wheeler Automobile Accident Victims

D Sah, F Huda, S Sharma

Citation

Abstract

Background: Globally, injuries are responsible for about 5% of the total mortalities and a large proportion out of them is due to road traffic accidents. One of the most important factors for these accidents is the driver himself and his driving characteristics.

Aim and Objective: To evaluate the impact of driver characteristics on the severity of injuries and final outcome of the victims of four-wheeler automobile accidents.

Materials and Methods: All cases of four-wheeler automobile accidents admitted in Teerthankar Mahaveer Medical College, Moradabad from 1st May 2008 to 31st October 2008 were studied. The automobile drivers were divided in two groups: Group A: Professional drivers and Group B: Non-professional drivers, and their various characteristics and the impact on accidents and victims were tabulated. Results: Among the two groups of drivers, there was a much higher percentage of accidents in the former compared to the latter group. Also, the risk factors for driving were found to be more commonly associated with professional than with non-professional drivers. Consequently, victims associated with Group A drivers had, overall, more severe injuries and poorer outcome as compared to victims belonging to the latter group.

INTRODUCTION

The history of trauma dates back to the time of evolution of mankind. Since then, injuries are common and their incidence is increasing in most of the developing countries including India. Globally, injuries are responsible for about 5% of the total mortalities and a large proportion out of them is due to road traffic accidents. The incidence of road traffic accidents is on an increase, partly due to rapid growth of motorized transportation media like trains, airplanes and other fast moving vehicular traffic, due to expansion of industrial production and, partly due to vast urbanization and changing social pattern.(1)

Though there may be innumerable factors responsible, either directly or indirectly for these accidents, one of them, of paramount importance, is the driver himself and his driving characteristics. Vehicles, in general, are either driven by their owners or by professional drivers and these two groups may have unique impacts on the type and severity of injuries and so this study was undertaken in the Department of General Surgery, Teerthankar Mahaveer Medical College & Research Centre, Moradabad, to evaluate the impact of driver characteristics on the severity of injuries and final outcome of the victims of four-wheeler automobile accidents admitted in the medical college from 1st May 2008 to 31st October 2008.

AIMS AND OBJECTIVES

This study was undertaken to evaluate:

Impact of driver characteristics on the severity of injuries and final outcome of four-wheeler automobile accidents victims, admitted in Teerthankar Mahaveer Medical College & Research Centre, Moradabad.

MATERIALS AND METHODS

INCLUSION CRITERIA

All cases of four-wheeler automobile accidents admitted in Teerthankar Mahaveer Medical College & Research Centre, Moradabad from 1st May 2008 to 31st October 2008.

EXCLUSION CRITERIA

1. Patients who were brought dead.
Those who needed specialist care and were referred to higher centres.

Those who left against medical advice within two days of admission.

Patients with only orthopaedic injuries.

**DRIVER CHARACTERISTICS**

In this study, we divided the drivers in two groups:

Group A: Professional drivers, i.e. those who were automobile drivers by profession.

Group B: Non-professional drivers.

All the victims belonged to either of the two groups. We then tabulated various driver characteristics and their impact on four-wheeler automobile accidents with respect to these groups.

The following characteristics were considered:

Age

Whether the drivers were drunk or not

Approximate driving speed at the time of impact

No. of hours of sleep the driver had in the preceding 24 hours

These characteristics were assessed by direct questionnaire from the driver or the co-passengers. The intake of alcohol was assessed by its smell in breath.

**INJURY SEVERITY SCORE**

We used the Acute Physiological and Chronic Health Evaluation II scoring (APACHE II) system to assess the health status of the patients at the time of presentation; and then, these scores were correlated with the outcome of the patients.

APACHE II Score is the sum of three variables; namely

A) Acute physiological score of the patient

B) Age points

C) Chronic health points.

A). Acute Physiological Score:

This score is the sum of individual variable points of 12 physiological entities and this score can range from 0 to +4, 0 depicting normal range and +4 abnormal range. The 12 variables used are as in the table below:

**Figure 1**

**ACUTE PHYSIOLOGICAL SCORE**

B). Age Points:

The points allotted for various age groups are as follows:

**Figure 2**

C). Chronic Health Points:

If the patient has history of severe organ dysfunction or is immunocompromised, points are assigned as follows:

For non- operative or emergency postoperative patients - 5 points
For elective postoperative patients - 2 points.

