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Injury patterns in motorbike collisions – a retrospective review in an urban trauma unit in Johannesburg, South Africa

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Background: Motorbike collisions (MBC) pose significant public health challenges in low- to middle-income countries (LMICs), particularly in urban settings. This study examines the injury patterns of patients involved in MBCs at the Charlotte Maxeke Johannesburg Academic Hospital (CMJAH) trauma unit over a two-year period (May 2022 to April 2024).
Methods: This was a retrospective review of all patients involved in MBCs.
Results: A total of 134 patients were identified, predominantly male (97.1%), with a mean age of 32 years (SD ± 8.8). Most of these incidents were work-related, highlighting the increasing use of motorbikes for commercial purposes, including food delivery. The analysis revealed that head injuries were present in 22.4% of patients, with 9.7% sustaining facial fractures and one patient presenting with a cervical spine injury. Chest injuries were reported in 21.6% of cases, while abdominal and pelvic injuries occurred in 8.2% and 6.7% of patients, respectively. The predominant injuries were long bone fractures, with 58 patients affected. The mean injury severity score (ISS) was 25 (SD plus-minus 2), indicating high levels of trauma. The mortality rate after an MBC was 2.2%. Two patients died in the emergency department due to severe injuries. The findings underscore the complexity of injuries sustained in MBCs, which often involve multiple body regions.
Conclusion: This study highlights the urgent need for targeted interventions to enhance the safety of motorbike riders in urban areas, particularly as the prevalence of MBCs rises in association with commercial transport services. Improved trauma care and public health strategies are essential to address the ongoing challenge of motorbike-related injuries in Johannesburg and similar urban contexts.
Keywords: motorbike, injury, fractures, head injury, femur fracture, rib fractures

Introduction

Trauma is one of the leading causes of death globally.[1] Road accident injuries are the leading cause of death for children and young adults aged 5–29 globally.[2] Millions sustain non-fatal injuries annually leading to emergency care, temporary or permanent disability and the need for rehabilitation.[3]

Between 2010 and 2021, the number of people who died in traffic incidents in Africa rose by 17% despite global road traffic deaths (RTD) decreasing by 15%.[4] The World Health Organization (WHO) in 2016 reported 22.5% of road traffic deaths were due to motorbikes.[2] In South Africa, road accidents are estimated to cost the government R43 billion annually.[5] In 2019, less than 0.9% of deaths recorded were for those on motorbikes.[5] The majority of these deaths were male motorcyclists.[5]

Motorbikes are widely used in low- to middle-income countries (LMICs) for public transport and delivery services.[6] There has been an increase in commercial motorbike riders in Africa.[6] Motorbikes expose riders and passengers to a high risk of injuries or even death.[7] Motorbike collisions (MBCs) increased during the COVID-19 pandemic, particularly involving individual motorcycle use and motorcycle courier services.[7]

The food industry in South Africa is growing driven by the increasing numbers and convenience of food delivery applications.[8] The online food delivery industry is projected to reach USD 2.4 billion in 5 years.[8] Consumers are embracing the ease of meals and groceries delivered to their doorsteps.[8] Most of these deliveries are on motorbikes.[8]

The most fatal road accidents are those to motorcyclists.[8,9] Head injuries are the most fatal injury described in MBCs.[8,9] Injuries sustained in MBCs are classified into low side, high side, top side and collision.[9] MBCs can potentially injure several body regions.[9]

A previous study in Tembisa, South Africa, described orthopaedic injuries sustained in e-hailing motorbike accidents.[10] Soft tissue injuries on the lower limbs were the most common injuries described in the study.[10] Motorbike accidents are high velocity injuries and have a combination of injuries.[10] In the upper limb, distal radial fractures were common.[10] The common injury described globally is head injuries.[10,11]

There are few studies to improve safety of motorbike riders in Africa,[11] however, there is a lack of epidemiological or outcome studies in motorbike accidents. The study aims to describe injury patterns of motorbike accident patients

presenting to our trauma unit. The study will add to the body of literature and hopefully inform policy-makers especially around medical insurance cover for those on motorbikes for work.

Methods

This was a retrospective review of all patients involved in MBC seen in the Charlotte Maxeke Johannesburg Academic Hospital (CMJAH) trauma unit over 2 years (1 May 2022 to 30 April 2024). Patients 18 years and older were included in the study. Those with missing records were excluded from the study.

Data was collected from the emergency department (ED) records. Clinical records and Medibank forms were reviewed. The data collected included demographics, physiological status in ED (blood pressure [BP], pulse rate, respiratory rate, Glasgow Coma Scale [GCS], the base excess, lactate levels,) revised trauma score (RTS) in ED and transfusion requirements during the first 24 hours. The injury severity score (ISS) and the new injury severity score (NISS) were also documented. The disposition of the patient was also noted. In the case of in-hospital mortality, the determination of the cause of the mortality was noted.

