

THE PATTERN OF WHEEL SPOKE INJURY TREATED AT COMBINED MILITARY HOSPITAL RAWALPINDI

QADEER A, MASOOD T*, AHMAD S, JAMSHED I, NAYEED KU, ALAM K

Department of Plastic Surgery, Combined Military Hospital (CMH), Rawalpindi, Pakistan

*Correspondence author email address: surgtahir@gmail.com

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Abstract: *This research investigated the characteristics and patterns of wheel spoke injuries treated at Combined Military Hospital Rawalpindi. The study was conducted at Combined Military Hospital Rawalpindi, a prominent healthcare facility in Rawalpindi, Pakistan, providing medical services to military personnel and civilians. The research analyzed data gathered over a year regarding wheel spoke injuries. A random sample of eighty-two patients was selected, and data was collected on demographic information, injury specifics, clinical presentations, treatments, and outcome measures to provide a quantitative analysis. The study's results showed that the average time elapsed from injury to presentation was 6 hours. Most injuries occurred on the right foot (37 patients) and were associated with the rear wheel (34 patients). Injuries to the lateral aspect of the ankle were common (73%), with the posterior ankle being the most frequent site (n=30). Soft-tissue injuries were classified into grades 0, 1, 2, and 3, with changes in grading noted in some cases. Patients with grade 0 or 1 injuries healed faster (mean 28 days) than those with grade 2 or 3 (mean 40 days). Eight patients had associated fractures, all healed without complications with a mean healing time of 18 days. The study concluded that wheel spoke injuries are common and are often found near the Achilles tendon. Injury classification is critical for treatment decisions and predicting prognosis. Monitoring for infection and necrosis within 48 hours is vital due to poor vascularity. Customized treatment approaches, including below-knee back splints, ankle foot orthoses, and debridement, are recommended based on injury characteristics.*

Keywords: Wheel Spoke Injuries, Bicycle-Related Injuries, Soft-Tissue Injuries, Injury Patterns, Injury Classification, Healthcare, Injury Prevention

Introduction

In the more affluent areas of Pakistan, bicycles are a common mode of transportation. Interestingly, three to five-year-olds represent 52 percent of all bicycle-spaced injuries (Singh et al., 2017). A wide variety of injuries, usually to the foot or leg, can occur when a person gets caught between the spokes of a bicycle wheel. Bicycles are lauded for being inexpensive, convenient, and environmentally friendly, but also present certain special dangers (Keerio et al., 2023). A serious injury can result when a passenger, generally a young kid, becomes caught between the moving spokes of a bicycle wheel. Typically, the passenger sits on the bicycle's handlebar, the bar connecting the handle and seat, or as a pillion rider, with their feet dangling to one side (the "side-saddle position") or both sides of the bike. Figure 1 shows that the right foot is more likely to be injured when riding in a side saddle posture since it is closer to the wheel. Similarly to how a human tooth can penetrate stretched and de-vascularized tissue when biting with a clenched fist, this is the mechanism of harm in these circumstances. Shearing injuries, tissue lacerations, and foot crush injuries frequently result from the interaction between these pressures (Omoke et al., 2020).

To accomplish this, researchers at Combined Military Hospital Rawalpindi hope to learn more about the unique traits and patterns seen in cases of wheel spoke damage. In doing so, we seek to learn more about the causes, frequency, and most vulnerable groups for these occurrences. It is hoped that effective preventative interventions may be developed from this study by understanding the causes and processes of these injuries. We want to advance healthcare and injury prevention by researching wheel-spoke injuries in this unique

urban setting. Understanding the nuances of these accidents can help us spread the word and devise plans to reduce the dangers of biking, making this city and others like it safer and more welcoming for everyone. Vital to improving public health and protecting the safety of citizens, this examination of the wheel spoke injuries at Combined Military Hospital Rawalpindi is underway.

Methodology

This primary quantitative research analysis examines the distribution of wheel-spoke injuries observed at the Combined Military Hospital (CMH) in Rawalpindi, Pakistan, over one year. The research was carried out within the Orthopaedics and Trauma Department at CMH Rawalpindi, a well-regarded medical facility catering to civilian and military populations residing in the Rawalpindi region. A sample of eight two persons who had wheel spoke damage was selected by random sampling for this study. The sample size adequacy was established to derive relevant conclusions on the prevalence of wheel spoke injuries observed at the hospital. Individuals of varying ages and genders who sought medical attention for injuries related to wheel spokes within a designated one-year research period were eligible for potential inclusion in the study.