**GLASGOW COMA SCALE**

This is an objective way of recording the conscious state of a person; 3 types of responses are assessed:

Best Motor Response: This has 6 grades with scores as mentioned below

6 - Patient obeying
5 - Localizing Pain
4 - Withdraws to pain
3 - Flexor response to pain
2 - Extensor posturing to pain
1 - No response to pain

2. Best Verbal Response: This has 5 grades

5 - Oriented
4 - Confused conversation
3 - Inappropriate speech
2 - Incomprehensible speech
1 - No verbal response

3. Best Eye Response: This has 4 grades

4 - Spontaneous eye opening
3 - Eye opening in response to speech
2 - Eye opening in response to pain
1 - No eye opening

An overall score is made by summing the scores in the above three areas assessed and so the score can range from 15 to 3. A score of 15 is normal and a score of 3 indicates death, the intervening scores depicting increasing severity of head injury.

**APACHE II Score = A+B+C**

This score can range from less than 10 to more than 40, lesser scores indicating better health status and higher scores depicting poor status.

**MATERIALS**

- X-ray
- Ultrasonography
- CT scan
- Operative procedures.

**OBSERVATIONS**

A total of 88 victims, involved in a total of 26 four-wheeler accidents, were brought in the casualty of Teerthankar Mahaveer Medical College & Research Centre during this study period.

Out of them, 5 were brought dead, 4 left against medical advice within two days of admission and 15 had only orthopaedic injuries. These cases were excluded from the study and the remaining 64 cases were studied.

**GROUP A & GROUP B Drivers:**

Out of 26 four-wheeler automobile accidents, 17 (65.4%) were due to Group A drivers, accounting for a total of 48 victims and 9 (34.6%) were due to Group B drivers, accounting for the remaining 16 victims.

From here on, in our paper, we have referred to these victims as Group A and Group B victims.

**Age of drivers vs. the number of accidents**

In our study, the majority of the drivers were young adults (17 (65.6%) drivers younger than 41 years of age) signifying much higher association of risky driving with this age group compared to the older group.

**Age of drivers vs. the number of accidents (Table 1)**

<table>
<thead>
<tr>
<th>GROUP</th>
<th>NO. ACCIDENTS</th>
<th>%AGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>21-30</td>
<td>9</td>
<td>34.6</td>
</tr>
<tr>
<td>31-40</td>
<td>8</td>
<td>31</td>
</tr>
<tr>
<td>41-50</td>
<td>5</td>
<td>19.2</td>
</tr>
<tr>
<td>51-60</td>
<td>3</td>
<td>11.6</td>
</tr>
<tr>
<td>&gt;60</td>
<td>1</td>
<td>3.6</td>
</tr>
<tr>
<td>TOTAL</td>
<td>26</td>
<td>100%</td>
</tr>
</tbody>
</table>
Impact of Driver Characteristics on the Severity of Injuries and Final Outcome of Four-Wheeler Automobile Accident Victims

Time of day vs. the number of accidents

7 (27%) accidents occurred between 8AM to 8PM and 19 (73%) occurred between 8PM & 8AM.

As is evident from the table below, night time driving was much more common in Group A drivers than in Group B drivers (76.5% vs. 55.6%).

Time of day vs. the number of accidents (Table 2)

Association of Drinking & Driving:

In all, association of drinking and driving was found in 11 (42.3%) accidents. This association was more common in group A drivers (52.9%) than in group B drivers (22.2%).

This association might be an important factor for the higher number of accidents among the former group.

Impact speed vs. drivers (professional or owners):

There was a higher tendency of overspeeding in group A than in group B drivers, as 82.4% (14) drivers of the former group were driving at speeds of >60km/h and, out of them, more than 50% (5) had a speed of >100km/h.

Among group B drivers, 66.7% (6) were driving at speeds of >60km/h and, out of them, 50% (2) had a speed of >100km/h.

Impact speed vs. drivers (Table 3)

Drivers and No. of Hours of Sleep:

Sixty percent (9 out of 15) of group A drivers had had <5 hours of sleep in the last 24 hours preceding the accidents and only 40% had slept for >5 hours.

