



Burden of Motorcycle-Related Hand and Wrist Trauma in Medan: A Hospital-Based Study

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KEYWORDS

Motorcycle accidents, Upper extremity trauma, Hand injuries, Wrist injuries, Retrospective study

ABSTRACT

Motorcycle traffic accidents represent a growing public health concern, particularly in urban areas such as Medan, North Sumatra. This study aims to assess the incidence, patterns, and demographic characteristics of hand and wrist injuries resulting from motorcycle accidents in Medan, North Sumatra. This retrospective observational study analyzed the medical records of 327 patients admitted to the surgery department of Adam Malik General Hospital for hand and/or wrist injuries related to motorcycle traffic accidents between July 2022 and June 2024. Results show that out of 881 patients treated for hand and wrist injuries, 327 (37.1%) were specifically victims of motorcycle-related accidents. Among these, hand injuries constituted 73 cases (22.3%), wrist injuries accounted for 164 cases (50.1%), and combined hand and wrist injuries were present in 90 cases (27.5%). The demographics showed a male-to-female ratio of 3:1, with a mean age of 24.3 years (range: 1 to 78 years; median: 23 years). The adult population (ages 19–64) made up 78% of cases, children under 19 accounted for 19%, and the elderly (over 64 years) represented 3%. Injuries to the dominant hand were more prevalent, seen in 203 cases (62.4%), while fractures of the hand and wrist were identified in 96 (29.3%) and 197 (60.2%) patients, respectively. Notably, 11 patients (7.5%) required amputation. The study reveals a significant incidence of hand and wrist trauma among motorcyclists involved in traffic accidents in Medan, predominantly affecting adult males. The findings underscore the need for targeted prevention strategies and highlight the importance of addressing injuries to the dominant hand.

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INTRODUCTION

Motorcycle traffic accidents constitute a significant public health issue in Indonesia, especially in densely populated urban centers like Medan, North Sumatra. With over 1.5 million registered motorcycles in Medan and an annual growth rate of 13% (BPS, 2023), the city exemplifies the increasing reliance on two-wheeled vehicles for daily transportation. This surge in motorcycle usage has corresponded with a growing burden of traffic-related injuries, particularly to vulnerable anatomical regions such as the hands and wrists (Kurniawan et al., 2021; Puspitasari & Rahardjo, 2020; Syahril et al., 2019; WHO, 2018; Wulan & Sari, 2022).

Hand and wrist injuries are commonly sustained during motorcycle collisions, primarily due to instinctive bracing mechanisms and the anatomical vulnerability of these regions (Ardiansyah et al., 2021; Kusuma et al., 2020; Santoso et al., 2021; Rahman & Putri, 2019; Widodo, 2022). These injuries not only cause immediate trauma but may also result in long-

term functional impairment, affecting the quality of life and productivity of the injured individuals. Despite their frequency, the use of protective gear, such as motorcycle gloves and jackets with integrated body armor, remains critically low. Contributing factors include lack of awareness, economic limitations, and cultural attitudes toward safety practices (Hadi et al., 2021; Kurniadi & Prasetyo, 2020; Lestari & Nugroho, 2022; Pratama et al., 2019; Yuliani et al., 2020).

Existing literature strongly supports the protective efficacy of specialized motorcycle clothing. De Rome et al. (2011) highlighted a significant reduction in injuries when riders wore fitted protective gear, while Schuller et al. (1986) reported that motorcyclists with leather protective clothing had shorter hospital stays and were less likely to sustain permanent disabilities. Further studies corroborate these findings, emphasizing the protective role of clothing in mitigating soft tissue and osseous injuries (Zettas et al., 1979; Otte et al., 2002; Erdogan et al., 2013).

In Medan, behavioral risk factors such as adolescent illegal racing, overloaded family travel during festive seasons, and child motorcyclists without supervision or protective gear exacerbate the injury burden. The situation is compounded by a lack of stringent enforcement of safety regulations and low public health awareness.

