Original Article

Motorcycle Wheel Spoke Injury to the Ankle and Foot in Children: A Cross-sectional Observational Study

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Abstract

Background: In developing countries, motorcycles are a widespread transportation method, leading to a notable increase in road traffic injuries, particularly those involving the ankle and foot caused by motorcycle wheel spokes. **Aims and Objectives:** Our study sought to understand the epidemiological features and characteristics of motorcycle-induced wheel spoke injuries to the ankle and foot in children. The objectives were to comprehend injury patterns, evaluate their severity and pinpoint clinical indicators predicting injury nature and extent, aiming to guide prevention strategies. **Materials and Methods:** We conducted a cross-sectional observational study with a retrospective data collection focused on children under the age of 16 years who sustained injuries from motorcycle rear wheel spokes while riding as pillion passengers and were admitted to our department over 11 years, from 1 January 2010 to 31 December 2020, with a minimum follow-up of 2 years. Soft tissue wounds were classified using the Oestern-Tscherne classification. **Results:** Thirty patients were enrolled in this study. Before 2015, cases ranged from none to one annually, increasing to 2–7 cases per year after 2015. The average age was 6.7 ± 2.1 years. Significantly, more patients were older than 6 years ($P < 0.001$), injured on the right side ($P < 0.001$) and suffered the injuries in the afternoon ($P < 0.001$). All patients were pillion and were injured by the motorcycle's rear wheel. Twenty-five patients (83%) had a Grade 3 injury. There was a tendon rupture in 22 (73%) and a bone fracture in 15 (50%) patients. Loss of soft tissue ($P = 0.036$) and reduced ankle mobility ($P = 0.046$) were linked to tendon ruptures. Lengths of wound exceeding 6 cm ($P = 0.025$) and loss of soft tissue ($P = 0.025$) were associated with a bone fracture. **Conclusion:** Children's motorcycle wheel spoke injuries have increased in recent years. Loss of soft tissue and ankle mobility deficit proved to be reliable clinical signs of a tendon rupture. A wound length exceeding 6 cm and a loss of soft tissue were indicative of a related bone fracture.

Keywords: Ankle and foot injuries, children, epidemiology features, motorcycle wheel spokes

Introduction

Motorcycles are a prevalent mode of transport in developing countries such as ours. As a result, injuries related to motorcycles are a significant contributor to road traffic accidents in these nations.[1] Injuries to the ankle and foot due to motorcycle wheel spokes happen when a passenger's lower limbs become entrapped within the rotating spokes. The occurrence of this injury is on the rise, primarily attributed to inadequate safety precautions, with children being the most affected demographic.[2,3] The range of these injuries can span from minor grazes and cuts to severe crush injuries, predominantly affecting the ankle and foot.[2] Compared to bicycles, motorcycles have the potential to inflict more grievous wheel spoke injuries owing to their greater energy.[4,5]

Children are especially susceptible to severe injuries, as their smaller feet and ankles can easily become caught between the spokes. Treating these injuries can prove challenging due to the combined damage to skin, bones and tendons. Consequently, treatment can entail intricate and multiple surgical interventions.

This research sought to understand the epidemiological facets of motorcycle-induced wheel spoke injuries to the ankle and foot in children. The objectives were to assess the mechanisms

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and patterns of injury, evaluate their severity, recount our experiences in handling these injuries and pinpoint potential preventative measures for such injuries in children. To the best of our knowledge, no prior study has documented this specific injury in children within our nation.

Materials and Methods

Study design, settings and population

We undertook a cross-sectional observational study from 1 January 2010 to 31 December 31, 2020, within our department, with a retrospective data collection. Our research focused on motorcycle rear wheel spoke injuries resulting from ankle and foot entrapment in children riding as pillion passengers. We included all children under the age of 16 years who were admitted to our department for these specific injuries during the period of study and had a minimum follow-up of 2 years. We excluded from our study: children who suffered wheel spoke injuries because of bicycle accidents, individuals who sustained injuries due to falling from a motorcycle, and those presenting with ankle or foot injuries attributable to alternative causes.