Assessment and treatment

MBC patients who presented as priority one patients were resuscitated by the trauma team. The team is made up of 2 doctors and 2 nurses. The initial evaluation is done by the general surgery trainee rotating in the trauma unit, with trauma consultant cover. The primary survey and secondary survey are conducted by the team. Other surgical specialties were consulted after the adjuncts of the secondary survey are completed.

Statistical analysis

Means (standard deviations, SD) and medians (interquartile ranges, IQR) were calculated for normally distributed and skewed continuous variables, respectively. Frequencies and percentages were used to describe distributions of categorical variables.

All analyses were done using STATA version 18 (StataCorp. (2023). Stata Statistical Software: Release 18. College Station, TX: StataCorp LLC). Continuous variables were first tested for normality using the Shapiro-Wilk test. Fisher's exact test was used to test the significance of the relationship between categorical variables. A *p-value* of <0.05 was considered statistically significant.

Results

There were 134 patients involved in MBC identified. There were 130 males. The mean age was 32 years (SD ± 8.8). The majority (97.1%) of patients were involved in MBC for work related purposes. The majority of patients had more than 1 body region injured (polytrauma). The mortality rate after an MBC was 2.2%. Two patients died in the ED due to a bleeding pelvis and another due to a severe head injury. One patient died on the theatre table from a bleeding liver injury.

Injuries sustained were mostly to the lower limb, head and chest (Table I). Soft tissue injuries were present in 17.4% ($n = 23$).

The most common brain injury was a concussion (mild traumatic brain injury) (88.7%). The computed tomography (CT) findings revealed intracerebral haemorrhage in 56% ($n = 17$), traumatic subarachnoid in 46.7 % ($n = 14$), subdural haematoma in 26.7% (n=8), extradural haematoma in 10% ($n = 3$) and skull fractures in 10% ($n = 3$). Fifteen patients sustained moderate to severe head injury according to the GCS. Eighteen patients needed intubation and ventilation after an MBC.

Rib fractures were the most commonly occurring injury to the chest, followed by pneumothorax and haemothorax (Table II). Ten patients had solid organ injuries that were managed non-operatively, liver ($n = 4$), spleen ($n = 3$), kidney ($n = 2$) and minor pancreatic injury ($n = 1$). Six patients (4.5%) required emergency laparotomy for small bowel and large bowel injuries. Two patients had bladder injuries associated with pelvic fractures which needed repair.

Ten patients sustained a pelvic fracture (Table III). Three patients sustained dislocations, with the involved joints being hip, knee and shoulder. Cervical and thoracic spine injuries occurred in 8 patients each (Table IV).

Five patients had popliteal artery injuries with three having an associated tibial plateau fracture. Two patients had blunt aortic injuries. One patient had an axillary artery injury. Four patients had primary lower limb amputations, two for mangled limbs and two for popliteal artery injuries with non-viable limbs at time of surgery.

On presentation to the ED, the mean systolic and diastolic blood pressures were 128 mmHg (SD ± 21) and 81 mmHg (SD ± 16). The median pulse was 88 beats per minute (IQR 78–147). Four patients (3%) presented with severe metabolic acidosis (pH7.2). The mean pH in the ED was 7.36 (SD ± 0.76). The median lactate and base excess were 2.5 mmol/l (IQR 1.4–9.1) and -4 (IQR -1.8 to -15.4)

Table I: Frequency of anatomical region of injury

Anatomical region of injury	Frequency (*n*)	Percentage
Head	30	22.4%
Facial bones	13	9.7%
Neck	1	0.8%
Chest	29	21.6%
Abdomen	11	8.2%
Pelvis	9	6.7%
Vertebral	13	9.7%
Upper limb	21	15.7%
Lower limb	58	43.2%

Table II: Chest injuries in MBC patients

Chest	Frequency
Pneumothorax	13
Haemothorax	13
Lung contusion	11
Rib fractures	16
Major vessel injury	1

Table III: Pelvic fracture patterns in MBC patients

Pelvis	Frequency
Open book	3
Ilium	2
Pubic rami	5

Table IV: Spinal injuries in MBC patients

Vertebral injury	Frequency
Cervical	8
Thoracic	8
Lumbar	3

Table V: Long bone fracture patterns in MBC patients

Long bone fractures	Frequency
Femur	25
Tibial plateau	6
Tibia and fibular	28
Humerus	2
Mangled extremity	2

respectively. The mean haemoglobin was 14 g/dl (SD ± 2). Among the patients requiring blood transfusion, six patients required massive transfusion protocol with 93.2% patients receiving a single unit of blood during the resuscitation period.