In recent years, motorcycle traffic accidents have become a significant health issue globally, particularly in Indonesia, where high rates of injuries occur. For instance, a study by Yusof et al. (2020) highlighted that although protective gear like helmets is commonly used, other protective equipment such as gloves and jackets remains underutilized, leaving motorcyclists vulnerable to hand and wrist trauma. This research emphasizes the importance of general safety equipment but does not specifically address the relationship between protective gear usage and the reduction of hand and wrist injuries, particularly in urban settings like Medan. Similarly, Ahmed et al. (2021) studied the role of public awareness campaigns in increasing helmet usage but did not explore how specific safety interventions (such as the use of gloves or protective jackets) could impact injury rates in the hands and wrists, which are particularly prone to trauma in motorcycle accidents.

This study aims to quantify and characterize hand and wrist injuries related to motorcycle accidents in Medan. By identifying demographic trends, injury patterns, and treatment needs, it seeks to inform public health policy and clinical approaches for injury prevention and management. The study is crucial for raising awareness about the need for comprehensive safety measures, which can ultimately reduce traffic-related injuries and enhance motorcyclist safety in urban areas. Ultimately, the author hopes that this research will serve as both a call to action and a foundation for future injury prevention programs in Indonesia and similar low- to middle-income countries facing rising motorcycle accident rates.

METHOD

This study employed a retrospective descriptive design to assess the epidemiological characteristics and clinical burden of hand and wrist injuries sustained from motorcycle traffic

accidents. The approach was chosen to provide a comprehensive overview of injury patterns, treatment modalities, and demographic profiles of affected patients over a two-year period.

Data were collected from the Department of Surgery, H. Adam Malik Central General Hospital in Medan, North Sumatra, Indonesia — the largest tertiary referral center in the region. The study focused on trauma patients admitted between July 2022 and June 2024 who sustained hand and/or wrist injuries due to motorcycle-related accidents.

1. Inclusion Criteria:

- a. Patients of all ages with documented motorcycle-related trauma resulting in hand and/or wrist injuries.
- b. Sufficiently complete medical records detailing demographics, injury classification, and treatment interventions.

2. Exclusion Criteria:

- a. Patients with non-motorcycle-related hand/wrist injuries.
- b. Incomplete records or those lacking essential clinical documentation.

A total of 881 trauma records were initially screened from which 327 cases met the inclusion criteria for motorcycle-associated hand and wrist injuries. Data were extracted manually from hospital records and tabulated using Microsoft Excel.

Collected variables included:

1. Demographic data: age, sex, hand dominance
2. Injury characteristics: anatomical location (hand, wrist, or both), type (fracture, soft tissue, etc.)
3. Protective gear usage: glove and body armor status at time of injury
4. Surgical interventions: need for debridement, fixation, amputation

Descriptive statistics were used to summarize demographic distributions and injury types. Categorical variables were expressed as frequencies and percentages. Comparative data, such as protected versus unprotected injury outcomes, were assessed to evaluate the potential protective effects of motorcycle gear.

RESULT AND DISCUSSION

Demographic Profile

Among the 327 patients who sustained motorcycle-related hand and wrist injuries, a marked gender disparity was evident: 78% were male (n=255) and 22% were female (n=72). This aligns with global trends indicating higher risk-taking behaviors and greater motorcycle usage among males.

The mean age of the cohort was 24.3 years, with a median of 23 years and an age range from 1 to 78 years, suggesting a predominance of injuries among young adults.

In terms of anatomical location Wrist-only injuries were the most frequent, comprising 164 cases (50.1%). Combined hand and wrist injuries were recorded in 90 cases (27.5%) and Hand-only injuries were observed in 73 cases (22.3%).

Importantly, injuries involving the dominant hand were significantly more common, present in 203 patients (62.4%), highlighting potential long-term functional impairments due to compromised dexterity and strength in daily activities and employment.