Data collection and variables

We reviewed the records of patients. Data on demographics, circumstances of the accident, characteristics of injuries, treatments administered, complications and outcomes were obtained. The site of injury was categorised as ankle, foot, or both. Soft-tissue wounds were classified as per the Oestern-Tscherne classification.[6] The injuries spanned from closed soft-tissue swelling (Grade 0), to superficial scrapes and bruising (Grade 1), advancing to deep scrapes or lacerations with loss of soft tissue (Grade 2) and culminating in extensive injuries causing damage to soft tissue, underlying structures, or fractures (Grade 3).

Injury management

The approach to treatment was guided by the Oestern-Tscherne classification. Patients were resuscitated with intravenous fluids, and a blood transfusion was given as needed for stabilisation. Following a clinical evaluation, X-rays were taken to detect any bone injuries. Grade 1 injuries were meticulously cleaned with 0.9% saline solution and then dressed in povidone-iodine-soaked gauze. After 48 h, wounds were checked, and a below-knee back splint was fitted for 2 weeks, keeping the ankle neutral and the limb elevated. Patients were also prescribed oral co-amoxiclav for 10 days. Unless, there were life-threatening injuries or systemic instability, patients with Grade 2 or 3 injuries were transferred to the operating room. The treatment protocol included: an initial wound examination under general anaesthesia, cleaning and debridement of non-viable or necrotic tissue, repair of ruptured tendons, fixing bone fractures (employing Kirschner wires, screws or external fixators), reconstruction of bone defects, loose stitching, dressings, application of a below-knee back splint for immobilisation and elevation to facilitate healing. For ankle joint injuries, systematic temporary Kirschner wire divergent transfixation (tibio-talo-calcaneal and talo-navicular-first metatarsal arthrodesis) or external fixators were employed to prevent equines deformity. Post-operative care encompassed broad-spectrum antibiotics, anti-inflammatory medications, tetanus prevention, daily monitoring and dressing changes. Further debridement was conducted if necessary. For Grade 3 patients, secondary procedures such as necrosectomy, skin grafting from the thigh, or flap coverage were employed for definitive wound treatment. A joint team of paediatric orthopaedic and plastic surgeons performed all the surgeries. Outpatient follow-ups were scheduled post-discharge as required.

Statistical analysis

The data were processed using IBM SPSS Statistics version 28 for Microsoft Windows (IBM Corporation, Armonk, NY, USA). The Shapiro–Wilk test established the normal distribution of variables. Categorical variables were displayed as numbers (percentage). Depending on the distribution, continuous variables were shown either as median [interquartile range] or as mean ± standard deviation. The Chi-square goodness-of-fit test was utilised to discern differences in study population proportions. A $P = 0.05$ was deemed statistically meaningful. Both univariate and multivariate binary logistic regression analyses were performed to identify independent clinical factors linked with tendon rupture and fractures. Variables with a $P = 0.15$ in univariate regression analysis were included in the final model. A $P = 0.05$ was finally taken as statistically significant with a 95% confidence interval. The Hosmer–Lemeshow test was used to assess the logistic models' goodness of fit.

Ethical considerations

Our institution's ethics committee granted ethical approval for this study (reference No. 25/22). The requirement for informed consent was waived due to the observational and retrospective nature of this study. Data were collected anonymously, with information that could identify patients or physicians not being recorded or stored.

Results

Series characteristics

During the study, 79 children were admitted to our department with concerns related to ankle or foot injuries. Of these, 30 patients (38%) were admitted due to wheel spoke injuries resulting from motorcycle incidents, with an age range of 28 months to 11 years. Before 2015, the number of such cases varied from none to one per annum and increased to 2–7 cases per annum post-2015 [Figure 1]. The percentage of motorcycle wheel spoke injuries relative to all ankle and foot injuries was between 0% and 25% before 2015 and rose to between 33% and 67% from 2015 onwards [Figure 2]. The sex ratio was 1:1. There was a notable overrepresentation of children aged six and above compared to their younger

counterparts ($P < 0.001$). Every injured child was a pillion passenger, harmed by the motorcycle's rear wheel. In each instance, the motorcycle rider was a parent or relative.