Most patients were polytrauma patients with the chest and long bones commonly injured. The average ISS and NISS were 25 and 32, respectively. Long bone fractures were the most common injury (Table V).

Orthopaedic surgery admitted the most patients (38.2%). Twenty-nine per cent were discharged home from the ED. Twenty-four per cent of patients were admitted to the trauma unit (ward), with 55% of these being trauma ICU admissions. Only 5 (4.1%) patients were admitted to the neurosurgical ward. Six patients were stepped down to our referring district hospitals for neurological observation.

Discussion

There is a rise in MBCs, especially with rise in food delivery applications.[7,10] A previous study at CMJAH had 259 patients over 7 years.[12] In our current study we had 134 patients over 2 years. Studies have attributed the rise in MBC to several factors. Level of education, behavioural and societal factors, such as rider's age, gender, circadian rhythms, riding experience, type of road, and characteristics of the motorcycle, increase the risk of accidents among riders.[13]

Studies have shown that the majority of motorbike riders are male.[10,13] This was also noted in our study group. Previous studies found young commercial motor riders to be injured often due to risk-taking behaviour.[14] The average age of patients in the study is consistent with other studies.[10] The high occurrence of injuries in males is also related to using motorcycle for employment reasons.[10]

Riders are susceptible to limb fractures due to their exposure.[10] Non-fatal fractures and dislocations are common. In a study done at Tembisa Hospital, tibial and fibular fractures and femur fractures were noted frequently.[10] Our patients have the same injury patterns needing admission to the orthopaedic ward.[9] Lower limb injuries result from low side crash mechanism.[7,9] It is a common mechanism of injury. The most common injuries are tibia fractures.[15]

MBC can result in disablement.[16] There were four patients who had primary amputations after crashes due to vascular injury or mangled limb in our study. The lower limbs are involved in operating a motorbike which explains the injury patterns.[9] The amputation rate in our study is 3%. This comparable to that in literature which ranges from 3–9%.[16] The early involvement of a trauma team during resuscitation may be a contributing factor to why our amputation rate is at the lower end of the range.

Head and facial fractures are frequently observed in MBC.[17] Brain injuries are the leading cause of death in MBC.[9,17] In a systematic review, the most common brain injury observed was a concussion (mild TBI).[18] There were few fatal head injuries in our study, and this can be attributed to the use of helmets. Helmets have been shown to reduce risk of head and brain injuries in motorcyclists of all ages.[19] Helmets continue to be a vital preventative measure against fatal head injuries in motorbike accidents.

Chest and abdominal injuries pose a risk of death in trauma patients. Chest injuries are common with MBC.[19] Rib fractures occur frequently, followed by haemothorax/pneumothorax in the chest in our study. The energy transferred from a motorbike accident can also cause major vessel injuries. We had 2 with blunt aortic injuries. Liver injuries are common with rib fractures in MBC. Handlebars cause pancreas and spleen injuries.[20] In our study, there were few patients who sustained spleen and pancreas injuries.

Pelvic fractures in MBC are attributed to the patient contacting the fuel tank during the collision.[9] An unstable pelvic fracture can be life threatening. The pelvic fractures were low in our study group (6.7%). Pelvic fractures can lead to early death from haemorrhage in motorbike accidents.

The low mortality rate of 2.2% in this study group might be attributed to the trauma resuscitation teamwork or those with severe injuries died on scene.

This is one of the few studies looking at the injury pattern of MBC in LMICs. It includes all patients presenting to the emergency department. We recommend motorbike patients be seen by a general surgery or trauma team initially to identify all life-threatening injuries. There is a critical need for medical insurance that includes commercial riders, as the healthcare system is already overwhelmed with cases. This coverage will facilitate early treatment and help individuals return to work. Establishing a central system for collecting and analysing data on commercial motorbike accidents may inform future policies and identify high risk areas.

The limitations of the study include that it is a retrospective review done at a single centre. There is no long-term follow-up on patients included in the study. Future prospective outcome studies in MBC patients are essential for enhancing our understanding and improving trauma care.

Conclusions

This study highlights the urgent need for targeted interventions to enhance the safety of motorbike riders in urban areas, particularly as the prevalence of MBCs rises in association with commercial transport services. Improved trauma care and public health strategies are essential to address the ongoing challenge of motorbike-related injuries in Johannesburg and similar urban contexts.

Conflict of interest

The authors declare no conflict of interest.

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Ethical approval

Ethical approval was obtained from the University of the Witwatersrand Human Ethics Committee and the hospital CEO. Ethics number M201134.

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