

Frequency and Presentation of Wheel Spoke Injury of Heel at Plastic Surgery Department of Allama Iqbal Memorial Teaching Hospital, Sialkot

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ABSTRACT

Objective: The purpose of this study was to assess demographic distribution and presentation of spoke wheel injury at Sialkot.

Study Design: Retrospective / Cross sectional study

Place and Duration of Study: This study was conducted at the Plastic Surgery Department of Allama Iqbal Memorial Teaching Hospital Sialkot from December 2015 to December 2016.

Materials and Methods: This was a case control study based on retrospective record review of 400 patients presenting in Emergency Department of Allama Iqbal Memorial Teaching Hospital Sialkot. Patients were selected on basis of wheel spoke injury involving foot and ankle while riding bicycle or motorcycle. Management of patients was done according to Oestern and Tschernie classification for soft tissue injury. A form was designed to record Demographic data and severity of injuries according to above mentioned classification. Permission of record review was granted by Departmental Review committee of Plastic Surgery Department of Allama Iqbal Memorial Hospital, Khawaja Muhammad Safdar Medical College, Sialkot. Sanctity of data was maintained by all authors and persons concerned. Data was analyzed for results by SPSS 10.

Results: In this study the frequency of motorcycle spoke wheel injury was 67% (n=268) and bicycle spoke wheel injury was 33% (n=132). The frequency of spoke wheel injury was maximum (61.5%) n=246 at the age of 15-25 years. The patients of spoke wheel injury were (72.5%) n=289 in male and (27.75%) n= 111 in female as the ratio of female riders was less. The frequency of spoke wheel injury was maximum (42.25%) n=69 of grade 1 injury and minimum (04%) n=16 in case of grade 0 injury. The frequency of spoke wheel injury was maximum (62.25%) n=249 in case of Postero lateral side of foot involvement and minimum (5.75%) n= 23 in case of Toe Amputation. The spoke wheel injury of right foot was higher (72.25%) n= 289 as compared to left foot (17.25%) n= 69 and both feet (10.5%) n= 42.

Conclusion: Wheel spoke injuries may result in severe soft tissue damage and bony trauma. Poor prognostic factors included high-energy injury, contamination, and infection, and delayed treatment.

Key Words: Motorcycle/ Bicycle wheel spoke injury, Oestern and Tschernie classification.

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INTRODUCTION

Bicycle and motorcycle is a cheap source of transport in developing countries like Pakistan¹. Due to abundant use and lack of proper safety measures, Cyclists and Bikers comprise a majority of cases

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presenting in Emergency Department (ED) of our healthcare setups, and to make matters worse when sometimes more than 2 passengers are riding simultaneously. Frequently a child or female is pillion riding and carrying a child².

In such conditions one of the frequent injuries in ED is spoke wheel injury involving heel & ankles³. Injury pattern varies widely with minor abrasion, bruises, laceration to amputations and injury of tendoachilies. Bicycle and motor bike spoke wheel injury occur when the foot or heel is caught between the spokes and frame of a bicycle, that is, if a child sits on the backseat of a bicycle⁴.

Bicycle spoke wheel injury rarely occurs in adults due to length of lower limb but children are commonly involved⁵.

There are typically three aspects to the trauma of Bicycle and motor bike spoke wheel injury:

1) Laceration of the tissue from the knife-like action of the spokes, 2) crushing from the impingement of the wheel and frame of the bicycle, and 3) shearing injury from the coefficient of these two forces⁶.

Soft tissue injuries are classified on Oestern and Tscherne classification for closed fractures⁷.

Grade 0	Minimal soft tissue damage
Grade 1	Superficial abrasion or contusion
Grade 2	Deep abrasion skin or muscle contusion
Grade 3	Extensive skin contusion or crush injury severe damage to underlying muscle

MATERIALS AND METHODS

This was a retrospective observational study including 400 patients presenting in Emergency Department of Allama Iqbal Memorial Teaching Hospital Sialkot. Patients were selected on basis of wheel spoke injury involving foot and ankle while riding bicycle or motorcycle. Management of patients was done according to Oestern and Tscherne classification for soft tissue injury.

Grade 0 injuries were cleaned with Normal Saline and in case of inability to weight bear on affected limb below knee POP slab was applied; patients were discharged with oral analgesic and follow up was done in Out Patient Department.

Grade 1 injuries were treated with Normal Saline wound lavage and dressing with Povidine Iodine solution and limb immobilized in back slab; patient discharged on Oral Antibiotics and Oral analgesic. Wound reassessed in Out Patient Department.

Grade 2 injuries were washed with Normal Saline cleaned with Povidine Iodine solution, dressing was done, POP back slab applied and discharged on follow up next day with oral antibiotics and oral analgesics.