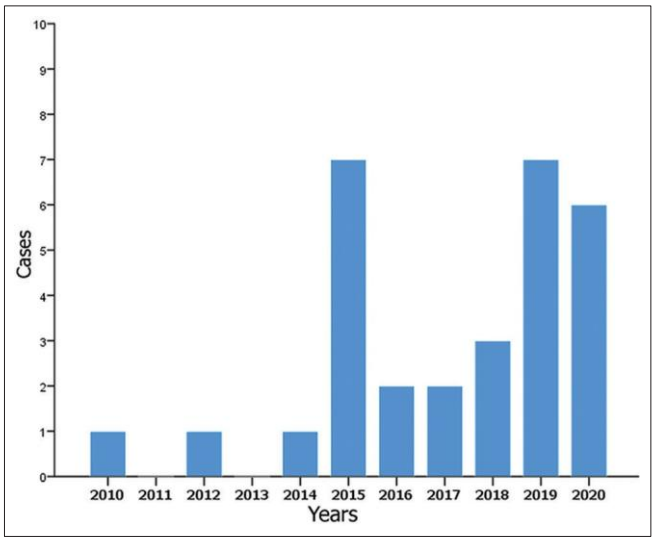


Figure 1: Annual number of motorcycle wheel-spoke injuries in our study

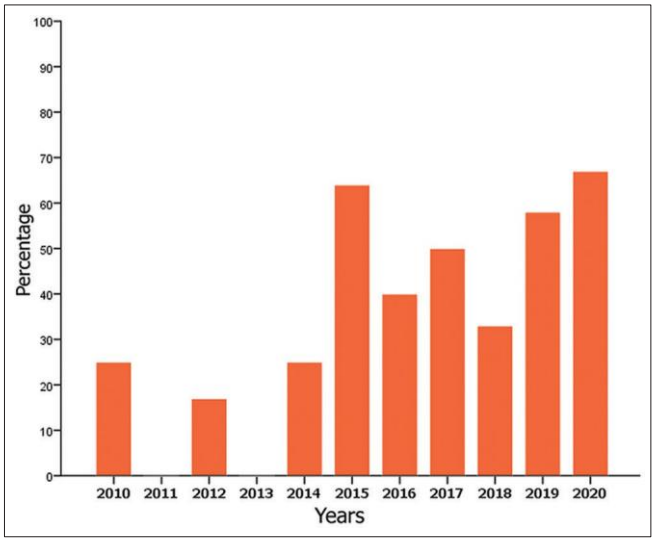


Figure 2: Annual percentage of motorcycle wheel-spoke injuries out of all ankle and foot injuries in our study

A majority, 83%, suffered injuries to the right side, with this disparity being statistically significant ($P < 0.001$). All the children were shod at the time of the incident except one who was barefoot. A significant number of injuries occurred during the afternoon compared to other times of day ($P < 0.001$). The duration between injury occurrence and hospital arrival ranged from 1 h to 14 days. There were no instances of injuries to both feet. All motorcycles lacked rear wheel-spoke guards, and no child had been wearing protective gear for their lower limbs during the injury. Further demographic details and circumstances surrounding the accidents can be found in Tables 1 and 2. Grade 2 injuries were noted in five patients and Grade 3 in 25 children. Injuries were most commonly located at the posterior ankle,

Table 1: Patient's demographics*

Characteristics	Patients (*n*=30)
Sex	
Male	15 (50)
Female	15 (50)
Age (years)	6.7±2.1
5 years or under	5 (17)
6 years or over	25 (83)
Weight	23 (20–27)
22 kg or under	14 (47)
23 kg or above	16 (53)
Home town	
Casablanca	27 (90)
Other towns	3 (10)
Footwear at the time of injury	
Shoes	29 (97)
Barefoot	1 (3.3)
Seating-position on the motorcycle	
Rider	0
Pillion passenger	30 (100)
Duration between injury occurrence and hospital arrival (h)	3 (2–5)
Patient route	
Direct consultation	20 (67)
Referred patient	10 (33)

*Values are presented as a *n* (%), median (IQR), and mean±SD. IQR: Interquartile range, SD: Standard deviation



Figure 3: Grade 3 motorcycle wheel-spoke injury surgical treatment (upper photos) and healing process (lower photos)

Table 2: Accident's circumstances*

Characteristics	Patients (*n*=30)
Time of the year	
First quarter	8 (27)
Second quarter	5 (17)
Third quarter	7 (23)
Fourth quarter	10 (33)
Day of the week	
Week day	19 (63)
Week end	11 (37)
Part of the day	
Morning (6:00–12:00)	8 (27)
Afternoon (12:00–18:00)	16 (53)
Evening (18:00–24:00)	5 (17)
Night (00:00–6:00)	1 (3.3)
Reason for travel	
Travelling to school	4 (13)
Leisure activities	26 (87)
Cause of the foot or ankle entrapment	
Inadvertence swing of the leg	25 (83)
Collision with other types of vehicles	5 (17)
Side of injury	
Right	25 (83)
Left	5 (17)

