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Various Risk Factors and Patterns of Injuries in Victims Involved in Motorized Two Wheelers Accidents

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Authors' contributions

This work was carried out in collaboration among all authors. Author AK, PKS and MB designed the study, performed the statistical analysis, wrote the protocol and wrote the first draft of the manuscript. Authors MJ, AG, QD, SV and SN managed the analyses of the study. Authors QD, SV and SN managed the literature searches. All authors read and approved the final manuscript.

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ABSTRACT

Aims: This study aims to analyze the various patterns of injuries and risk factors involved in motorized two-wheelers accident.
Materials and Methods: This a prospective observational study on patients who are presenting with complaints of the road traffic accident, any motorized two wheeler accidents attending primarily to the Emergency Department of Peerless Hospital And B.K. Roy Research Centre, Kolkata. The duration of this study was 1 year extended from January 2017 to December 2017.
Results: This study founded that apart from head injuries there was a significant occurrence of limb injuries and facial trauma. We observed that helmet was preventive for a head injury, but still helmet wearing is lessed in pillion passengers as compared to riders which might be the cause of the almost equal appearance of head injuries among both. Incidence of abrasion wounds was the

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most common type of injury pattern sustained by both, though the incidence of lacerated wounds were found to be significantly higher in pillion passengers.
Conclusion: This study concludes that there are several measures that can be suggested to lower the injuries rate and severity among motorized two-wheeler drivers, which are Helmet laws that need to be implemented more strictly. Helmets should be made compulsory for pillion riders as well. More preventive measures, such as lowering the speed limits and avoiding motorized two-wheelers in the rainy time.

Keywords: Pattern of injury; two-wheeler.

1. INTRODUCTION

Road traffics accidents are very common and lead to vast devastation of human life and country resources. Injury to any part of the body can lead to instantaneous death or various types of damage and disabilities. The quality of life of wounded people is often low and affects them for the remainder of their lives. Prevention of brain injuries and other types of injuries should be of great importance in the Indian region.

Motorized two-wheeler crash victims form a high proportion of those killed or injured in road traffic crashes. Injuries to the head, following motorized two-wheeler crashes, are a common cause of severe morbidity and mortality but injuries to limbs and other parts of the body cannot be neglected too. There has been a wide range of studies over the injuries sustained by the rider and much more emphasis on the helmet use but injuries sustained by the pillion passenger and injuries to the face, limbs, and other parts of the body that lead to disabilities and morbidity of these patients can't be neglected.

There have been studies over the Pillion of passengers, the risk factors, and the pattern of injuries sustained by them in an accident nationally and internationally but still more preventive measures and improvisation are required to decrease the fatal outcome of the patients. We need to understand the difference in the risk factors, the pattern of injuries, and causes of accidents between the rider and the pillion passenger for this.

The object of this study is recording and documenting the patterns of injuries in riders and pillion passengers in motorized two-wheeler riders.

2. MATERIALS AND METHODS

2.1 Study Design

This is a prospective observational study on patients who are presenting with complaints of the road traffic accident, any motorized two wheeler accidents attending primarily to the Emergency Department of Peerless Hospital And B.K. Roy Research Centre, Kolkata. The duration of the study will be 1 year extended from January 2017 to December 2017.

2.2 Eligibility Criteria

2.2.1 Inclusion criteria

All patients traveling in a motorized two-wheeler coming to the Department of Emergency Medicine following a road traffic accident will be included in the study

- Both genders of the patients
- Both – helmeted and non-helmeted
- Patients presenting within 6hr of the accident.
- Single rider without pillion passengers.

2.2.2 Exclusion criteria

- Non-two-wheeler road traffic accident cases.
- Non-motorized two-wheeler road traffic accident cases and rider.
- A patient presenting after 6hr of the accident.

2.3 Data Analysis

The finding of the data sheet was entered in an excel format by the principal investigator and sent for statistical analysis by a statistician. Sensitivity, specificity, and relative risks for each study outcome were calculated using standard formulae.

3. RESULTS

The mean age (Mean ± S.D.) of the patients was 32.58 ± 12.49 years with range 6 – 69 years and the median age was 30 years. Most of the patients 147(59.4%) were with age between 20 –

39 years which was significantly higher than other age group (Z=6.44; p<0.001). Thus injuries of riders and pillion passengers in motorized two wheelers accidents were mostly prevalent among the patients with age between 20 – 39 years.

Table 1. Distribution of patients according to the age

Age (in years)	Number	%
<10	3	1.2%
10 - 19	34	13.7%
20 - 29	79	31.9%
30 - 39	68	27.4%
40 - 49	36	14.5%
50 - 59	19	7.7%
60 - 69	9	3.6%
Total	248	100.0%
Mean ± S.D.	32.58±12.49	
Median	30	
Range	6 - 69	

Table 2. Distribution of patients according to the gender.

Gender	Number	%
Male	213	85.9%
Female	35	14.1%
Total	248	100.0%
Male: Female	6.1:1.0	

The ratio of male and female (Male**:** Female) was 6.1:1.0. Test of proportion showed that proportion of males (85.9%) was significantly higher than that of females (14.1%) (Z= 10.18; p<0.0001). Thus males were in significantly higher risk of having injuries of riders and pillion passengers due to motorized two wheelers accidents than females.

Table 3. Month wise distribution of the accidents of the patients

Month	Number	%
June	28	11.3%
September	28	11.3%
July	27	10.9%
January	25	10.1%
March	24	9.7%
April	20	8.1%
August	18	7.3%
February	18	7.3%
May	18	7.3%
December	16	6.5%
November	15	6.0%
October	11	4.4%
Total	248	100.0%

Most of the accidents occurred during rainy season (June-September) 101 (40.8%) followed by winter season (December-February) 59 (23.9%) which were significantly higher than other seasons (Z= 2.56; p=0.0101). It was lowest in the month of October.

Table 4. Climate wise distribution of the accidents of the patients

Level of education	Number	%
Rainy	101	40.8%
Foggy	88	35.3%
Clear	59	23.9%
Total	248	100.0%

Most of the accidents occurred in rainy (40.8%) and foggy (35.3%) weather which was significantly higher (Z= 2.56; p=0.0101). It was lowest in clear weather (23.9%).