CMH Rawalpindi's Orthopaedics and Trauma Department had a team of qualified medical experts in data collecting. Patient demographics such as age, gender, and contact information were collected in addition to any medical history. Moreover, information on each injury was collected, including its type, location on the body, time of occurrence,

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and contributing factors. Patients' symptoms and signs were noted, as were their diagnoses, the types and frequency of any surgical procedures they underwent, how long they were in the hospital, and whether or not they were followed up on after that. Outcome measures were also documented, such as adverse events, functional status changes, and overall patient health.

The data underwent analysis using SPSS (Statistical Package for the Social Sciences), a well-recognized healthcare and social sciences software for statistical data processing. The acquired data was analyzed using descriptive statistics, encompassing frequencies, percentages, means, and standard deviations. Associations and correlations between the variables were examined using inferential statistical methods such as chi-square tests, t-tests, and regression analysis. In the present study, a p-value equal to or less than 0.05 was considered to show statistical significance. Throughout analyzing the data, this criterion was consistently employed to assess the significance of relationships and findings.

The research placed significant emphasis on ethical issues. The study was carried out in adherence to the ethical guidelines specified in the Declaration of Helsinki. The researchers obtained ethical permission from the Institutional Review Board (IRB) of CMH Rawalpindi. Furthermore, the researchers ensured that they got informed agreement from all study participants or their legal guardians, particularly in situations involving children. This measure was implemented to preserve and safeguard patients' rights and privacy. Careful measures were taken to protect the privacy of our patient's information, and we followed all applicable laws and guidelines as we gathered, analyzed, and reported our findings. Only permitted persons who were actively participating in the study were provided access to the data, keeping it safe from prying eyes. We took these measures to protect our patient's privacy and prevent unauthorized access to their sensitive medical records.

Results

Following the outlined methodology, we present the study's results on the pattern of wheel spoke injuries treated at Combined Military Hospital Rawalpindi. The study included eight two patients who sought medical attention for wheel spoke injuries over one year.

Table 1: Demographic and Injury Characteristics

Parameter	Value
Mean Interval (in hours)	6 (Range: 2–24)
Right Foot Injuries	37 patients
Left Foot Injuries	4 patients
Rear Wheel Injuries	34 patients
Front Wheel Injuries	7 patients
Front-Wheel Injuries Location	Forefoot and Midfoot
Lateral Aspect of the Ankle	73% of injuries
Common Injury Sites	Posterior Ankle (n=30), Medial Midfoot (n=7), Forefoot (n=3), Finger Entrapment (n=1)

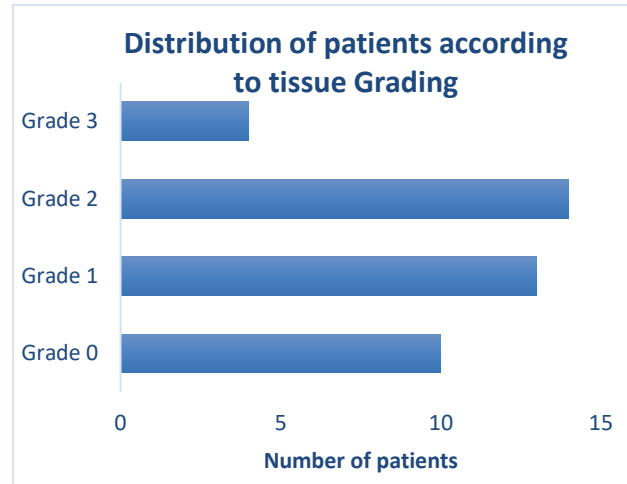


Figure 1: Soft-Tissue Injury Classification

Note: The grading changed to a higher grade on reassessment in 8 patients (5 from grade 0 to 1 and 3 from grade 1 to 2) owing to tissue necrosis and superimposed infection. (Figure 1)

Table 2: Healing Times for Soft-Tissue Injuries

Injury Grade	Mean Healing Time (in days)
Grade 0	28 (Range: 5–40)
Grade 1	
Grade 2	40 (Range: 14–90)
Grade 3	

According to the study, the average time between the injury occurrence and the patient seeking medical attention was 6 hours, ranging from 2 to 24 hours. Most injuries were observed on the right foot, affecting 37 patients, and were shown to be more prevalent in cases involving the rear wheel, with 34 patients affected. Injuries to the front wheel predominantly impact the forefoot and midfoot regions. The occurrence of injuries on the lateral surface of the ankle was found to be widespread, accounting for 73% of cases. These injuries were evenly distributed across the anterolateral and posterolateral areas. The posterior ankle was identified as the most prevalent injury location, with 30 cases. This was followed by the medial midfoot, which accounted for 7 cases, the forefoot with 3 cases, and a single instance of finger entrapment.