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Table 1. Demographic profile of hand and wrist injury

	Frequency (n)	Percentage (%)
Age	62	19
Children & adolescent (< 19 y.o)	255	78
Adult (19-64 y.o)	10	3
Elderly (>65 y.o)		
Gender		
Male	213	65.1
Female	114	34.8
Anatomy of injury		
Hand injury	73	22.3
Wrist injury	164	50.1
Both hand and wrist injury	90	27.5
Site of injury		
Dominant hand	203	62.4
Non-dominant hand	115	35.2
Both hands	9	2.8

Type of Injury and Management

Fractures represented a significant clinical burden in this cohort, identified in 29.3% of patients with hand injuries (n=96) and 60.2% of those with wrist injuries (n=197). These injuries often required specialized orthopedic or reconstructive intervention, reflecting the complexity of trauma associated with motorcycle crashes. The total number of patients who underwent surgical treatment was 167, indicating that over half of the study required operative management. Common surgical procedures included open reduction and internal fixation (ORIF) for unstable fractures, external fixation for comminuted or severely displaced injuries, debridement and wound closure in cases with open wounds or soft tissue loss, and tendon or nerve repair for functional restoration.

Among the surgically treated patients, 11 (3.4%) ultimately required amputation due to extensive tissue destruction, vascular compromise, or non-salvageable traumatic injuries. Amputations were more frequent in injuries involving high-energy mechanisms, such as direct crush or rotational forces, where limb viability could not be preserved despite aggressive

intervention. These cases emphasize the devastating functional and psychosocial consequences of severe extremity trauma and highlight the urgent need for comprehensive trauma systems — including access to microsurgical reconstruction and rehabilitation services — to improve outcomes.

Moreover, the predominance of wrist fractures over hand fractures can be attributed to the biomechanical role of the wrist during falls; instinctive bracing with outstretched arms results in direct axial loading, making the distal radius and ulna particularly susceptible. The high rate of surgical intervention not only reflects injury severity but also illustrates the burden placed on tertiary care centers to deliver timely, specialized treatment — a demand that is expected to grow with increasing motorcycle use in urban centers.

Protective Gear Usage and Injury Severity

Among the 327 patients included in this retrospective analysis, documentation regarding the use of protective gloves was limited. Based on available records, 7 patients (2.1%) were noted to have been wearing gloves at the time of the motorcycle accident. Of these, 1 patient was recorded as using padded gloves, while the remaining 6 had standard, non-padded gloves. The remaining 320 patients (97.9%) had no documented glove use at the time of injury. No data were available regarding the use of other types of protective gear such as wrist guards, jackets, or reinforced clothing.

Injury types among patients with documented glove use included both soft tissue and skeletal trauma. Specifically, 4 of the 7 glove users sustained soft tissue injuries, and 3 patients experienced fractures, with 2 involving the hand and 1 involving the wrist. Among those without documentation of glove use, injuries included 30 cases of soft tissue damage, and 290 fractures affecting the hand and/or wrist. These included 94 hand fractures and 196 wrist fractures, based on the injury classification available in the medical records.

Table 2. Distribution of injuries by protective status

Type of Injury	Hand Injury - Protected	Hand Injury - Unprotected	Wrist Injury - Protected	Wrist Injury - Unprotected
	n	%	n	%
Soft Tissue Injury	4	1%	21	6%
Fracture Injury	2	0.6%	94	28%

Total protected patients (gloves) = 7

Wearing motorcycle padded gloves = 1

This retrospective study analyzed 327 cases of motorcycle-related hand and wrist injuries in Medan, North Sumatra, revealing significant insights into injury distribution, demographic patterns, and the role of protective equipment. Wrist injuries were most prevalent (50.1%), followed by combined hand and wrist injuries (27.5%), and isolated hand injuries (22.3%). The majority of patients were adult males (78%), with a notable proportion of injuries affecting the dominant hand (62.4%).

Our findings are consistent with global trends. Prior studies have reported the upper extremities, especially the wrists, as highly vulnerable during motorcycle accidents due to instinctive bracing mechanisms and exposure during collisions (Erdogan et al., 2013).

The gender and age distribution observed aligns with the epidemiological data indicating young adult males as high-risk groups for road traffic injuries. This is attributed to aggressive driving behavior, higher exposure, and lower use of protective gear (Savolainen et al., 2011).

Role of Protective Gear

Despite substantial evidence supporting the use of protective clothing, our data show extremely low glove use (only 7 patients wore gloves, 1 wore padded gloves). The protective effect of such gear is well-documented. For example, de Rome et al. (2011) found that gloves significantly reduced the risk of hand and wrist injuries (RR = 0.55) in motorcycle crashes (de Rome et al., 2011). Wu et al. (2019) also emphasized gloves as the most frequently worn item with a measurable impact on injury mitigation (Wu et al., 2019).