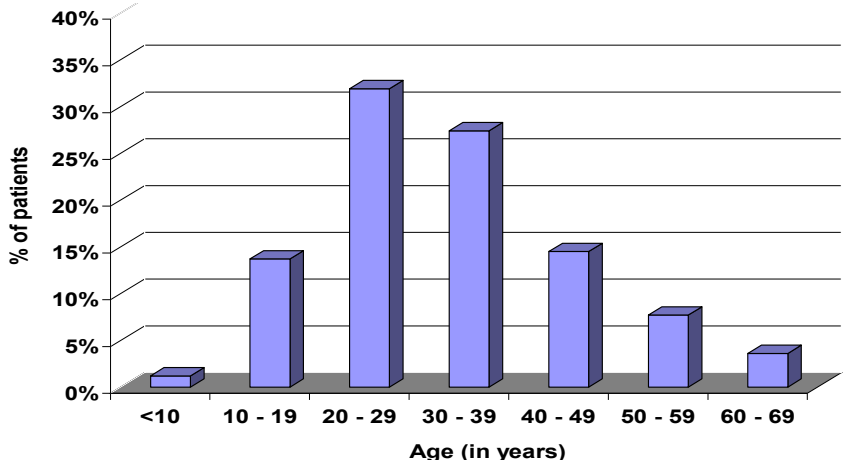

Fig. 1. Distribution of age of the patients

Table 5. Distribution of the accidents of the patients according to the hours of the whole day

Time	Number	%
12:00 am - 6:00 am	48	19.4%
6:01 am - 12:00 pm	43	17.3%
12:01 pm - 6:00 pm	56	22.6%
6:01 pm - 12:00 am	101	40.7%
Total	248	100.0%

Most of the accidents occurred at the last quarter of a day (6:01 pm - 12:00 am) (40.7%) which was significantly higher than other quarters of a day (Z=2.72; p=0.0063).

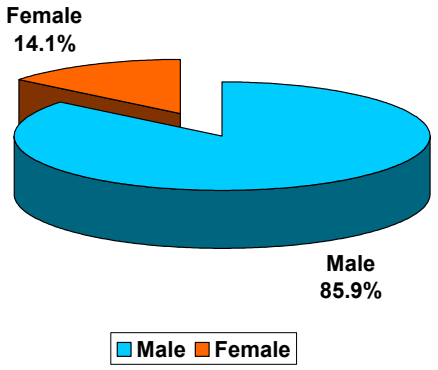

Fig. 2. Distribution of gender of the patients

Table 6. Distribution of persons who brought the accidental patients to the reporting centre

Brought by	Number	%
Others than family members	163	65.7%
Parents	44	17.7%
Spouse	28	11.3%
Patient himself/herself	12	4.8%
Police	1	0.4%
Total	248	100.0%

Most of the patients broughted to the reporting centre after the accidents by other than family members (65.7%) which was significantly higher than others (Z=6.87; p<0.0001), Only 1 (0.4%) patients was brought by the local police.

Table 7. Types of vehicles which used to bring the accidental patients to the reporting centre

Vehicles used	Number	%
Ambulance	28	11.3%
Private Vehicle	220	88.7%
Total	248	100.0%

In 88.7% of the cases private vehicles were used to bring the patients to the reporting centre which was significantly higher than ambulance (Z=10.94; p<0.0001).

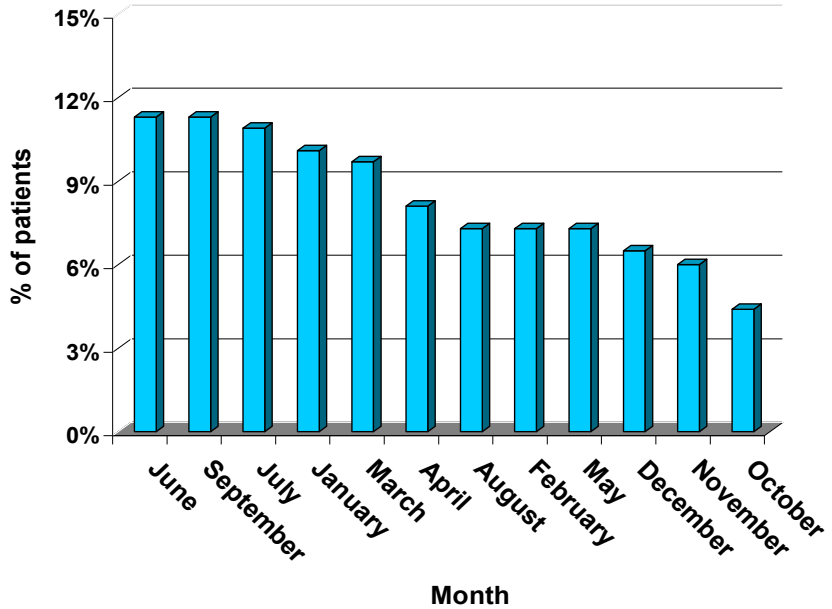

Fig. 3. Month wise distribution of the accidents of the patients

Table 8. Mode of riding of the accidental patients

Mode of riding	Number	%
Pillion	67	27.0%
Rider	181	73.0%
Total	248	100.0%

Most of the patients were rider (73.0%) which was significantly higher than pillion (27.0%) (Z=6.50; p<0.0001).

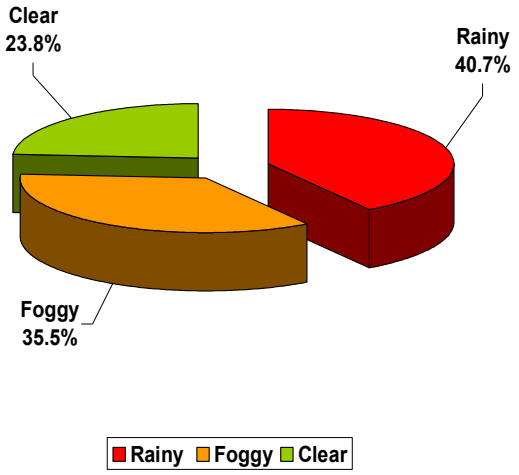

Fig. 4. Climate wise distribution of the accidents of the patients

Table 9. Distribution of helmet used while driving by the accidental patients

Wearing Helmet	Number	%
Yes	152	61.3%
No	96	38.7%
Total	248	100.0%

Use of helmet was observed in 61.3% of the patients which was significantly higher (Z=3.19; p<0.0001).

