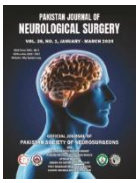

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Original Research

# Navigating Peril: Unraveling the Consequences of Violation of Lane by Bike Riders on Traumatic Brain Injury Outcomes in a Developing Country's Neurosurgical Department

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## ABSTRACT

**Objective:** To infer the impact of violation of lanes by the bike riders on the severity of injury and clinical outcome.

**Materials & Methods**: Prospective observational study conducted from 1st January 2023 to 30th June 2023. Fifty patients who met inclusion criteria were studied for the impact of violation of lane on the severity of injury and clinical outcome. Data was analyzed for gender distribution, valid driving license, helmet wearing, trauma scene violation of lane, duration of stay in the ward, the severity of the injury, mode of injury and outcome was assessed by the Glasgow outcome scale extended after 1 month.

**Results:** In our study 49(98%) patients were male and 1(2%) female. 37 (74%) patients had documented evidence by 1122 regarding the lane violation group while 13(26%) patients of the lane non-violation group. 14(28%) patients had STBI, and 18(36%) patients were categorized in moderate and mild traumatic brain injury. Neuro monitoring was done in 14(28%) patients. Operative intervention was done in 31(62%) patients and 9(64%) patients were those who had STBI.11(78%) out of 14 patients with severe injury were from the lane violation group. Patients of the lane violation group had higher disability i.e. 12 (32.4%).

**Conclusion:** Violation of lanes is an aberrant driving behavior. It has emerged as a common cause of bike-related road traffic accidents leading to mortality. A prevailing disregard for traffic norms adds fuel to this perilous fire, paving the way for a grave outcome.

**Keywords:** Severe Traumatic brain injury (STBI), Road traffic accident (RTA), Violation of lane, Bike rider, Intracranial pressure (ICP), Glasgow outcome scale extended.

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## INTRODUCTION

Traumatic brain injury (TBI) is a significant cause of prolonged disability, death, and economic burdens in the world. Road traffic accidents (RTAs) stand as a common cause of TBI and the prevalence is particularly high in developing countries, encompassing 90% of all RTA-related TBIs. In Pakistan, motorcycles which are considered the most unsafe vehicles, have become the predominant mode of transportation for most people. Consequently, Pakistan bears one of the highest TBI incidences globally.[1]

Ever ever-increasing population and number of vehicles on roads have brought along a steep rise in RTA. This phenomenon has severely hit the developing world, Pakistan being no exception. Pakistan is the 5th populous country in the world with a 1.96% growth rate being one of the highest in the world and most of this population is comprised of the young age group.[3]

Scarcity of proper transport resources, poorly maintained roads, disobeying traffic rules, and not adhering to safety gear have resulted in a rising trauma admission in hospitals in the last decade[4]. Pakistan has 23 million registered motorcycles which makes it the 5th largest motorcycle housing country. They account for 75% of registered vehicles in the country.[5] Punjab province has witnessed about 65000 accidents involving motorcycles in the year 2022, which corresponds to an average of 725 accidents per day.[6] The major reasons are overspeeding, carelessness, and wrong lane change. Though in recent years, traffic police have formulated strict regulations and efficiently implemented helmet-wearing, unsafe lane change remains a dilemma.[7]

These injuries have immediate effects as well as long-term repercussions on cognitive abilities, emotional equilibrium, and overall quality of life. We proposed this project to infer the impact of a lane change by the bike riders on the severity of the injury and clinical outcome afterward.

## MATERIALS & METHODS

This study was conducted at the Department of Neurosurgery unit II, Punjab Institute of Neurosciences, Lahore from 1st January 2023 to 30th June 2023. All patients who met the inclusion criteria were included in the study after informed consent was taken from the patient or the available attendants. Data was analyzed for gender distribution, valid driving license, helmet wearing, trauma scene lane change, severity of injury, and mode of injury. The outcome was assessed by the Glasgow outcome scale extended after 1 month of admission. Data was also analyzed for CT scan findings and Neuro monitoring along with Neurosurgical intervention.

### Inclusion Criteria

Regarding the inclusion criteria bike rider patients of both genders with age range from 13 years to 60 years were included in the study. All patients included had confirmed documentation from 1122 service regarding trauma scene information of lane violation (both correct and wrong) & transported by 1122 service.