In contrast, 50% (4 out of 8) of group B drivers had had <5 hours of sleep and the remaining half had >5 hours of sleep.

According to these statistics, lack of sleep may have been an important contributing factor for the higher number of accidents associated with group A drivers.

Drivers and No. of Hours of Sleep (Table 4)

APACHE II Score & Victims

Sixty-four percent (41) of the victims had APACHE II scores of <10, 15.6% (10) had scores between 11 & 20, 12.5% (8) had scores between 21 & 30 and the remaining 7.9% (5) had scores of >30.

APACHE II Score & Victims (Table 5)

This study revealed a much higher incidence of severe
injuries among victims associated with Group A drivers as compared to those associated with Group B drivers as, out of the 5 victims who had APACHE scores of >30, 4 (80%) were associated with Group A and only 1 (20%) was associated with Group B whereas, among 59 victims with APACHE scores of <=30, 44 (74.5%) were associated with Group A and the remaining 15 (25.5%) with Group B drivers.

**DRIVER GROUPS (A & B) vs. VICTIM APACHE II SCORES** (Table 6)

<table>
<thead>
<tr>
<th>APACHE II SCORES</th>
<th>GROUP A VICTIMS</th>
<th>GROUP B VICTIMS</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;10</td>
<td>32</td>
<td>9</td>
<td>41</td>
</tr>
<tr>
<td>11-20</td>
<td>6</td>
<td>4</td>
<td>10</td>
</tr>
<tr>
<td>21-30</td>
<td>6</td>
<td>2</td>
<td>8</td>
</tr>
<tr>
<td>31-40</td>
<td>2</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>&gt;40</td>
<td>2</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>48</strong></td>
<td><strong>16</strong></td>
<td><strong>64</strong></td>
</tr>
</tbody>
</table>

**DRIVER GROUPS (A & B) vs. MORTALITIES:**

There were a total of 6 deaths in our study out of which 5 (83.3%) were associated with group A drivers and 1 (16.7%) death with a group B driver.

With respect to APACHE II scores, there was 1 death among victims with scores <=30 and the remaining 5 deaths occurred among victims with higher scores.

**DRIVER GROUPS (A & B) vs. MORTALITIES** (Table 7)

**DISCUSSION**

Age of drivers vs. the number of accidents

This study showed a significantly higher association of risky driving with drivers of <=40 years compared to the elder group as, out of a total of 26 drivers, 17 (65.6%) belonged to the younger age group (Table 1).

**Time of day vs. the number of accidents**

The majority of the accidents (73%) occurred during the dark and most of them (76.5%) were due to professional drivers (Table 2). This higher association of night driving with Group A drivers may be due to the demand of their profession. Hence, night-time driving is much more risky compared to driving in daylight.

**IMPACT SPEED VS. MORTALITIES:**

There were 2 deaths among 13 accidents having impact speeds between 60-100km/h and 4 deaths among 7 accidents with impact speeds of >100km/h.

**IMPACT SPEED VS. MORTALITIES** (Table 8)
Overall, the impact speeds were higher in group A than in group B accidents as 82.4% (14) of drivers of the former group were driving at speeds of >60km/h compared to the latter group in which only 66.7% (6) were driving at speeds of >60km/h (Table 3).

Hence, there was a higher tendency of overspeeding among group A drivers.

A much higher number of group A drivers were sleep-deprived as compared to group B as 60% of the former group had <5 hrs of sleep in the 24 hrs preceding the accidents as compared to the former group, wherein 50% were found to be sleep-deprived (Table 4).

This again may also be an important contributing factor to the higher number of accidents in the former group as sleep deprivation may directly contribute to decrease in mental alertness leading to increased reaction time, e.g. in braking.

This study showed a higher incidence of severe injuries in group A than in group B victims (Table 6). This could be directly related to the higher prevalence of night driving, driving without adequate sleep and association of drinking and driving among group A drivers.

Statistical analysis was done by using the Z-test for double sample proportions at 5% level of significance. It was found that there was a significant difference (p<0.05) between the APACHE II scores of group A and group B victims (higher APACHE scores in the victims of the former group).
DRIVER GROUPS (A & B) vs. MORTALITIES

Five (83.3%) out of a total of 6 deaths were of group A victims and one death (16.7%) was of a group B victim (Table 7). This could be directly related to the overall higher APACHE II scores in the former than in the latter group.