Table 10. Distribution of intoxication while driving by the patients

Intoxication	Number	%
Yes	17	6.9%
No	231	93.1%
Total	248	100.0%

Only 17(6.9%) of the patients were intoxicated while driving which was significantly lower (Z=12.19; p<0.0001).

Table 11. Distribution of factors which leading to accidents

Factors leading to accidents	Number	%
Skid due to bad road	72	29.0%
Loss of balance	60	24.2%
Hit by van	58	23.4%
Fell down	29	11.7%
Head on collision	29	11.7%
Total	248	100.0%

Skid due to bad road (29.0%), loss of balance (24.2%) and hit by van (23.4%) were the leading causes of accidents which were which was significantly higher than other causes of accident (Z=4.90; p<0.0001). However, fall from motorized two wheelers (11.7%) and head on collision (11.7%) were other leading factors of accidents.

Table 12. Distribution of accidental patients depending on the site of injury or wound

Site of injury	Number (n=248)	%
Lower limbs	59	23.8%
Face	37	14.9%
Limbs	34	13.7%
Face+Limbs	30	12.1%
Head	24	9.7%
Upper Limbs	20	8.1%
Shoulder	17	6.9%
Head+Limbs	8	3.2%
Face+Hand	4	1.6%
Head+Face	5	2.0%
Leg open fracture	2	0.8%
Others	8	3.2%
Total	248	100.0%

Most of the patients had injuries in face and head alone with other injuries 108 (43.5%) which was significantly higher than other injuries (Z=4.67; p<0.001). Overall numbers of patients having limb injuries was 184 (74.2%).

Table 13. Distribution laterality of injury of the patients

Laterality	Number	%
Unilateral	92	37.1%
Right	63	25.4%
Both left and right	51	20.6%
Left	42	16.9%
Total	248	100.0%

Most of the injuries were unilateral 92 (37.1%) which was significantly higher (Z=1.78; p=0.08).

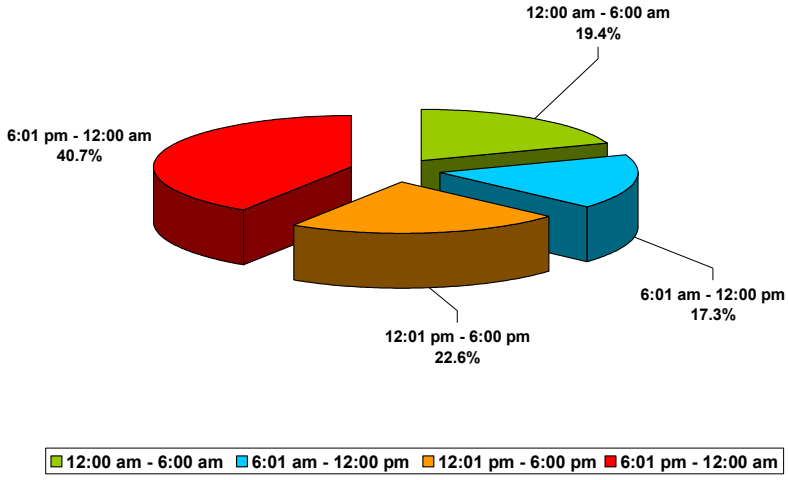

Fig. 5. Distribution of the accidents of the patients according to the time

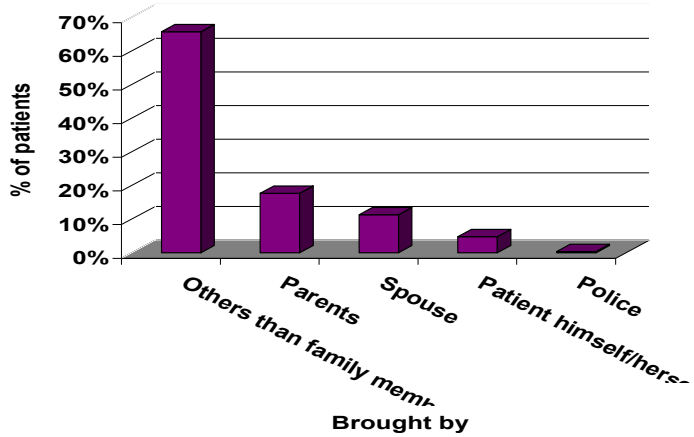

Fig. 6. Distribution of persons who brought the patients to the reporting centre

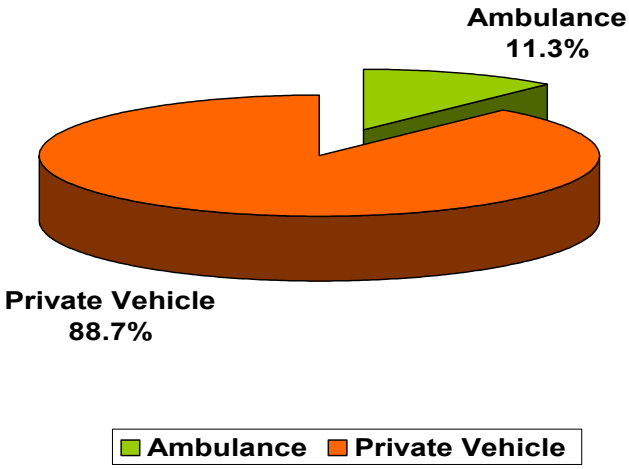

Fig 7. Vehicles used to bring the patients to the reporting centre

Table 14. Distribution of accidental patients according to the mental state at the time of reporting to the reporting institute

Loss of consciousness	Number	%
Yes	38	15.3%
No	210	84.7%
Total	248	100.0%

Loss of consciousness was observed in 38 (15.3%) of the patients which was significantly lower (Z=9.81; p<0.0001).