### Exclusion Criteria

Bike back seater & Patients with co-morbidities e.g., DM (Diabetes Mellitus), HTN (hypertension), CLD (chronic liver disease), etc. along with Polytrauma patients were excluded from the study.

### Operational Definitions

*Lane Violation group:* Bike riders have fixed the left side lane according to traffic rules, a lane violation is considered as a bike rider who changes his lane from the left side lane.

*Lane Non-violation group:* A bike rider is considered as one who remains on the fixed left side and changes lanes at the signal or turn of the road to his/her left side.

# RESULTS

## Demographics

50 patients who met the criteria were included in the study. 49(98%) patients were male, and 1(2%) patient was female. Astonishingly 48 (96%) patients had no driving license whereas 2(4%) patients had a driving license. Regarding helmet wearing, 39(78%) patients were not wearing helmets and only 11(22%) patients were wearing helmets.

## Lane Violation

37 (74%) patients had documented evidence by 1122 regarding wrong lane change while 13(26%) patients had road traffic crash even changing the lane correctly.

## The Severity of Injury & Neuromonitoring

14(28%) patients had severe traumatic brain injury and 18(36%) patients were categorized as moderate and 18(36%) mild traumatic brain injury each. Neuro monitoring was done in the 14(28%) patients who had severe traumatic brain injury in the form of intracranial pressure monitoring as well as brain microdialysis. Regarding the mode of injury

**Table 1:** Mode of injury

| Mode of Injury | Frequency (n) | Percent (%) |
|---|---|---|
| Bike skidding | 11 | 22.0 |
| Bike vs Bike | 19 | 38.0 |
| Bike vs Car | 11 | 22.0 |
| Bike vs another vehicle | 9 | 18.0 |
| Total | 50 | 100.0 |

bike vs. bike was common i.e. 19(38%) (Table 1). CT scan showed that extradural hematoma was the most common finding i.e., 23(46%) (Table 2).

It was further analyzed that 11(78%) out of 14 with severe injury were from the lane violation group. It was analyzed that they had higher disability grades i.e., 12 (32.4%) patients according to the outcome scale fall in higher disability (Table 4).

**Table 2:** CT SCAN Findings.

| CT Findings | Frequency (n) | Percent (%) |
|---|---|---|
| EDH | 23 | 46.0 |
| SDH | 6 | 12.0 |
| Contusion | 13 | 26.0 |
| Depressed Fracture | 4 | 8.0 |
| IVH | 3 | 6.0 |
| Combination | 1 | 2.0 |
| Total | 50 | 100.0 |

**Table 3:** Outcome after one-month GOS Extended.

| Outcome | Frequency (n) | Percent (%) |
|---|---|---|
| Dead | 7 | 14.0 |
| vegetative state | 5 | 10.0 |
| Severe disability | 4 | 8.0 |
| Moderate disability | 15 | 30.0 |
| good recovery | 19 | 38.0 |
| Total | 50 | 100 |

**Table 5:** Outcome after one-month GOS extended of lane non-violation group patients.

| Outcome | Frequency (n) | Percent (%) |
|---|---|---|
| Dead | 2 | 15.3 |
| vegetative state | 2 | 15.3 |
| Severe disability | 0 | 0 |
| Moderate disability | 2 | 15.3 |
| good recovery | 7 | 53.8 |
| Total | 13 | 100.0 |

Patients in this group had a good recovery in 53.8% of participants (Table 5). Neurosurgical operative intervention was done in 31(62%) patients and 9(64%) patients were those who had severe traumatic brain injury.

## DISCUSSION

Motorcycles being an affordable mode of transport are being increasingly used in Pakistan. According to the World Health Organization (WHO) about one-third of the road traffic accidents in South Asia involve motorcyclists. Data from Pakistan shows that 21% of Road Traffic accidents involve motorcycles. About 34% of total RTA-related deaths are documented as bike trauma. Traumatic brain injury (TBI) is one of the common causes of fatality and morbidity in these patients. Aberrant driving behaviors such as lane violations and overspeeding are some of the frequent observations in bike accidents.[7] In Pakistan, there is a lack of dedicated lanes for motorcycles on most highways. Consequently, motorcycle riders often engage in hazardous practices, including unnecessary lane changes, exceeding speed limits, and passing from the inside lane on the road. Overspeeding while changing lanes and entering the wrong lane with distracted driving are common scenes on busy metropolitan roads.[6]