Statistical analysis was done by Student’s “t” test for testing the difference between the number of deaths in the above two categories of patients (Table 7) at 5% level of significance. A significantly higher incidence of mortalities was found in group A than in group B victims (p<0.05, p<0.01).

Thus, the incidence of severe injuries and hence mortalities were higher in victims of group A than in victims of Group B drivers signifying the higher prevalence of risky driving in the former group.

IMPACT SPEED VS. MORTALITIES

Mortality rate was highest in accidents with impact speeds of >100km/h (0.57), lesser in those with impact speeds between 60 and 100km/h (0.15) and nil in accidents of lesser speeds (Table 8).

Hence, overspeeding directly contributed to the number of severe injuries and so to mortalities among the victims.

CONCLUSIONS

Out of 26 four-wheeler automobile accidents, 17 (65.4%) were due to Group A drivers, accounting for a total of 48 victims and 9 (34.6%) were due to Group B drivers, accounting for the remaining 16 victims.

The majority of the drivers were young adults (17 (65.6%) drivers younger than 41 years of age) signifying a much higher association of risky driving with this age group compared to the older group.
Seven (27%) accidents occurred between 8AM & 8PM and 19 (73%) occurred between 8PM & 8AM. Night-time driving was more common in Group A than in Group B drivers (76.5% vs. 55.6%).

Association of drinking and driving was found in 11 (42.3%) accidents. This association was more common in group A drivers (52.9%) than in group B drivers (22.2%).

There was a higher tendency of overspeeding in group A than in group B drivers as 82.4% (14) drivers of the former group were driving at speeds of >60km/h and, out of them, more than 50% (5) had a speed of >100km/h. Among group B drivers, 66.7% (6) were driving at speeds of >60km/h and, out of them, 50% (2) had a speed of >100km/h.

Sixty percent (9 out of 15) of group A drivers had had <5 hours of sleep in the last 24 hours preceding the accidents and only 40% had slept for >5 hours. In contrast, 50% (4 out of 8) of group B drivers had had <5 hours of sleep and the remaining half had >5 hours of sleep.

Sixty-four percent (41) of the victims had APACHE II scores of <10, 15.6% (10) had scores between 11 & 20, 12.5% (8) had scores between 21 & 30 and the remaining 7.9% (5) had scores of >30.

This study revealed a much higher incidence of severe injuries among victims associated with Group A drivers as compared to those associated with Group B drivers as, out of the 5 victims who had APACHE scores of >30, 4 (80%) were associated with Group A and only 1 (20%) was associated with Group B whereas, among 59 victims with APACHE scores of <=30, 44 (74.5%) were associated with Group A and the remaining 15 (25.5%) with Group B drivers.

There were a total of 6 deaths in our study, out of which 5 (83.3%) were associated with group A drivers and 1 (16.7%) death was associated with a group B driver. Hence, there was a higher mortality rate in the former than in the latter group.

With respect to APACHE II scores, there was one death among victims with scores <=30 and the remaining 5 deaths were among victims with higher scores.

There were 2 deaths among 13 accidents with impact speeds between 60 & 100km/h and 4 deaths among 7 accidents with impact speeds of >100km/h. So, the impact speed had a direct bearing with severity of injuries and mortalities.

References
6. Nilambar Jha, Chandra Shekhar Agrawal. Epidemiological study of road traffic accident cases: a study from Eastern Nepal. Regional Health Forum WHO South-East Asia Region, Volume 8, Number 1, 2004
8. Augenstein JS, Digges KH, Lombardo LV, Perdeck EB, Stratton JE, Malliaris AC, Quigley CV, Craythorne AK, Young PE. Occult abdominal injuries to air bag-protected crash victims - a challenge to trauma systems; J Trauma 1995; 38: 502-508
Author Information

Deepak Sah, MBBS, DNB
Senior Resident, Department of Surgery, Teerthankar Mahaveer Medical College & Research Centre

Farhanul Huda, MBBS, MS
Asst. Professor, Department of Surgery, Teerthankar Mahaveer Medical College & Research Centre

S. B. Sharma, MBBS, MS
Associate Professor, Department of Surgery, Teerthankar Mahaveer Medical College & Research Centre