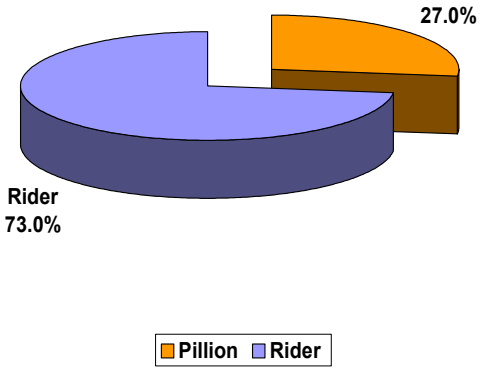

Fig. 8. Mode of riding of the patients

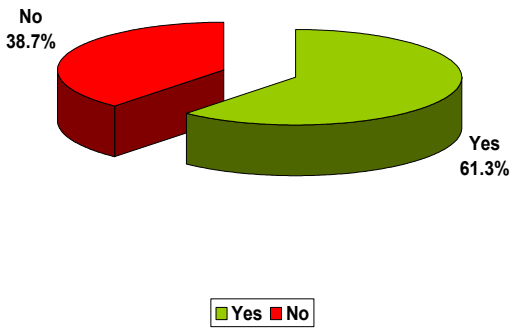

Fig. 9. Distribution of helmet used while driving by the patients

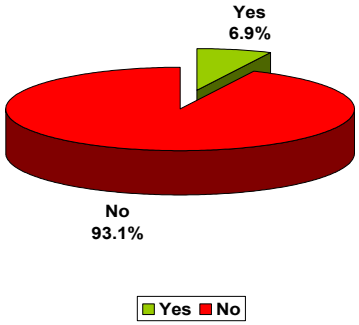

Fig. 10. Distribution of intoxication while driving by the patients

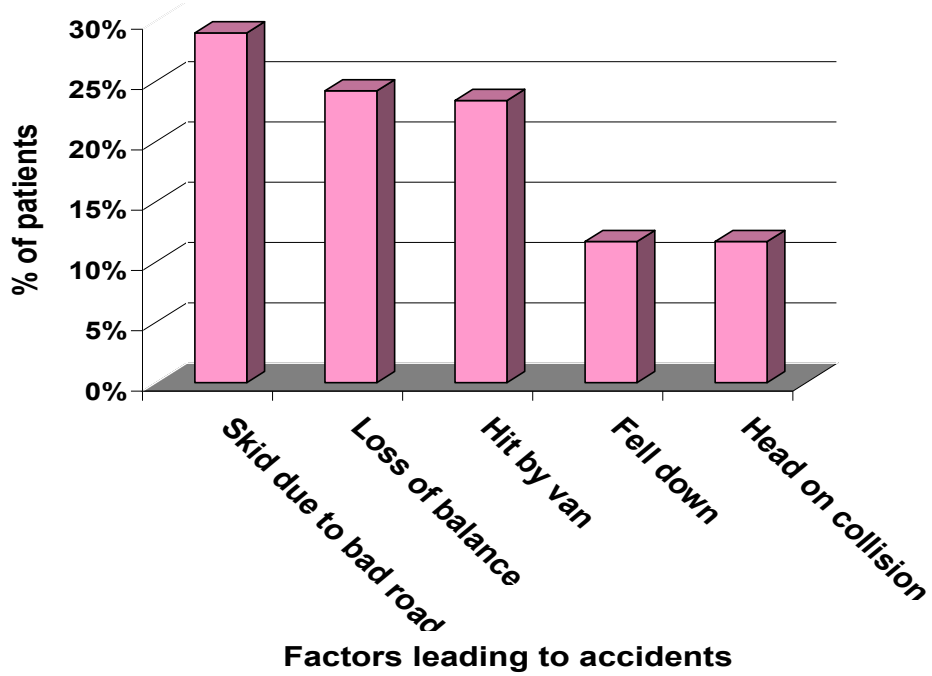

Fig. 11. Distribution of factors leading to accidents

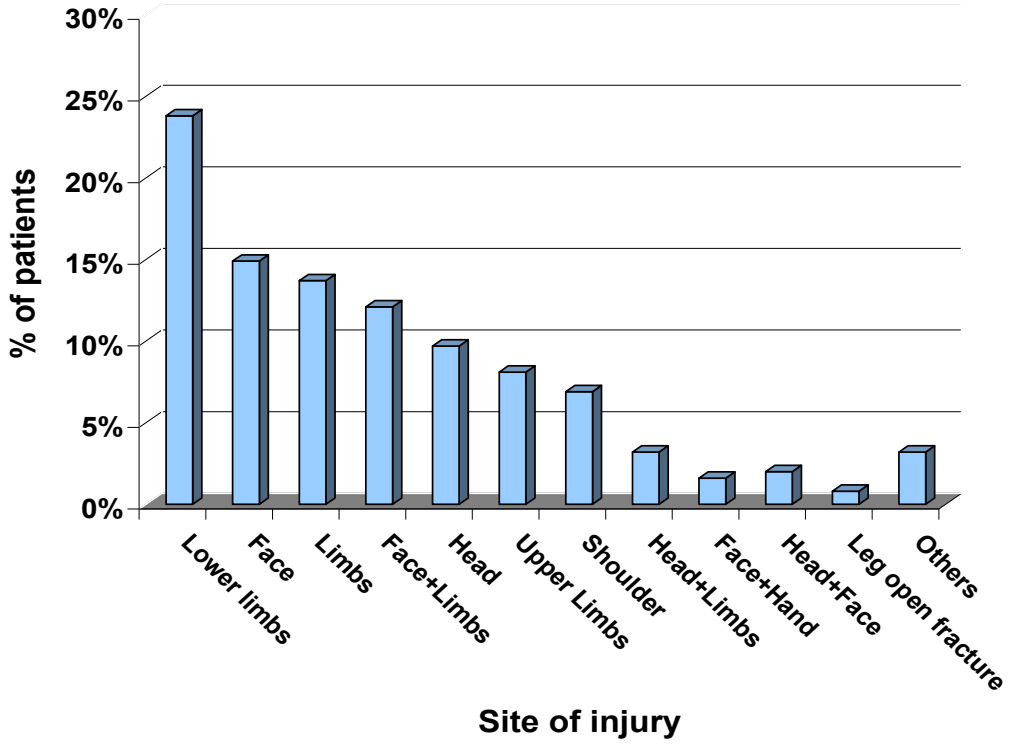

Fig. 12. Distribution site of injury of the patients

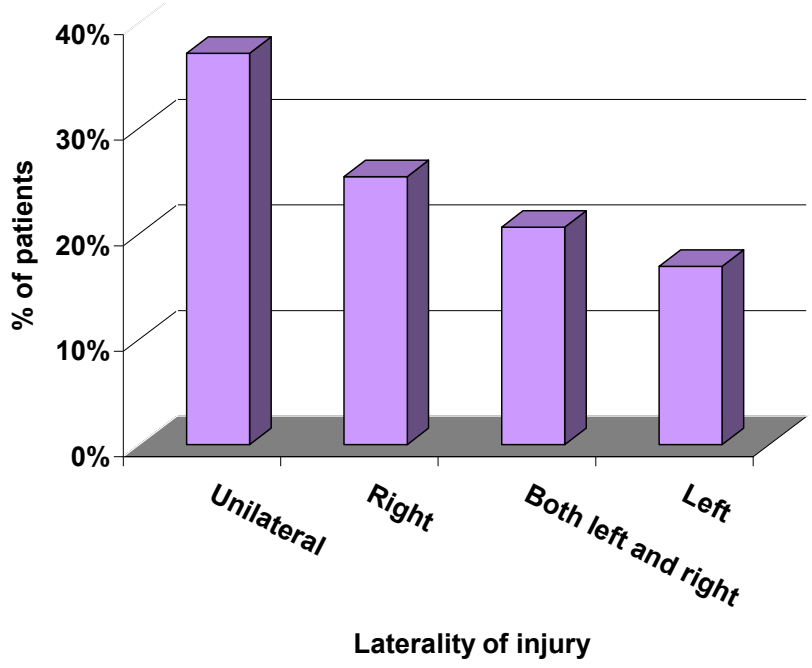

Fig. 13. Distribution laterality of injury of the patients

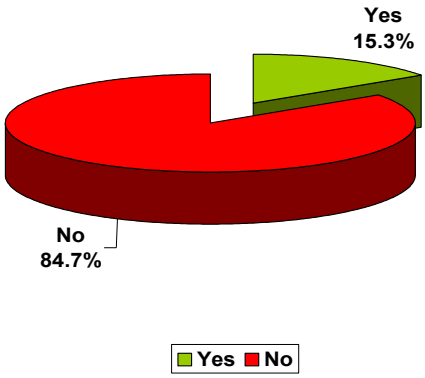

Fig 14. Distribution of loss of consciousness of the patients at the time of reporting to the reporting institute

Table 15. Distribution of GCS of the patients at the time of reporting to the reporting institute

GCS	Number	%
<10	16	6.5%
10 - 11	9	3.6%
12 - 13	8	3.2%
14 - 15	215	86.7%
Total	248	100.0%
Mean ± s.d.	14.17±2.41	
Median	15	
Range	3 - 15	

The mean GCS (Mean ± S.D.) of the patients at the time of reporting was 14.17 ± 2.41 with range 3 – 15 and the median was 15. 86.7% of the patients had GCS between 14 - 15 at the time of reporting which was significantly higher (Z=11.36; p<0.0001). However, 6.5% of the patients had GCS<10.