*Values are presented as a *n* (%)

Table 3: Wound's characteristics*

Characteristics	Patients (*n*=30)
Anatomical site of injury	
Ankle only	15 (50)
Foot only	10 (33)
Both ankle and foot	5 (17)
Wound length (cm)	6 (5–8)
6 cm or fewer	18 (60)
More than 6 cm	12 (40)
Soft tissue loss	18 (60)
Ankle mobility deficit	26 (87)
Plantar flexion deficit	17 (57)
Dorsiflexion deficit	23 (77)
Tendon rupture	22 (73)
Calcaneal tendon	13 (43)
Anterior tibial tendon	2 (6.7)
Posterior tibial tendon	4 (13)
Fibularis brevis tendon	1 (3.3)
Plantaris tendon	2 (6.7)
Toe flexor tendons	4 (13)
Toe extensor tendons	5 (17)
Vascular or nerve injury	3 (10)
Dorsalis pedis artery	3 (10)
Posterior tibial artery	3 (10)
Tibial nerve	2 (6.7)
Foreign body in wound	7 (23)
Primary toe amputation	2 (6.7)

*Values are presented as a *n* (%)

affecting 16 patients (53%). Other locations included the lateral aspect in eight patients (27%), the medial aspect in one patient (3.3%), the dorsal aspect in five patients (17%), and the plantar aspect in six patients (20%). A bone fracture accompanied half of these cases, and tendon ruptures were observed in 73% of patients. Specifically, calcaneal tendon rupture was complete in 12 patients and partial in one. All patients eventually regained their walking abilities. Additional details regarding the injuries can be found in Tables 3-5.

Table 4: Bone injury characteristics*

Characteristics	Patients (*n*=30)
Bone exposure	20 (67)
Bone fracture	15 (50)
Distal tibia or fibula	3 (10)
Calcaneus	7 (23)
Cuboid bone	1 (3.3)
Metatarsus or phalanx	4 (13)
Bone defect	7 (23)
Lateral malleolus	1 (3.3)
Calcaneus	4 (13)
Metatarsus or phalanx	3 (10)

*Values are presented as a *n* (%)

Table 5: Surgery, immediate complications and long-term sequelae*

Characteristics	Patients (*n*=30)
Injury grade (Oestern-Tscherne classification)	
Grade 2	5 (17)
Grade 3	25 (83)
Plastic and orthopaedic surgery	
Necrosectomy	7 (23)
Skin graft	3 (10)
Reverse sural artery flap	1 (3.3)
Surgical treatment of clubfoot deformity	1 (3.3)
Wound length (cm)	6 (5–8)
6 cm or fewer	18 (60)
More than 6 cm	12 (40)
Soft tissue loss	18 (60)
Unsightly scar	26 (87)
Long-term sequelae	5 (17)
Discomfort whilst walking	4 (13)
Difficulty climbing stairs	3 (10)
Recurrent ulcerations	3 (10)
Foot deformity or footwear conflict	2 (6.7)
Follow-up period (years)	4 (3–7)

*Values are presented as a *n* (%) and median (IQR). IQR: Interquartile range

Clinical predictors of bone fracture and tendon rupture

In the univariate analysis, both the loss of soft tissue (odds ratio [OR] = 0.125 [0.020; 0.799], P = 0.028) and a deficit in ankle mobility (OR = 0.079 [0.007; 0.933], P = 0.044) showed a significant association with tendon rupture. Once adjusted for factors deemed significant in the univariate analysis–accounting for 44% of the variance in the risk of tendon rupture–the multivariate analysis confirmed the

Table 6: Univariate and multivariate logistic regressions of independent clinical predictors of tendon rupture

Characteristics	Univariate analysis			Multivariate analysis		
	OR	CI 95%	*P*	OR	CI 95%	*P*
Injured area						
Ankle only or foot only	1					
Both ankle and foot	2.111	0.283–15.770	0.466			
Wound length						
6 cm or fewer	1					
More than 6 cm	0.400	0.066–2.437	0.320			
Loss of soft tissue						
No	1			1		
Yes	0.125	0.020–0.799	0.028	0.083	0.008–0.846	0.036
Ankle mobility deficit						
No	1			1		
Yes	0.079	0.007–0.933	0.044	0.045	0.002–0.941	0.046