While gloves help prevent soft tissue injuries, they are less effective against fractures unless equipped with rigid components or armor (Phillips et al., 2015). This nuance underlines the importance of both design quality and regulatory standards for motorcycle gear.

Sociocultural and Behavioral Dimensions

Context-specific behaviors such as underage driving, illegal racing, and overloaded travel during festive periods ('mudik') heighten accident risks. These practices are compounded by poor public awareness and weak enforcement of safety regulations. Cultural norms that discourage protective clothing, particularly among users of light motorcycles, further aggravate the problem.

Clinical and Public Health Implications

From a clinical standpoint, the high rate of dominant-hand injuries and fractures calls for resource allocation toward surgical expertise and rehabilitation services. Public health efforts should target young male riders with educational campaigns and potentially subsidize protective gear to improve compliance.

Mandating the inclusion of protective equipment in motorcycle sales, or offering insurance incentives for riders who use safety gear, could reduce injury incidence — a strategy proposed by several injury prevention models [(Schuller et al., 1986); (Hurt et al., 1981)].

Limitations

The retrospective nature of the study introduces inherent biases, including potential underreporting or incomplete documentation. Being a single-center study, the findings may not fully represent regional or national patterns.

Future Directions

Further research should explore prospective, multi-center data with standardized injury scoring systems. Investigations into behavioral interventions, quality ratings for protective gear, and longitudinal follow-ups on patient recovery and functional outcomes are warranted.

From the authors' perspective, the findings regarding glove usage are both striking and concerning. Despite decades of international evidence advocating for motorcycle gloves as a fundamental safety measure, the local adoption rate remains critically low. Only 7 out of 327 patients wore gloves at the time of injury, and just one of those had gloves with adequate padding. This reflects not only a gap in access and affordability but also a cultural and behavioral disconnect between awareness and action.

The data strongly support the view that motorcycle gloves — particularly those designed with impact resistance and abrasion protection — should not be considered optional accessories but essential personal protective equipment, akin to helmets. In line with previous research, gloves have been shown to significantly reduce soft tissue damage and, when properly designed, can mitigate the severity of bony injuries as well (de Rome et al., 2011); (Phillips et al., 2015).

The authors emphasize that prevention should not rely solely on individual responsibility. Structural and policy-level interventions are urgently needed:

1. **Regulatory Enforcement:** Implement mandatory standards for motorcycle protective gear, including gloves, similar to helmet regulations.
2. **Public Awareness Campaigns:** Utilize media, schools, and healthcare networks to educate riders about the risks of riding unprotected, especially focusing on youth and first-time drivers.
3. **Incentivized Protection:** Offer tax reliefs or insurance benefits for riders who purchase certified safety gear.
4. **Retail Policy:** Advocate for bundling protective gear with vehicle sales, ensuring that gloves, jackets, and boots are part of standard motorcycle purchases.

In sum, the burden of motorcycle-related hand and wrist injuries is preventable. Strengthening glove adoption through culturally sensitive and economically viable strategies could dramatically reduce morbidity and healthcare costs in Indonesia and other low-to-middle-income countries.

CONCLUSION

This study highlights a substantial burden of hand and wrist injuries from motorcycle accidents in Medan, North Sumatra, predominantly affecting young adult males, with wrist injuries and dominant hand trauma being most common, leading to significant functional and socioeconomic consequences. Despite strong evidence supporting the protective effect of motorcycle gloves in reducing soft tissue and fracture-related injuries, their usage remains critically low, compounded by risky riding behaviors and cultural factors. These findings reveal notable gaps in awareness and enforcement, underscoring the need for integrated public health interventions—combining regulation, education, and economic incentives—to promote glove use and reduce injury rates. Future research should focus on evaluating the effectiveness of

targeted safety programs and behavioral interventions to increase protective gear adoption and ultimately decrease hand and wrist trauma among motorcyclists in urban Indonesian settings.

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