Table 16. Distribution of type of injuries of the patients due to accident.

Type of injuries	Number (n=248)	%
Abrasion	64	25.8%
Head injuries	38	15.3%
Lacerated wound	38	15.3%
Multiple injuries	33	13.3%

Abrasions (25.8%) were the leading type of injuries of the patients which was significantly higher (Z=1.99; p=0.044). Head injuries were found in 38 (15.3%) of the patients.

Table 17. Distribution of hemodynamical status of the patients at the time of reporting to the reporting institute

Hemodynamical Status	Number	%
Stable	226	91.1%
Unstable	22	8.9%
Total	248	100.0%

Condition of the most of the patients was stable 226 (91.1%) of the patients which was significantly higher (Z=11.62; p<0.0001).

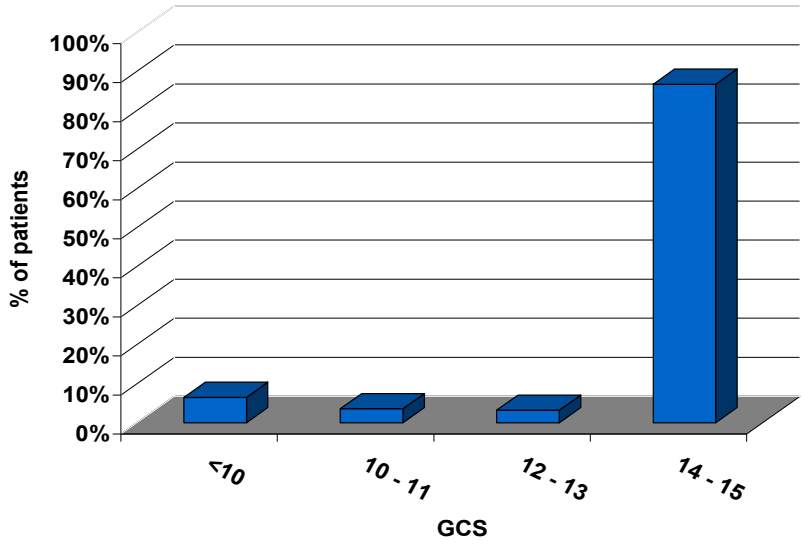

Fig. 15. Distribution of GCS of the patients at the time of reporting to the reporting institute

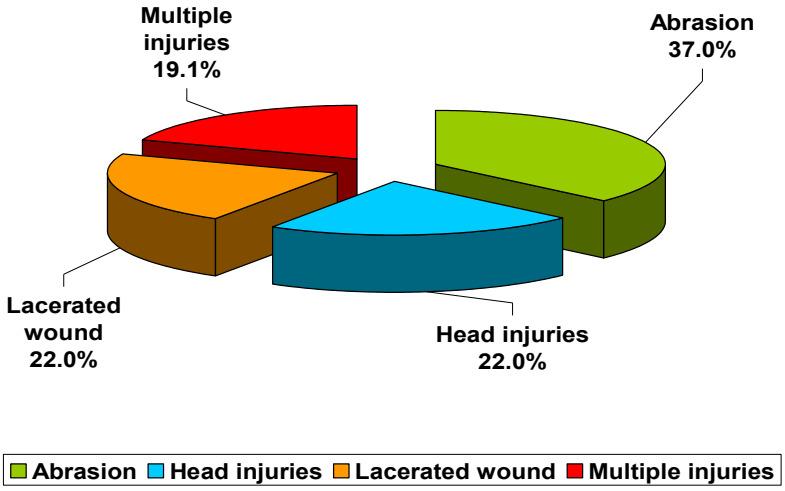

Fig. 16. Distribution of type of injuries of the patients due to accident

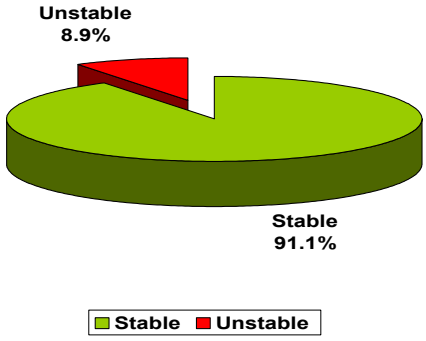

Fig. 17. Distribution of hemodynamical status of the patients at the time of reporting to the reporting institute