OR: Odds ratio, CI 95%: 95% confidence interval

Table 7: Univariate and multivariate logistic regressions of independent clinical predictors of fracture

Characteristics	Univariate analysis			Multivariate analysis		
	OR	CI 95%	*P*	OR	CI 95%	*P*
Injured area						
Ankle only or foot only	1					
Both ankle and foot	0.196	0.019–2.017	0.171			
Wound length						
6 cm or fewer	1			1		
More than 6 cm	0.026	0.003–0.267	0.002	0.048	0.003–0.687	0.025
Loss of soft tissue						
No	1			1		
Yes	38.500	3.749–395.407	0.002	0.048	0.003–0.687	0.025
Ankle mobility deficit						
No	1					
Yes	0.286	0.026–3.121	0.304			

OR: Odds ratio, CI 95%: 95% confidence interval



Figure 4: One of the motorcycle models that caused a wheel-spoke injury in one of our patients

association of loss of soft tissue (OR = 0.083 [0.008; 0.846], *P* = 0.036) and ankle mobility deficit (OR = 0.045 [0.002; 0.941], *P* = 0.046) with tendon rupture [Table 6]. The univariate analysis further revealed that factors significantly linked to bone fracture included a wound length exceeding 6 cm (OR = 0.026 [0.003; 0.267], *P* = 0.002) and the loss of soft tissue (OR = 38.500 [3.749; 395.407], *P* = 0.002). Adjusting for significant factors from the univariate analysis, which represented 70% of the bone fracture risk variance, the multivariate analysis confirmed the loss of soft tissue (OR = 0.048 [0.003; 0.687], *P* = 0.025) and wound length of more than 6 cm (OR = 0.048 [0.003; 0.687], *P* = 0.025) as factors linked to bone fracture [Table 7].

Discussion

Our study has unveiled a significant increase in motorcycle wheel-spoke injuries among children since 2015, predominantly occurring on the right side, during the afternoon, and mainly affecting those over the age of five. These findings delineate an epidemiological trend, signifying a specific demographic for implementing preventative measures. Moreover, the predominance of Grade 3 injuries, coupled with the significant correlations between soft tissue loss, diminished ankle mobility

and tendon ruptures, highlights the severity of these injuries. Our analysis identified reliable clinical indicators of tendon rupture (soft-tissue loss and reduced ankle mobility) and factors associated with bone fractures (wound length surpassing 6 cm and soft-tissue loss). These indicators could aid in the early diagnosis and management of such injuries.

Motorcycling is popular in developing nations.[1] Economic growth allows more individuals from lower socioeconomic backgrounds to purchase motorcycles for the transportation of family members.[1,7] Motorcycle riders and their passengers are prone to injury from road traffic accidents, especially the lower extremities.[1,7,8] Multiple passengers on a single motorcycle increase the risk of injuries.[9] Since Ahmed's report, motorcycle wheel-spoke injuries have risen, particularly in Asia and Africa.[1,3,7,9] Subsequent studies have highlighted its prevalence among children.[10,11] Children on motorcycles without spoke guards risk foot injuries from wheel spokes. Positioned on the rear seat behind the driver, the child's foot can abruptly become ensnared between the wheel spokes of the rotating wheel.[9] The child's foot can get trapped for various reasons, such as a fall, road bumps, accidental swinging of the leg, or the entanglement of untied shoelaces in the wheel spokes.[12,13] Typically, the motorcycle comes to an abrupt halt following such incidents, either due to its fall or to the child's screams, which alert the rider, prompting them to stop the vehicle.[9] Motorcycle wheel spokes cause more severe injuries than bicycles due to higher kinetic energy.[3,9,10] Motorcycles have greater speed and mass, leading to forceful impacts on entrapped limbs.[13] Motorcycle spokes are rigid, whereas bicycle spokes are more flexible.[4,13] These factors contribute to the characteristic shearing injuries caused by motorcycle wheel spokes, resulting from a combination of laceration due to a knife-like action and crushing from the wheel spokes' pressure on the trapped ankle and foot.[14] Therefore, motorcycle wheel spokes can lead to significant injuries to soft tissues, along with a range of complications such as degloving, avulsion, devascularisation, wound infections and even tetanus, in addition to bone fractures. As a result, they present a challenge in treatment.[4,5,9,13,15,16]