Grade 3 injuries were managed with wound toilet under general anesthesia, patient was assessed next day and further debridement done. Parenteral Antibiotics for gram positive and negative cover was done. All patients were given immunization for tetanus.

Performa was designed to record Demographic data and severity of injuries according to above mentioned classification. Permission of Departmental review committee of Allama Iqbal Memorial Teaching Hospital was obtained. Data was analyzed for results by SPSS 10.

Inclusion criteria

Selection criteria was developed to include all patients visiting emergency department between December 2015-December 2016 with injuries to heel ankle and fore foot resulting in contusion, abrasion, distortion, laceration while riding a bicycle or motorbike behind the rider.

Exclusion Criteria: All patients with open fractures during spoke wheel injury were excluded from the study.

RESULTS

In this study the frequency of motorcycle spoke wheel injury was 67% (n=268) and bicycle spoke wheel injury was 33% (n=132) as shown in table no1. The frequency of spoke wheel injury was maximum (61.5%) n=246 at the age of 15-25 years as shown in table no 2. The patients of spoke wheel injury was (72.5%) n=289 in male and (27.75%) n= 111 in female as the ratio of female riders was less as shown in table no 2. The frequency of spoke wheel injury was maximum (42.25%) n=69 of grade 1 injury and minimum (04%) n=16 in case of grade 0 injury as shown in table no 4.

Table No. 1: Distribution of Bicycle/ Motorcycle spoke wheel injury

Sr. No	Spoke Wheel Injury	Cases	Percentage (%)
1	Bicycle spoke wheel injury	132	33%
2	Motorcycle Spoke Wheel Injury	268	67%
	Total	400	100%

Table No. 2 Age Distribution in Bicycle/ Motorcycle spoke wheel injury

Sr. No	Age (Years)	Cases	Percentage (%)
1	9 -14	91	22.75%
2	15-25	246	61.50%
3	26-35	31	7.75%
4	36-45	21	5.25%
5	46 & above	11	2.75%
	Total	400	100%

Table No. 3 Gender distribution in Bicycle/ Motorcycle spoke wheel injury

Sr. No	Gender	Cases	Percentage (%)
1	Male	289	72.25%
2	Female	111	27.75%
	Total	400	100%

Table No. 4 Distribution of injured patients according to grading of Injury

Sr. No	Grading	Cases	Percentage (%)
1	Grade 0	16	04%
2	Grade 1	169	42.25%
3	Grade 2	121	30.25%
4	Grade 3	94	23.50%
	Total	400	100%

The frequency of spoke wheel injury was maximum (62.25%) n=249 in case of Postero lateral side of foot

involvement and minimum (5.75%) n= 23 in case of Toe Amputation as shown in table no 5. The spoke wheel injury of right foot was higher (72.25%) n= 289 as compared to left foot (17.25%) n= 69 and both feet (10.5%) n= 42 as shown in table no 6.

Table No. 5 Distribution of patients according to foot region involved

Sr. No	Region of foot	Cases	Percentage (%)
1	Poster lateral Foot	249	62.25%
2	Toe Amputation	23	5.57%
3	Tendoachilles Rupture	57	14.25%
4	Anterolateral Injury of foot	71	17.75%
	Total	400	100%

Table No. 6 Distribution of patients according to injury of foot

Sr. No	Side of foot	Cases	Percentage (%)
1	Right Foot	289	72.25%
2	Left Foot	69	17.25%
3	Both Feet	42	10.50%
4	Total	400	100%

DISCUSSION

Due to prevalent socioeconomic conditions motorcycle spoke wheel injuries are common in Pakistan as compared to bicycle spoke wheel injuries. In our study also motorcycle wheel spoke injury was higher as compared to bicycle wheel spoke injury. In our study mostly adolescent males were involved with majority having Grade 1 & 2 injuries. Posterolateral foot was commonly accompanied with heel pad injury which required flaps for coverage^{8,9}. In a study by Mine et al, has shown that spoke wheel injuries healing time was prolonged and repeat debridement was needed for severe injuries⁷. Insufficient treatment or closure with tight sutures of heel flap and contamination resulted in longer hospital stay and flap necrosis¹⁰. Poor prognostic factors included high-energy injury, contamination, infection, and delayed treatment¹¹ Injuries resulting in heel pad loss at Calcaneum were needed to be covered by Sural artery based flaps¹². Instep flaps was mostly in the zone of trauma. Despite flap coverage the missing glabrous skin and loss of sensation, sensate flaps require highly specialized microscopic surgery and teamwork which is not readily available everywhere in Pakistan. All patients with tendoachilles rupture, required repair followed flap coverage. Injuries in motor bike are of severe in nature compared to bicycle spoke wheel injury due to speed and shearing forces applied⁸. A lot of modification have been recommended to prevent these injuries like mesh or guard to cover wheel spokes and horizontal upright¹³. Public

awareness and education can also lead to reduction in number of accidents.