Table 18. Distribution of findings of CT scan of brain of the patients at the time of reporting to the reporting institute

CT Scan of brain	Number	%
Fracture of facial bones	5	2.0%
ICH	20	8.1%
ICH and fracture of skull	3	1.2%
Normal	102	41.1%
Not Required	118	47.6%
Total	248	100.0%

In 47.6% of the cases CT scan of brain was not required. However, most of the CT scan findings of brain was normal (41.1%) which was significantly higher (Z=5.41; p<0.0001). Out of the 28 abnormal findings ICH 23(9.3%) was the most common (Z=2.23; p=0.0236). Fracture of facial bones was found in 5(2.0%) of the cases.

Table 19. Distribution of findings of chest x-ray of the patients at the time of reporting to the reporting institute

Chest X-Ray	Number	%
Fracture of rib	2	0.8%
Fracture of clavicle	2	0.8%
Fracture of clavicle and ribs	1	0.4%
Normal	109	44.0%
Not Required	133	53.6%
Total	248	100.0%

In 53.6% of the cases Chest X-Ray was not required. However, most of the Chest X-Ray findings was normal (44.0%) which was significantly higher (Z=7.32; p<0.0001). Out of the 5 abnormal findings fracture of rib 3 (1.6%) and fracture of clavicle 3 (1.6%) were found but there was no significant difference between them (Z=0.01; p=0.99).

Table 20. Distribution of findings of FAST scan of the patients at the time of reporting to the reporting institute

FAST Scan	Number	%
Positive	1	0.4%
Negative	75	30.2%
Not Required	172	69.4%
Total	248	100.0%

As per the findings of FAST Scan only 1 (0.4%) positive case was found.

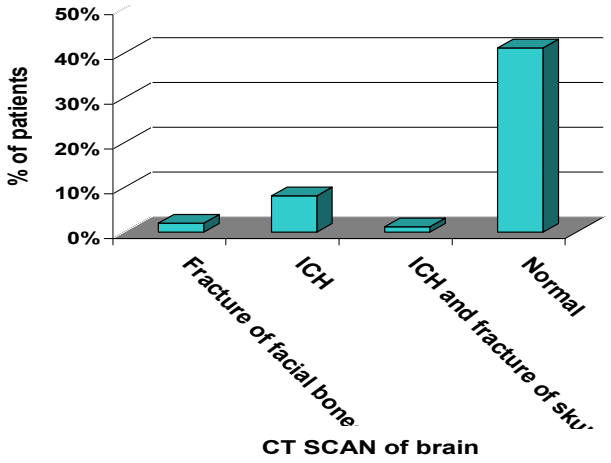

Fig. 18. Distribution of findings of CT scan of brain of the patients at the time of reporting to the reporting institute

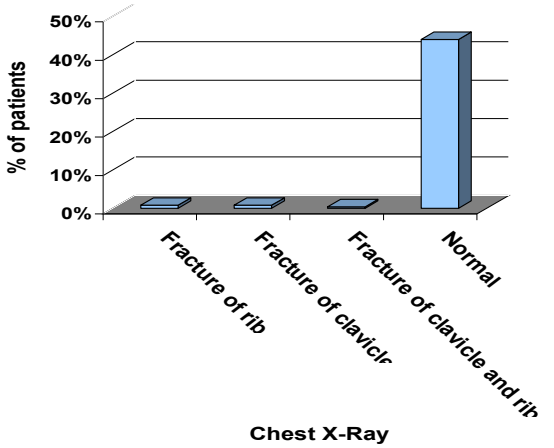

Fig. 19. Distribution of findings of chest x-ray of the patients at the time of reporting to the reporting institute

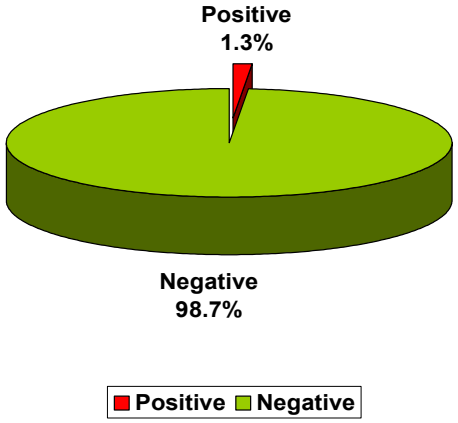

Fig. 20. Distribution of findings of FAST scan of the patients at the time of reporting to the reporting institute

Table 21. Distribution of type of disability of the patients due to accident

Type of disability	Number	%
Movement Restriction	141	62.4%
Facial Marks	62	27.4%
Difficulty in Walking	9	4.0%
Facial Marks And Movement Restriction	8	3.5%
Leg Restrain	5	2.2%
Rest	1	0.4%
Total	226*	100.0%

**14 patients died during treatment and 8 patients did not have any kind of disability.*

Among 226 cases of disability movement restriction was found in 141 (62.4%) of the cases which was significantly higher ($Z=4.98$; $p<0.0001$).