Our study showed more right lower limb extremity injuries, aligning with prior observations.[3,4,9,11] This pattern is likely attributable to the standard placement of a chain guard on the motorcycle's left side. This guard serves to shield the left foot from becoming entangled with the wheel spokes, thereby reducing the incidence of injuries to the left lower limb. Injuries mainly occurred in the afternoon, aligning with peak traffic hours. All the patients sustained injuries from the rear wheel while seated behind a parent or relative. Naumeri *et al.*[11] reported 6.7% involvement of the front wheel and 93% of the rear wheel in children who suffered from a motorcycle wheel-spoke injury. In our series, patients usually sought medical attention within hours of the injury. The perceived gravity of these wounds likely spurred their prompt presentation. The posterior ankle was the most frequently injured site, in line with prior research.[10,13] The lateral foot was the second most injured site, which is situated a fair distance from the wheel. Only one injury was on the foot's medial side. This injury distribution implies that motorcycle wheel-spoke injuries might be more intricate than previously thought, as observed by He *et al*.[16] Their study on severe motorcycle wheel-spoke injuries in 31 children revealed that soft-tissue defects primarily occurred on the lower leg's lateral aspect and less so on the medial side. They postulated that when wheel spokes ensnare the heel, the lower limb is compelled to twist laterally, leading to lateral foot injuries.

The Oestern-Tscherne classification is commonly used for motorcycle wheel spoke injuries.[6,11,14] Our study showed no Grade 1 injuries. Such injuries transpire when the wheel spokes penetrate the skin but halt immediately.[17] Motorcycles often result in severe trauma, making Grade 1 injuries rare.[9,11] Most patients had Grade 3 injuries, with only five children showing Grade 2 injuries [Figure 3]. Suri *et al.*[13] Observed that motorcycles are more often associated with Grade 3 injuries and bicycles with Grade 2 injuries. Our findings concur with their observations. Grade 2 and 3 injuries occur when the wheel spokes make contact with the skin but do not stop immediately and can lead to defects in the calcaneal tendon.[16,17] Over two-thirds of our patients had a tendon rupture, and nearly half of them experienced a total severance of the calcaneal tendon. This is largely attributed to the fact that the posterior ankle was the principal site of injury. In this context, a loss of soft tissue and ankle mobility were suggestive clinical signs of tendon rupture in this study. Surgeons should, therefore, be vigilant for a tendon injury in the presence of these clinical indicators. Motorcycle wheel spoke injuries can result in displaced bone fractures, bone defects, osteitis and amputations.[18] In contrast, bicycle wheel spoke injuries typically lead to skeletal injuries less frequently, usually manifesting as nondisplaced greenstick or spiral fractures.[9] Mak *et al.*[10] found that 56% of motorcycle injuries resulted in fractures, compared to 6.7% for bicycles. Our findings align, as half of our patients had sustained a bone fracture. Zhu *et al.*[9] reported a lower bone fracture rate of 37%, often in the calcaneus 18%), which was also the most prevalent site of bone defect (6.7%). In our cohort, the calcaneus was similarly the most frequently fractured bone (23%) and the principal site of bone defect (13%). The calcaneus fracture presented significant challenges for Zhu *et al.*,[9] mainly due to its attachment to the calcaneal tendon, compared to other bone fractures around the ankle. Jeffers *et al.*[19] observed that in adults, the metatarsal fracture was the most prevalent bone fracture following motorcycle foot trauma. A metatarsal fracture was detected in 10% of our patients, making it the second most common fracture. Given children's skeletal and cartilage elasticity compared to adults, this may elucidate the difference in the typical location of bone fractures after a motorcycle wheel spoke injury. This study identified a link between bone fracture and a wound length exceeding 6 cm or with soft tissue loss. This association between the severity of soft-tissue injury and fractures was not observed in other studies. Reports on bicycle wheel spoke injuries have indicated

that no clinical signs reliably predict the existence of a bone fracture in children.[20,21] Previous research on motorcycle wheel spoke injuries in children has not sought predictive clinical signs of bone fractures.[9-11]