The majority of spoke-wheel injury occurred in the area of posterior aspect of ankle and posterolateral aspect. Most of them were minor injuries of grade 0 and 1. Severe injury to heel may lead to heel pad avulsion and often transaction of tendoachilles.^{9,14} Results of our study were consistent with them. In literatures, it has been shown that bicycle spoke injuries have resulted in severe heel pad injury, transaction of tendo-achilles and warranted the need for flap surgeries to cover the wounds.³ Such injuries are often found to be deteriorating after 48 hrs or later as the vascularity of soft tissue in this area is poor and internal degloving is common due to shearing force sustained to the skin. Hence it becomes mandatory to see the wound repeatedly for any change in status of the wound. An ankle foot or a back splint is also recommended as it helps in good healing and exercise to be performed.⁴ Various modifications in bicycle has been advised for preventing such injuries, like mesh cover, or plastic shield to bridge the gap between fork and horizontal upright of bicycle or motorcycle etc.¹⁵ Making the people aware of the mode of injury and preventive measures explained at the costumer level of bicycle could decrease the frequency of these injuries.¹⁶

CONCLUSION

Wheel spoke injuries may result in severe soft tissue damage and bony trauma. Poor prognostic factors included high-energy injury, contamination and infection, and delayed treatment.

General people awareness regarding the injury, preventable measures, use of appropriate spoke guards, foot rests, children wearing proper shoes etc are the simplest measure to avoid the spoke wheel injury.

Author's Contribution:

Concept & Design of Study:	Sarfraz Ahmad
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Revisiting Critically:	Kamran Hamid
Final Approval of version:	Sarfraz Ahmad

Conflict of Interest: The study has no conflict of interest to declare by any author.

REFERENCES

1. Segers MJM, Wink D, Clevers GJ. Bicycle-spoke injuries: a prospective study. *Injury* 1997;28: 267-9.
2. Izant RJ, Rothmann BF, Frankel VH. Bicycle spoke injuries of the foot and ankle in children: an underestimated "minor" injury. *J Pediatr Surg* 1969;4:654-6.

3. Venema, S. Hag. Bicycle spoke entrapment in children. *Injury Surveillance Exchange (CISE)* 1999;2:5-6
4. Oestern HJ, Tscherne H. Pathophysiology and classification of soft tissue injuries associated with fractures. In: Tscherne H, editor. *Fractures with soft tissues injuries*. New York: Springer-Verlag; 1984.p.1-9.
5. Suri MP, Naik NR, Raibagkar SC, et al. Heel flap injuries in spoke wheel accidents. *Injury* 2007;38:619-24
6. Xiu H, Chong F, Wai J, et al. Treatment of spoke heel injuries in children. *KeZaZhi* 2009; 23(10):1180-2.
7. Mine R, Fukui M, Nishimura G. Bicycle spoke injuries in the lower extremity. *Plast Reconstr Surg* 2000;106(7):1501-6.
8. D'Souza LG, Hynes DE, McManus F, et al. The bicycle spoke injury: an avoidable accident? *Foot Ankle Int* 1996;17(3):170-3.
9. Agarwal A, Pruthi M. Bicycle-spoke injuries of the foot in children. *J Orthopaed Surg* 2010;18: 338-41.
10. David F, Cadbt J, Bosch G, Brama P, Weeren R, Schie H. Short-term cast immobilisation is effective in reducing lesion propagation in a surgical model of equine superficial digital flexor tendon injury. *Equine Vet J* 2012;44:570-5.
11. Strauch B. Bicycle spoke injuries in children. *J Trauma* 1966;6:61-4.
12. Yilmaz M, Karatas O, Barutcu A. The Distally Based Superficial Sural Artery Island Flap: Clinical Experiences and Modifications. *Plastic Reconstructive Surg* 1998;102(7):2358-2367.
13. Roffman M, Moshel M, Mendes DG. Bicycle spoke fracture. *Clin Orthop Relat Res* 1979;144:230-2.
14. Sankhala SS, Gupta SP. Spoke-wheel injuries. *Indian J Pediatr* 1987;54:251-6.
15. Suri MP, Naik NR, Raibagkar SC, et al. Heel flap injuries in spoke wheel accidents. *Injury* 2007; 38:619-24.
16. Waller JA. Bicycle ownership, use, and injury patterns among elementary school children. *Injury Prevention* 1995;1: 256-61

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