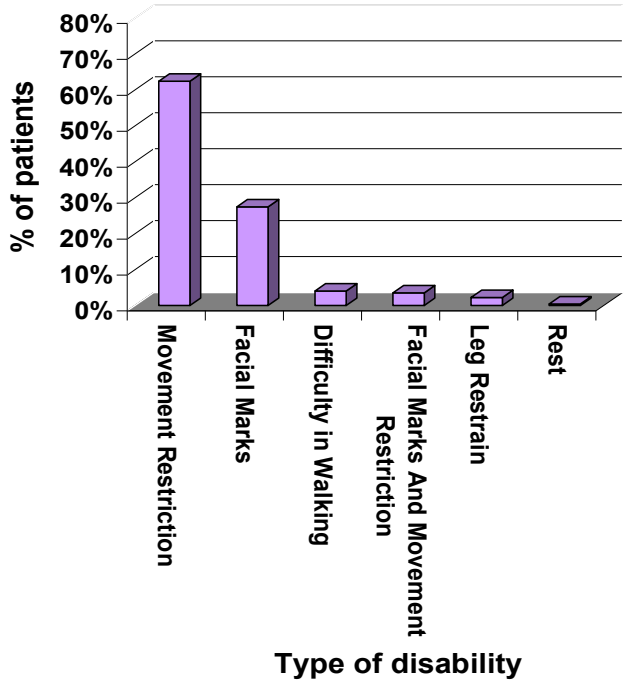

Fig. 21. Distribution of type of disability of the patients due to accident

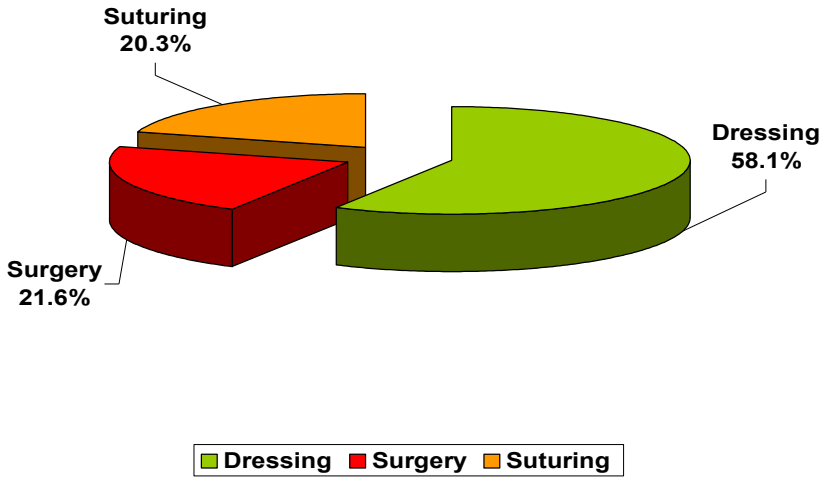

Fig. 22. Distribution of type of treatment required for the patients

Table 22. Distribution of type of treatment required for the patients

Type of treatment	Number	%
Dressing	137	58.1%
Surgery	51	21.6%
Suturing	48	20.3%
Total	236*	100.0%

**Out of the 14 patients there no scope of treatment in 12 patients.*

Only dressing was required in 157 (58.1%) which was significantly higher 102 (43.6%) ($Z=5.27$; $p<0.001$). Surgical inventions were in 51(21.6%) of the patients and in 48 (20.3%) only suturing was required. Among 132 cases of disability movement restriction was found in 37.6% of the cases which was significantly higher ($Z=4.78$; $p<0.0001$).

Table 23. Distribution of duration of bed ridden condition of the patients

Duration of bed ridden condition (in days)	Number	%
<7	38	18.4%
7 - 14	50	24.2%
15 - 21	57	27.5%
22 - 28	3	1.4%
29 - 35	24	11.6%
36 - 42	3	1.4%
43 - 49	18	8.7%
≥50+	14	6.8%
Total	207*	100.0%
Mean ± s.d.	17.80±16.57	
Median	15	
Range	0 - 90	

**14 died within few hours after admission and another 27 patients were discharged after primary conservative treatment and no admission was required for them.*

The mean duration of bed ridden condition (Mean ± S.D.) of the patients was 17.80 ± 16.57 days with range 0 – 90 days and the median was 15 days. Most of the patient (51.7%) were able to sustain their daily normal movements within 2 weeks which was significantly higher (Z=4.78; p<0.0001).

Table 24. Distribution status at last contact of the patients

Status at last contact	Number	%
Died during treatment	14	5.6%
Discharged alive after treatment.	234	94.4%
Total	248	100.0%

94.1% of the patients were discharged alive after treatment which was significantly higher 102 (43.6%) (Z=12.55; p<0.001). However, 14 (5.6%) of the patients died during treatment.

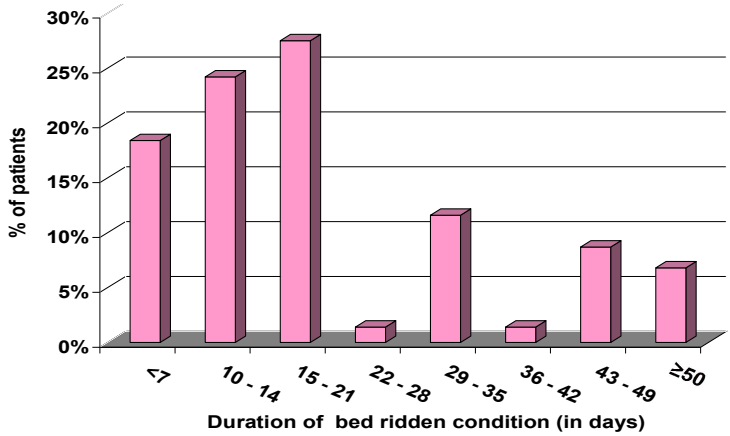

Fig. 23. Distribution of duration of bed ridden condition of the patients

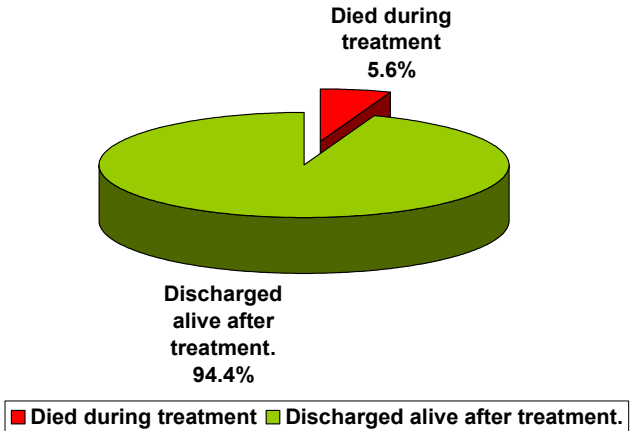

Fig. 24. Distribution status at last contact of the patients

4. DISCUSSION

In the present study, out of 248 patients, 181 (73.0%) were Riders and Pillion passengers constitute 67 (27.0%). Furthermore, 213 were males and 35 were females. The ratio of male and female (Male: Female) was 6.1:1.0. As shown by Behera *et. al* compared to females (6.4%) majority of the victims (93.6%) were males with a male: female ratio of 14.66:1. Commonest age group involved was 21-30 years (n=42, 44.67%) followed by 31-40 years (n=26, 27.66%).[1] also same by Ghaffari-fam S et al. [2] A very same result as our study, the study by S Bhoi et al. showed males were more commonly involved in RTIs (n = 276) and were 6.7 times more than female patients (n = 41).[3] According to Chichom Mefire A et al., the majority of patients (57.6 %) were aged 21–40 years. Patients aged between 41 and 60 years represented 25 % of the study population. Male sex significantly predominated in patients aged 21 – 40 years, while the female sex predominated in patient's aged 41–60 years [4].