Our country has implemented several initiatives aimed at reducing road traffic injuries, including those involving motorcycles. The National Committee for the Prevention of Traffic Accidents plays a crucial role in coordinating these efforts. Key measures include enforcing helmet laws for all motorcycle riders and passengers, which is critical in preventing head injuries. These efforts are part of Morocco's broader strategy to meet global road safety targets and reduce the burden of road traffic injuries, aligning with the World Health Organization's Decade of Action for Road Safety. In our country, no legislation prohibits children from being passengers at the rear of a motorcycle. Regrettably, it remains common on our roads to observe a child positioned between two adults on a motorcycle intended to accommodate only two individuals. It is crucial to implement more stringent regulations that limit the number of pillion riders to one on motorcycles designed to carry only a single passenger to reduce the incidence of motorcycle accidents involving children. Furthermore, injuries caused by motorcycle wheel spokes are preventable. Some research suggests that proper footwear reduces the severity and incidence of such injuries, while inappropriate footwear exacerbates them.[9,11] Suri *et al*.[13] found that unsuitable footwear contributed to wheel-spoke incidents and advocated making protective footwear mandatory. Otte *et al*.[22] emphasised that wearing high boots and impact protective gear lessens the frequency and severity of injuries to the lower extremities in motorcycle accidents. Furthermore, many researchers have highlighted the inadequate foot protection on the rear wheels of some motorcycles, advocating redesigns to shield the lower legs.[4,5,13,15,16,18] Waikakul *et al*.[18] nostalgically recalled that motorcycles of yesteryears had better-built rear wheels. They explained that traditional motorcycle wheel spoke were small, less rigid and formed a mesh, resulting in minimal gaps that trapped only tiny foot parts. Newer models have larger, thicker spokes with significant gaps, allowing for greater entrapment [Figure 4]. Tragically, children are often the victims.[4,5,9,13] Numerous experts have called for modifications to motorcycle rear wheel designs, especially the right rear section, to mitigate the risk of injury.[5,9,13,14] Installing spoke shields on both sides of the motorcycle rear wheel can eliminate such risks, making it crucial, from a public health perspective, to make rear-wheel guards a standard feature on new motorcycles.[3] The efficacy of the chain guard on the motorcycle's left side underscores the protective benefits of a physical barrier against wheel-spoke injuries. Zhu *et al*.[9] poignantly remarked on the regret that surgeons' pleas on that matter had limited impact. In addition, the risk of injuries from motorcycle wheel spoke might be diminished by introducing legislation prohibiting children under 140 cm in height from traveling as pillion passengers on motorcycles. Children should only ride as pillion passengers if they can comfortably reach the motorcycle's footrests and secure their arms around the rider's waist. Ultimately, parents must be made aware of the potentially severe nature of motorcycle injuries in children and, wherever feasible, refrain from carrying them on the rear of motorcycles. Raising public awareness about the mechanisms of wheel-spoke injuries can further enhance preventative measures.

Whilst the current study spanned a relatively extended duration, it does possess certain limitations. The retrospective study design, coupled with the restricted number of patients, predisposes this research to information bias. Furthermore, as this was a hospital-based study that excluded outpatients, our findings do not encapsulate the complete scenario of motorcycle wheel-spoke injuries to the ankle and foot in children. Future studies with more expansive populations, prospective data gathering, encompassing both outpatients and inpatients, are essential to corroborate our findings.

Conclusion

Motorcycle wheel-spoke injuries in children, a relatively novel phenomenon in our area, have risen in our department in recent years. Although this study was hospital-based, it offers insight into this injury type, linked with one of the most prevalent modes of transport in developing nations. It was evident that most injuries were on the right side due to inadequate protection of this part of the rear wheel. Soft-tissue loss and reduced ankle mobility were reliable clinical signs of tendon rupture. Wounds exceeding 6 cm in length and soft-tissue loss indicated a related bone fracture. In addition, this study underscores the pressing necessity to prevent such injuries. Raising public awareness about this type of injury and ensuring children wear suitable footwear are the simplest methods to prevent wheel-spoke injuries. As medical professionals, we urge motorcycle manufacturers to introduce alterations to the rear wheel to prevent the foot from becoming trapped between the spokes. These modifications could involve redesigning the spokes and introducing effective spoke guards. Finally, there is an imperative demand for legislation and comprehensive traffic regulations concerning motorcycles to prevent such devastating injuries.

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Conflicts of interest

There are no conflicts of interest.

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