Concerned authorities started dedicating an extreme left lane for bikers in crowded city roads like Shahrah Faisal in Karachi, Canal Road, and main boulevard in Lahore to name a few but violations of these lanes are a common phenomenon, especially in rush hours.[8,9]

Our study found that 49(98%) patients were male, and 1(2%) patient was female. These results are comparable to another research conducted by Amjad et all, which concluded that approximately 85.37% of total crashes involve male drivers. This reflects the common practice in Pakistan where males typically assume the role of motorcycle riders, while females tend to be passengers seated behind, influenced by social and cultural constraints.[10]

Our study inferred those 48 (96%) patients had no driving license whereas 2(4%) patients had a driving license. Similar results were observed in another research by Muhammad et all, which concluded that the frequency of RTA is more common in drivers not having licenses as compared to license holders.[11]

Current study results show that 14(28%) patients had severe traumatic brain injury and 18(36%) patients were categorized as moderate and mild traumatic brain injury respectively. In a previous study on bike trauma patients from the same Centre, it was found that 66% of patients had mild head trauma, 23% were classified as moderate head trauma whereas about 9% of patients were afflicted by severe head trauma.[12]

**Figure 1:** Lane violation despite specified lanes.

In this study, it was observed that 11(78%) out of 14 patients with severe injury were from the wrong lane changer group (Figure 1). It was analyzed that wrong lane changers had higher disability i.e. 12 (32.4%) according to outcome scale (including deaths, vegetative state, and severe disability) as shown in Table 4. There are no comparable studies that have specifically analyzed the outcomes of wrong lane change bike trauma. A study from Africa quoted that head injuries are the most common cause of prolonged disability after bike trauma. It reported that 12% of patients had grievous injuries and about 37% had severe injuries following bike trauma and wrong lane change was one of the common behaviors noticed in victims.[13,14,15,16,17] Moreover the risky behavior of bike riders not only leads to the severity of the

injury it also leads to financial implications even in the form of fines imposed on violation of rules.[18,19]

## CONCLUSION

Wrong lane change is an aberrant driving behavior. It has emerged as a common cause of bike-related road traffic accidents leading to adverse outcomes like death and severe traumatic brain injury. The repercussions of these injuries are long-lasting in the form of cognitive and emotional deficits and disturbed overall quality of life. Designating specific bike lanes on roads, road safety awareness campaigns strict legislation, and implementation of traffic rules are some recommendations to reduce the incidence of these accidents.

## RECOMMENDATIONS

We recommend the strict implementation of traffic rules and compliance with lane rules in developing countries for bike riders' lanes.

## LIMITATIONS

Although the result inferred depicts that traffic rules lane violations lead to grave outcomes, to interpret results on a larger scale, we should study on a larger sample size and conduct long-term follow-up.

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### Additional Information

**Disclosures:** No conflict of interest
**Institutional Ethical Review Board Approval:** The study complies with the ethical review board requirements.
**Human Subject:** Consent was obtained by all patients/participants in this study.
**Conflict of Interest:** In compliance with the ICMJE uniform disclosure form, all authors declare the following:
**Financial Relationships:** All authors have declared that they have no financial relationship at present or within the previous three years with any organizations that might have an interest in the submitted work.
**Other Relationships:** All authors have declared that no other relationships or activities could appear to have influenced the submitted work.
**Data Sharing Statement:** For data sharing, interested researchers can contact the corresponding authors.

## AUTHOR'S CONTRIBUTION:

| Sr. | Author Name | Author Contribution |
|---|---|---|
| 1 | Dr. Usman Ahmad | Study design & methodology. |
| 2 | Dr. Muhammad Irfan Sheikh | Paper writing. |
| 3 | Dr. Muhammad Rizwan | Data collection and calculation. |
| 4 | Dr. Mehwish Manzoor, Dr. Atiqa Arif | Data analysis and interpretation of results. |
| 5 | Dr. Usman Ahmad | Literature review and referencing. |
| 6 | Prof. Syed Shahzad Hussain Shah | Editing and quality insurer. |