Most of the accidents occurred in the last quarter of a day (6:01 pm - 12:00 am) (40.7%) which was significantly higher than other quarters of a day (Z=2.72; p=0.0063). Suman P *et. al* also showed that in Kolkata 6 pm to 6 am is broadly evident that the period, from 6 pm to 11 pm is very much vulnerable, in 2008 and specifically the period of 8 pm to 10 pm is severely vulnerable, experiencing nearly 80-90% of all accident cases occurred during this part of the day.[5] Misra P *et. al*. study showed the majority of RTIs happened between midnight to 6 A.M. (28%) followed by 6 P.M. to midnight (26%).[6] Chichom-Mefire A *et. al*. most of these crashes occurred over the weekend and in the night.[7] and also by Lwin T, Aung LL [8].

Only very few percent of the case were brought by the ambulance 11.3% of all cases, rest 88.7% of the cases private vehicles were used to bring the patients to the reporting center which was significantly higher than the ambulance (Z=10.94; p<0.0001). Behera *et. al*. show that's only two cases (2.13%) by ambulance and by private vehicle 28 (29.79%).[1] Puneet Misra *et. al*. found that, in most cases (45.1%), police control room van transported victims to the hospital. More than 40% of victims were carried to hospital in private vehicles, most commonly a motorized three-wheeler. The ambulance was used in only 14.6% of cases. All these findings suggest the gross inadequacies in providing prehospital care in India [5].

Different modes that lead to motorized two wheelers accidents were Skid due to the bad road (29.0%), loss of balance (24.2%) and hit by a van (23.4%). Theses causes which were significantly higher than other causes of the accidents (Z=4.90; p<0.0001). However, fall from motorized two-wheelers (11.7%) and head-on collision (11.7%) were other leading factors of accidents. The same was with Pruthi N study, It is alarming that 33–58% of crashes in two-wheeler injury resulted from skidding of the two-wheeler or fall from the vehicle.[9] While Behera et al. most of the fatalities occurred due to the impact of another vehicle from behind (40.42%), followed by fall of the rider due to loss of balance of vehicle due to various reasons (29.78 %) [1].

This study as alike other studies found that the use of helmets was observed in just 61.3% of 248 patients. Of 67 pillions passengers, patient maximum of 47(70.1%) were not wearing helmets and 49 (27.1%) of riders were too not wearing helmets. Sirathranont J and Kasantikul V Only 4 percent of the riders were wearing helmets at the time of the accident. Helmet usage was much lower among passengers, only about 1 percent [10].

Most of the patients had limb injuries 144 (58.1%), followed by face and head 108 (43.5%) which was significantly higher than other injuries (Z=4.67; p<0.001). In a study by Fatimah Lateef of the 1,809 motorcyclists studied, 1,056 (58.3%) sustained lower limb injuries, 328 (18.1%) had head injuries and 256 (14.2%), sustained facial injuries [11].

As per the findings of X-ray of limbs, 53 (22.9%) cases had a fracture of which 10(4.0%) case of fracture of femur bones was found and 4 cases of dislocation was seen. Chichom-Mefire A *et. al*. 53 % of fractures were located in the lower limb and 21 % in the upper limb. The most commonly fractured site was the leg with 113 (37.8 %) cases involving the tibia/fibula [7].

Abrasions (37.0%) were the leading type of injuries of the patients which was significantly higher (Z=1.99; p=0.044). Head injuries were found in 38(22.0%) of the patients. 25.4% of the pillions had abrasion of body parts after the accident which was lower than that of the drivers (26.0%) but it was not significant (Z=0.09; p=0.79). The risk of abrasion of body parts was 1.03 times more among the riders than the pillions but the risk was not significant. As per

Seethalakshmi M Out of 147 cases, 55-70 % of the abrasions all over the body were found on the right side of the body.[12] S.S. Oberoi, *et. al*. showed that the pattern of injuries sustained in victims of fatal two-wheeler accidents was-fractures 42(31.34%), abrasions 40(29.85%), lacerations 39(29.10%), and contusions 13(9.7%) [13].

16.4% of the pillion had a head injury after the accident which was higher than that of the rider (14.9%) (Z=0.19; p=0.84). Behera *et*. *al* concluded that head and face was the most vulnerable body region involved in 89.36% (n=84) of cases followed by extremities in 55.31% of cases [1].

The mean duration of the bedridden condition (Mean ± S.D.) of the patients was 17.80 ± 16.57 days with a range of 0 – 90 days and the median was 15 days. Most of the patients (51.7%) were able to sustain their daily normal movements within 2 weeks which was significantly higher (Z=4.78; p<0.0001). The mean duration of the bedridden condition of the riders was lower than that of the pillions but the t-test showed that there was no significant difference between them (t246 = 0.92; p=0.38). In a study by Lateef F mean duration of hospitalization was 4.8 ± 4.5 days in in-patients. Among those with lower limb injuries, the mean duration of hospitalization was 5.3 ± 3.9 days [11].

5. CONCLUSION

A road traffic accident is one of the major causes of morbidity and mortality throughout the world. We overtook this study as there was a rarity of such study in this part of the country which focused on analyzing the pattern of injuries in riders and pillion passengers in motorized two-wheeler accidents. We found that apart from head injuries there was a significant occurrence of limb injuries and facial trauma. We observe that helmet was preventive for a head injury but still helmet use is less in pillion passengers as compared to riders which might be the cause of the almost equal appearance of head injuries among both. Incidence of abrasion injuries was the most common type of injury pattern sustained by both, though the incidence of the lacerated wound was found to be significantly higher in pillion passengers. The percentage of death among the riders and pillion passengers was found to be almost equal though the duration of being bedridden was higher in riders.

CONSENT

As per international standard or university standard written patient consent has been collected and preserved by the author(s).

ETHICAL APPROVAL

It is not applicable

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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