The classification of soft-tissue injuries encompassed four classes, namely 0, 1, 2, and 3. It should be noted that certain patients may undergo a reassessment, resulting in a modification of their initial grading due to the occurrence of tissue necrosis and the development of superimposed infection. Individuals with grade 0 or 1 injuries showed a quicker return to functionality and weight-bearing than those with grade 2 or 3 injuries. The average time for complete healing was 28 days (with a range of 5 to 40 days) for the former group, whereas the latter group required an

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average of 40 days (14 to 90 days) for complete healing (Table 2).

Eight individuals in the study exhibited fractures, including medial tibial epiphyseal fractures, distal tibial fractures, and a proximal phalanx fracture of the fourth toe. These fractures all had a smooth healing process, with an average healing period of 18 days (ranging from 5 to 66 days).

Discussion

Based on the findings, our study demonstrates that a considerable number of injuries related to bicycle spokes, namely around 63%, mostly manifest in the proximity of the Achilles tendon. This discovery aligns with the empirical fact that there is a higher likelihood of encountering more serious soft-tissue injuries in the posterolateral region of the ankle, which frequently extends into the Achilles tendon. The lack of a globally recognized categorization for injuries of this nature requires examining many classification systems. In conjunction with the Western and Tschernec classification, soft-tissue injuries can be classified into many categories, such as uncomplicated abrasions or lacerations with partial avulsion, as well as indications of edema, bruises, abrasions, or full-thickness skin defects (Keerio et al., 2023). Our study highlights the importance of this categorization in guiding treatment decisions and predicting patient outcomes. It is worth mentioning that abrasions and ecchymoses commonly occur in the ankle area and may have a more pronounced appearance upon further evaluation (ROFFMAN et al., 1979).

The heightened susceptibility to wound infection in these injuries is attributed to the inadequate vascularity of the skin and soft tissues, frequently caused by underlying internal degloving (Waller, 1995). Therefore, it is crucial to evaluate wounds within a 48-hour to identify any indications of infection and necrosis, subsequently modifying the grading and treatment approach for the wound. According to our study findings, utilizing below-knee backsplints for 2 to 3 weeks is advisable while ensuring that the ankle is kept in a neutral posture. An ankle-foot orthosis (AFO) enables wound care management and facilitates physical exercise (Suri et al., 2007). In situations involving extensive exposed regions, it is advisable to do debridement, even if there is a delay, and to also contemplate the use of split skin grafting to facilitate the expeditious recovery of the wound, particularly in cases characterized by necrosis (Khan et al., 2021).

Lacerations that develop in the posterior ankle region and result in exposure of the Achilles tendon or heel flap avulsions due to the shearing impact of spokes are associated with an increased risk of necrosis (Agu, 2017; Chu et al., 2014). In these situations, it is imperative to implement comprehensive treatment procedures. The treatment protocol for heel flap avulsions often involves comprehensive lavage, debridement, suturing, and splinting. Moreover, in cases where heel flap necrosis ensues or painful contractures manifest, it may be imperative to postpone the implementation of a flap for wound coverage (Keerio et al., 2023; Subrahmanyam, 1984). As mentioned earlier, the findings highlight the need for customized treatment strategies that consider wheel-spoke injuries'

Although minor necrosis was identified throughout the wound-healing process, none of the patients needed a skin transplant. Additionally, there were no documented cases of functional impairment or persistent discomfort in the foot.

distinct characteristics and classifications to enhance patient outcomes.

It is important to note that there are certain caveats to this study. The findings may be limited in applicability to a wider population or other hospital settings because the research was done at a single center, the Combined Military Hospital in Rawalpindi. It would be ideal to do collaborative multi-center research to increase the results' external validity. To address these limitations and gain a deeper understanding of wheel-spoke injuries, future studies should use prospective data collection. While the sample size of this study was big enough to conclude, it only included 100 patients. A larger cohort would allow for investigating more unusual consequences and subgroups associated with wheel spoke injuries.

Conclusion

Our research on wheel-spoke injuries at Combined Military Hospital Rawalpindi highlights the importance of recognizing the unique characteristics of these injuries and employing specialized treatment methods to improve recovery rates. Over two-thirds of these injuries happen close to the Achilles tendon, and serious soft-tissue injuries commonly affect the posterolateral part of the ankle. Establishing a classification is crucial for determining how best to treat patients. Complete lavage, debridement, suturing, and splinting are necessary when treating heel flap avulsions.

Declarations

Data Availability statement

All data generated or analyzed during the study are included in the manuscript.

Ethics approval and consent to participate

Approved by the department Concerned.

Consent for publication

Approved

Funding

Not applicable

Conflict of interest

The authors declared absence of conflict of interest.

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